Articulatory and acoustic features of Mandarin rhotics: an ultrasound study

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INTRODUCTION

Background:
• English /r/ can be articulated with various tongue shapes with minimal acoustic consequence (Delattre and Freeman, 1968; Westbury et al., 1998; Twist et al., 2007; Zhou et al., 2008; Mielke et al., 2010).
• The continuum of tongue variation is usually roughly categorized as retroflex and bunched tongue shapes.
• Nearly the entire literature on the articulatory variation has been focused on English /r/.

Research questions:
• Can articulatory variation be found in Mandarin /ɿ/ sound?
• Is the articulation of Mandarin /ɿ/ affected by syllable position and vowel context?
• Is frication noise a consistent component for prevocalic /ɿ/?

METHOD

Participants: 18 native Mandarin speakers (4M,15F) who naturally speak with a rhotic accent of Mandarin.

Stimuli: Mandarin and English words with /ɿ/ sound.

Syllable positions: Vowels and consonants.

Tongue shapes described in Delattre and Freeman (1968).

Tongue shapes of Mandarin /ɿ/ found in the ultrasound images in the current study.

Tongue shapes described in Delattre and Freeman (1968).

Formant patterns:
• No significant differences between bunched and retroflex speakers in the first three formants of /ɿ/ sound.
• Mandarin /ɿ/ has a significantly higher F3 than English /r/ in prevocalic and syllabic position.
• The F3-F2 of Mandarin /ɿ/ was significantly higher than that of English /r/ in all syllabic positions.

DISCUSSION AND CONCLUSIONS

Like English /r/, Mandarin /ɿ/ can be articulated with various tongue shapes.

Our data showed that Mandarin prevocalic /ɿ/ was articulated with only bunched gestures, while syllabic and postvocalic /ɿ/ could be produced with either the retroflex or bunched gestures.

The tongue shape of Mandarin /ɿ/ was not influenced by vowel context.

Mandarin /ɿ/ had a higher F3-F2 values than English /r/ in all syllabic positions and a higher F3 in prevocalic and syllabic positions, which indicates that Mandarin /ɿ/ is less rhotic than the one in English.

Our data suggested that it might be more appropriate to categorize Mandarin prevocalic retroflex sound as an approximant with an optionally fricative onset rather than a fricative because it lacks the consistent presence of frication noise which is the most salient feature of fricatives.

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Selected references
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