

An acoustic analysis of vowel nasality in different tones in Mandarin

Chinese

Vowel nasalization involves the most complicated configuration of vocal tract found in human speech. Since nasal cavity and oral cavity resonate at the same time, nasalized vowels could carry most complex acoustic information which has many intriguing implications both acoustically and perceptually. Both acoustic features and their implications to perception of vowel nasality have received much detailed description. However, careful investigation of the relationship between vowel nasality and supra-segmental features, especially lexical tones and vowel nasalization, is still sparse. In the present study, I would like to shed some light on the interaction between lexical tone and anticipatory vowel nasalization using the data from Mandarin Chinese.

Measurements and calculations were made following the framework adopted in Chen (1997, 2000); in particular, the measure of A1-P0 (the difference between the amplitude of first formant and first nasal pole) was implemented in order to answer two research questions: Will the degree of anticipatory vowel nasalization differ in different tones? Will the pattern of change of vowel nasality, in terms of both direction and rate of change, differ with respect to different tones? Monosyllabic words with nasal codas were collected from four native mandarin speakers for analysis. To best avoid the F1 lowering effect contributed by nasal pole P0 in high vowels, only non-high vowels (/a/ and /ɤ/) have been analyzed. A1-P0 range and the slope of A1-P0 when plotted as a function of time were calculated for further analysis. As discussed in Chen (1997, 2000), larger A1-P0 range is associated with greater degree of nasalization and A1-P0 is inversely related with vowel nasality, which is a predictor of the direction and rate of the change of vowel nasality.

The results suggest that the degree of vowel nasality is affected by lexical tones in Mandarin Chinese, with tone 3 (fall-rising tone) having greatest degree of vowel nasality. Vowels become more nasalized toward the VN boundary in all four tones, but the change rate did not show significant difference across tones. However, tone 3 appeared to have the greatest variability with regard to the change of vowel nasality during time contour. Such variability in tone 3, as well as its degree of nasality, might be explained by the co-occurring creaky voice during tone 3 production. The articulatory and acoustic relations between creaky voice and vowel nasality are still largely unexplored and worth further investigation.

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