

# Variable Adaptation of Intervocalic Nasals in Mandarin Loanwords: Corpus, Perception, and Production Evidence from Bilinguals

## Abstract

Variation in phonological adaptation remains underexplored. While Mandarin loanword phonology shows considerable variability, recent studies suggest that some adaptation patterns are contextually conditioned (e.g., Hsieh, Kenstowicz, & Mou 2009; Lin 2008). This study investigates how English intervocalic nasals are variably realized as geminates or singletons in Mandarin, based on corpus data and bilingual perception and production experiments. The findings show that the perception of English prenasal vowel duration and nasalization determines which variant is preferred in Mandarin loanwords.

## Corpus Analysis

Building on Huang and Lin's (2013) corpus data, nasal insertion in Mandarin loanwords depends on the quality of the English prenasal vowel and the stress location. Intervocalic nasals are adapted with nasal insertion in 90.8% of cases when the prenasal vowel is lax, non-high, and stressed, e.g., *Di'ana* → [tai.an.na:] (lax low vowel) vs. *'Bruno* → [pu:.lu:.nwo:] (tense high vowel), *Bo'nita* → [pwo:.ni:.ta:] (postnasal stress), and *Ri'hanna* → [lei.xa:.na:] (vowel [a]). The inserted variant is preferred because (i) it matches the duration between an English lax vowel and a Mandarin short vowel in a closed syllable, and (ii) it better reflects vowel nasalization in non-high vowels. I hypothesize that perceived vowel quality primarily induces nasal insertion, while stress provides a secondary cue for syllabification. Nasal insertion thus enhances acoustic cue matching between source and target languages.

## Perception and Production Experiments

To test these hypotheses, 24 Mandarin–English bilinguals participated in a nonce-word production (oral adaptation) and an ABX forced-choice perception task. Both experiments examined whether prenasal vowel quality and stress location condition nasal insertion, and which variant is preferred in each context. When the English input contained a stressed **lax** vowel ([<sup>ˈ</sup>CVLaxNV]), both tasks showed significantly higher rates of nasal insertion [CVN.NV], supporting the vowel-type condition. Stress alone did not significantly affect adaptation: [<sup>ˈ</sup>CVLaxNV] and [CV'Nita] patterned similarly. However, [CVLax'Nita] triggered more insertions than [CVTense'Nita]. The low back [a] behaved like tense vowels, showing reduced gemination.

## Discussion and Conclusion

Given Mandarin's bimoraic requirement for full-toned syllables (Duanmu 2007), English prenasal lax vowels, perceived as monomoraic, tend to trigger nasal gemination to produce a bimoraic [CVN] syllable. Tense vowels instead correspond to heavy [CV:] syllables. Stronger vowel nasalization in non-high vowels further increases the likelihood of gemination. Adding a nasal to a short vowel yields a better match in duration and nasalization while satisfying Mandarin phonotactic constraints (cf. Yip 1993 on Cantonese gemination). The low back [a], being phonetically long, rarely induces gemination. The absence of a stress effect likely reflects bilinguals' limited sensitivity to English lexical stress: tonal language speakers often rely on F0 (Wang 2008), and Mandarin–English bilinguals perceive trochaic stress more accurately than iambic (Yu & Andruski 2010). This study shows how perceptual sensitivity to duration and nasalization shapes variation in Mandarin loanword adaptation, linking bilingual phonetics to phonological structure.