Vowel Quality Cues to Variable Nasal Adaptation in Mandarin Loanword Phonology

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Variation in phonological adaptation has not always been analysed in detail, but some studies on Standard Mandarin (SM) loanword phonology, where a seemingly wide range of variation is present, have started to uncover cases where instances of variable adaptation are contextually conditioned (e.g. Hsieh, Kenstowicz, & Mou, 2009 on SM nasal codas; Lin 2008 on SM vowels). Our study presents corpus and experimental data in which intervocalic English nasals are variably adapted as either geminates or singletons in SM. We argue that the perceived duration and nasalization of the English prenasal vowels condition which variant is preferred in SM, and suggest how these vowel quality cues are processed and mapped onto SM phonological representation by monolingual and bilingual SM speakers.

Corpus data. Based on a dictionary corpus with 2400 sound-based proper noun loanwords, we have identified that English intervocalic nasals are adapted with nasal gemination in SM (90.8%) when the English prenasal vowel is lax and non-high (the vowel type condition) and stressed (the stress location condition), e.g. *Diána*→[tai.a**n.n**aː] *vs.* *Brúno*→[puː.luː.**n**^{w}oː] (prenasal stressed tense high vowel) and *Bonita*→ [p^{w}oː.**n**iː.t^{h}aː] (postnasal stressed vowel). Free variation occurs when the English prenasal vowel is [ə], e.g. *Tíffany*→[tiː.fa**n.n**ei]~[tiː.fuː.**n**i]. We propose that the geminate variant is preferred due to (i) a better match for vowel duration between an English lax vowel and a phonetically short vowel in a SM closed syllable (CVN), (ii) a better match for English vowel nasalization in non-high vowels. We therefore hypothesize that the perceived vowel duration and nasalization of English prenasal vowels play a crucial role in inducing the geminate variant.

Experimental data. A perceptual similarity adaptation experiment was conducted to find out (i) whether the English prenasal vowel quality and stress location condition nasal variation in SM loanwords, (ii) which variant is preferred under what contexts, and (iii) whether or not SM speakers with different levels of English exposure/proficiency behave differently. The experiment was run on 24 SM-English bilinguals who speak English in daily life, and 33 SM "monolinguals" who learned English from classroom instruction but do not use English at all in daily life. All participants listened to 127 (42 test items & 85 filler items) nonce word triplets twice in the ABX and BAX formats with an English input (X, e.g. [bǽni]) and two possible SM adapted outputs (A and B, e.g. [ba**n.n**i] and [baː.**n**i]), and were asked to choose which adapted SM form sounded more similar to the English source.

The results show that in comparing inputs with stressed prenasal lax vs. stressed tense vowels, both groups of participants have a significant higher rate in choosing the geminate variant [CVN.NV] to match the [ˈCV_{lax}NV] structure ($F(1,55)=2.820$, $p<0.001$), and the two groups do not show significant difference ($F(1,55)=0.044$, $p=0.129$) (Fig. 1). Same findings obtain when the input postnasal vowel is stressed ($F(1,55)=4.124$, $p<0.001$). The two groups also do not show significant difference ($F(1,55)=0.006$, $p=0.563$) (Fig. 2). For the free variation pattern with English CV́CəNV, 60.2% of the bilinguals' and 74.7% of the monolinguals' responses chose nasal gemination; the difference in response rates between the two groups is significant ($t(35.445)=2.622$, $p=0.013$) (Fig. 3). Different from the corpus data, stress location does not seem to play an active role under the experimental condition in both groups ($F(1,55)=2.787$, $p=0.101$) (Fig. 4 cf. Figs. 1&2). Moreover, regardless of stress location, the lower a lax vowel is with a higher degree of nasalization (Beddor, 1993; Hajek & Maeda, 2000), the higher the gemination rate is (Fig. 5).

Discussion & Conclusion. The results indicate that English prenasal vowel duration and nasalization contribute to the selection of the geminate variant in SM. First, given the bimoraic requirement for full-toned SM syllables (Duanmu, 2007), English prenasal lax vowels are perceived as monomoraic vowels in SM and hence are more likely to trigger nasal gemination to produce a bimoraic [CVN] syllable. In contrast, tense vowels tend to have a direct match and form a heavy [CV:] syllable in SM. Second, an even higher gemination rate occurs as a result of a very short prenasal schwa, further supporting the vowel duration effect. Third, stronger vowel nasalization in non-high vowels triggers higher gemination rates in SM. Fourth, adding a nasal to a short vowel not only makes a better phonetic match on vowel duration and nasalization, but also fulfills SM phonotactic constraints (cf. Yip, 1993 on gemination in Cantonese), and last, overall, the vowel duration cue appears to be the dominant force, as indicated by the higher geminate rate after a prenasal schwa (Fig. 3) than other lax vowels (Figs. 1&2). The lack of the stress effects exhibited in the corpus data and the relative lower gemination rate in the prenasal stressed lax vowel context in the experiment (50%~63% Figs. 1&2; cf. 90.8% in corpus) are attributed to the auditory experimental setting, which likely leads to auditory variation (cf. Davidson, 2007, Smith, 2006) and less access to phonological representation such as metrical structure. The monolinguals' higher gemination rate in matching English CV́CəNV (Fig. 3) likely indicates their heavy reliance on perceptual cues, whereas the bilinguals may have a better access to phonological representation to reduce the vowel duration effect to some extent. To conclude, this study contributes to a better understanding of which phonetic cues modulate variation in adapted forms and how they do so. It also showcases multiple sources for variable loanword adaptation: linguistic contexts, auditory vs. non-auditory inputs, and monolingual vs. bilingual differences.

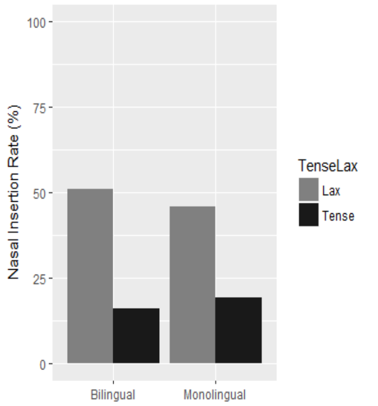

Figure 1. Nasal gemination rate with different prenasal vowel quality and stressed prenasal vowels: $\text{C}\acute{\text{V}}_{\text{tense}}\text{NV}$ vs. $\text{C}\acute{\text{V}}_{\text{lax}}\text{NV}$

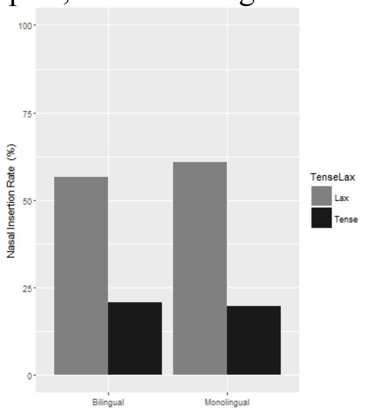

Figure 2. Nasal gemination rate with prenasal lax vs. tense vowels and stressed postnasal vowels: CV_{tense}níta vs. CV_{lax}níta

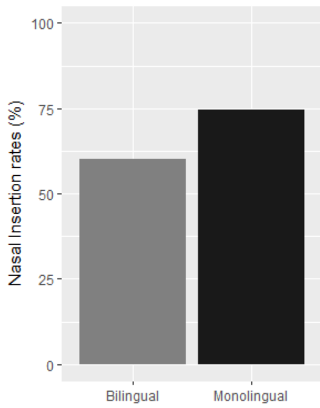

Figure 3. Nasal gemination rate when the prenasal vowel is [ə]: CV́CəNV

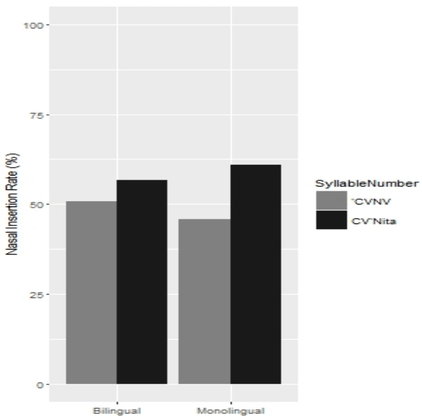

Figure 4. Nasal gemination rate with stressed lax prenasal vs. stressed postnasal vowels: $\text{C}\acute{\text{V}}_{\text{lax}}\text{NV}$ vs. CVNíta

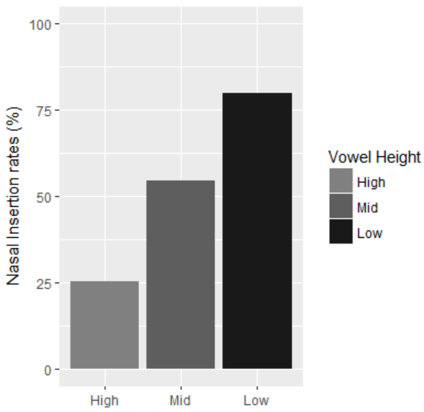

Figure 5. Nasal gemination rate in relation to the prenasal lax vowel height regardless of stress location.