

# Is Nasalization Phonological or Co-articulatory in Chinese? An Acoustic Study on Chengdu Dialect and Beijing Mandarin

Yongqing Ye and Yunting Gu\*

Michigan State University

yeyongqi@msu.edu guyuntin@msu.edu

It has been a quest for linguists to distinguish phonological processes from phonetic processes. An example of a universal phonetic process is anticipatory nasalization (Beddor and Krakow 1999; Cohn 1993). To distinguish between phonological and phonetic nasalization, Solé (1992, 1995) argued that if the nasalized portion of the vowel varies with speech rate, i.e., the proportion of nasalisation remains constant across speech rates, the vowel nasalization is phonological, whereas if it stays relatively constant regardless of speech rate, it is coarticulatory nasalization. This study aims to understand the vowel nasalization in two distinct Chinese varieties, Beijing Mandarin (henceforth BM) and Chengdu Dialect (henceforth CD). It adopts Solé’s (1992, 1995, 2007) linking hypothesis to examine whether these Chinese dialects have phonological or phonetic nasalization. The experimental results suggest that vowel nasalization in both Chinese dialects is phonological.

We conducted two experiments with the same design, using a handheld nasometer (Glottal Enterprises, Syracuse, NY), which is a split-channel microphone system and records the intensity and duration of nasal and oral channels simultaneously. Each native speaker (age 24-29) of BM (2 female) and CD (2 female, 3 male) produced 3 repetitions of real words in a carrier phrase at two speech rates, fast and slow, in two separate sessions with filler words (4 for BM, 0 for CD). Target words consisted of [CVn] and [CVŋ] (8 for BM, 6 for CD) and [CV] words (4 for BM, 4 for CD). Recordings were manually annotated using TextGrids in Praat (Boersma and Weenink 2020), and vowel nasal intensity was extracted from the nasal channel with a Praat script and averaged across three repetitions of all vowels for participants of each language variety. Vowels in [CVN] were compared against the nasal intensity baseline from [CV] structures. Figures 1 and 2 present line plots of vowel nasal intensity at every 10% increment point for the entire duration of the vowel. The results of both experiments show that the ratio of nasalized portion to the entire duration of the vowel stays consistent with different speech rates, suggesting that vowel nasalization in both CD and BM is phonological, not co-articulatory.

The study took an experimental approach and compared cross-dialectal patterns in changes in nasal energy. Our results are consistent with Duanmu’s (2011) claim that Chinese nasalisation is phonological; however, more work needs to be done to separate the issue of underlying vowel nasality from allophonic vowel nasality. Furthermore, as argued by Beddor et al. (2018), inter-speaker variability of production and perception potentially links to the initiation of sound change, and therefore further probing of the nasalisation patterns in such dialects will provide some insights about language change. We hope continuing the careful phonetic study of nasalisation in Chinese dialects will lead to a more nuance understanding of the development of nasal vowel contrasts in the world’s languages.

---

\*These authors contributed equally to this work and are co-first authors.

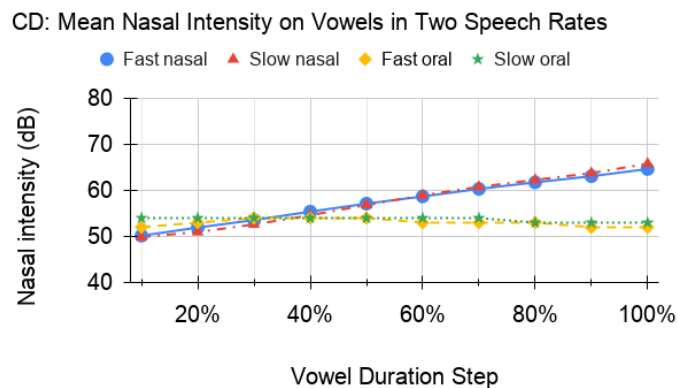
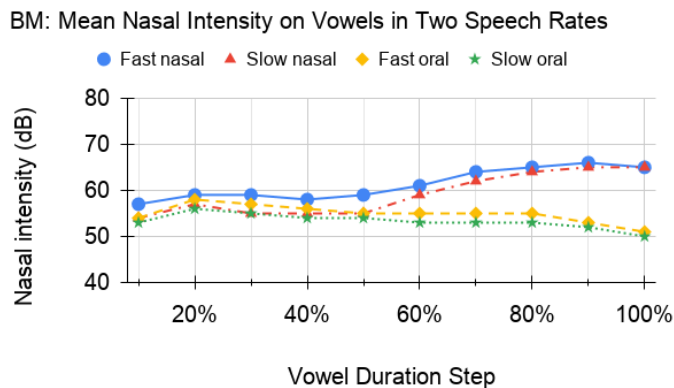


Figure 1: Beijing Mandarin Nasal Intensity Trajectories

Figure 2: Chengdu Dialect Nasal Intensity Trajectories

## References

- Beddor, Patrice Speeter, Andries W Coetzee, Will Styler, Kevin B McGowan, and Julie E Boland (2018). “The time course of individuals’ perception of coarticulatory information is linked to their production: Implications for sound change”. In: *Language* 94.4, pp. 931–968.
- Beddor, Patrice Speeter and Rena Arens Krakow (1999). “Perception of coarticulatory nasalization by speakers of English and Thai: Evidence for partial compensation”. In: *The Journal of the Acoustical Society of America* 106.5, pp. 2868–2887.
- Boersma, Paul and David Weenink (2020). *Praat: doing phonetics by computer [Computer program]. Version 6.1. 15.*
- Cohn, Abigail C (1993). “The status of nasalized continuants”. In: *Nasals, nasalization, and the velum*. Elsevier, pp. 329–367.
- Duanmu, San (2011). “Chinese syllable structure”. In: *The Blackwell companion to phonology*, pp. 1–24.
- Solé, Maria-Josep (1992). “Phonetic and phonological processes: The case of nasalization”. In: *Language and speech* 35.1-2, pp. 29–43.
- Solé, Maria-Josep (1995). “Spatio-temporal patterns of velopharyngeal action in phonetic and phonological nasalization”. In: *Language and Speech* 38.1, pp. 1–23.
- Solé, Maria-Josep (2007). “Compatibility of features and phonetic content. The case of nasalization”. In: *Proceedings of ICPHS*, pp. 261–266.