

## Producing // and /n/ from a merging L1 system: L1 Chongqing Mandarin, L2 Standard Mandarin, L3 English

Di Wang, Claire Nance  
Lancaster University

This study investigates how speakers of a linguistic system with an ongoing phonemic merger produce the merging contrast across their second and third linguistic systems. In doing so, it examines how theoretical models of L2 phonological acquisition can be extended to a context of ongoing sound change in multilingual phonological acquisition ([1],[2],[3]). In the context of Chongqing, a city in southwestern China, people acquire Chongqing Mandarin as their first linguistic system (L1), followed by Standard Mandarin (L2) and English (L3). In Chongqing Mandarin, there is an ongoing merger between word-initial // and /n/, but these two sounds are phonemic in Standard Mandarin and English. We investigate the following research questions: 1) To what extent can L1 speakers distinguish // and /n/ in their L1/L2/L3 production, and is the directionality in L1/L2/L3 towards // or /n/? How are they modulated by potential factors such as gender and proficiency? 2) Is there any significant correlation between their //-/n/ production accuracy among these three linguistic systems? 3) How can the predictions of SLM(-r), PAM(-L2), and L2LP be extended to this context?

We analysed production data from 40 Chongqing Mandarin speakers (21M, 19F) in their three linguistic systems. Stimuli contained word-initial near-minimal //-/n/ pairs controlled for vowel and tone in Chongqing Mandarin and Standard Mandarin, and controlled for vowel in English. The production task included 112 individual words. Participants also completed a language background questionnaire and proficiency assessment in Standard Mandarin and English. We analysed 4,474 production tokens in total. Two native speakers of British English and two native speakers of Mandarin were recorded as baseline controls, producing the same stimuli as the participants. To answer RQ1, we extracted 13 Mel-Frequency Cepstral Coefficients (MFCCs), which capture overall spectral information potentially relevant to the //-/n/ contrast. Token-level Euclidean distance was calculated between the 13-dimensional MFCC vectors of // and /n/ tokens to explore the extent of the //-/n/ merger. Principal component analysis (PCA) was used to de-correlate the MFCCs and reduce dimensionality. Linear discriminant analysis (LDA) was performed using PCA components, with the model trained on prescriptively labelled acoustic data from four contrast-preserving speakers to extract a primary acoustic dimension (LD1) distinguishing // and /n/. Cross-validation was used to validate the LDA directionality axis. Linear mixed-effects models were used to investigate potential factors contributing to the extent of //-/n/ merger (Euclidean distance) and the directionality (LD1). To answer RQ2, production accuracy was calculated as the proportion of tokens whose LDA-predicted labels matched their prescriptive labels. Pearson's correlation analysis was used to explore the correlations between //-/n/ production accuracy in their three linguistic systems. Results were adjusted for multiple comparisons via Bonferroni.

Results show that Chongqing Mandarin speakers produced almost no difference between // and /n/ in L1 Chongqing Mandarin, a greater distinction in L2 Standard Mandarin, and the greatest distinction in L3 English. The //-/n/ merger was more likely to occur in high-vowel or nasal-coda contexts. The directionality of the merger was towards // in their L1 and L2 production, modulated by vowel height and gender. No significant directionality towards // or /n/ in L3 English was observed. There were no significant correlations between //-/n/ production accuracy in any of three linguistic systems. These results are in line with the NEW scenario proposed by ([2]) or the Single Category assimilation proposed by ([1]). As L1 lacks the functional //-/n/ contrast, L1 speakers assimilate // and /n/ sounds in their L2 and L3 onto the merging L1 category. Thus, L1 speakers must establish a new phonological contrast that is not present in their L1. Overall, it demonstrates that the above speech learning models can be extended to a context of ongoing sound change in multilingual phonological acquisition.

[1] Best, C. T., & Tyler, M. D. (2007). Nonnative and Second-Language Speech Perception: Commonalities and Complementarities. In M. M. a. O.-S. Bohn (Ed.), *Second Language Speech Learning: The Role of Language Experience in Speech Perception and Production* (pp. 13-34). John Benjamins Publishing Company. [2] Escudero, P. (2005). Linguistic perception and second language acquisition: Explaining the attainment of optimal phonological categorization. Netherlands Graduate School of Linguistics. [3] Flege, J. E., & Bohn, O.-S. (2021). The revised speech learning model (SLM-r). In R. Wayland (Ed.), *Second language speech learning: Theoretical and empirical progress* (pp. 3-83). Cambridge University Press.