

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

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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],[4]). 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 /l/ and /n/, but these two sounds are phonemic in Standard Mandarin and English. We investigate the following specific research questions: 1) To what extent can L1 speakers distinguish /l/ and /n/ in their production? 2) Is the directionality towards /l/ or /n/? 3) Is there a relationship between /l/ and /n/ production in these three linguistic systems? 4) Can the predictions of SLM(-r), PAM(-L2), and the revised L2LP model be extended to this context?

We analysed production data from 40 Chongqing Mandarin speakers in their three linguistic systems. Stimuli contained word-initial near-minimal /l/-/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.

RQ1: We extracted 13 Mel-Frequency Cepstral Coefficients (MFCC), which capture overall spectral differences between /l/ and /n/. Token-level Euclidean distances were calculated between the 13-dimensional MFCC vectors of /l/ and /n/ tokens to quantify the extent of the /l/-/n/ merger. Linear mixed-effects models were then used to investigate potential factors contributing to the extent of /l/-/n/ merger. Results showed that Chongqing Mandarin speakers produced almost no difference between /l/ and /n/ in L1 Chongqing Mandarin, a greater distinction in L2 Standard Mandarin, and the greatest distinction in L3 English (Figure 1). The /l/-/n/ merger was more likely to occur in high-vowel or nasal-coda contexts ([3]).

RQ2: The 13 MFCCs were reduced to nine components using Principal Component Analysis (PCA). Linear Discriminant Analysis (LDA) was then performed on these nine components to extract a primary acoustic dimension (LD1) distinguishing /l/ and /n/. The LDA model was trained on prescriptively labelled acoustic data from two Mandarin and two British English speakers. All of them were female. The English speakers were L1 speakers of British English from north-west of England. Mandarin speakers had obtained the Level 1-B (i.e., 一级乙等) in the *Putonghua* proficiency test, i.e., the advanced level required for teaching Chinese. After training, the model was used to categorise tokens produced by Chongqing Mandarin speakers. The directionality of the merger was towards /l/ in L1 and L2 production (Figure 2), modulated by vowel height and gender.

RQ3: Pearson's correlation analysis was used to explore the correlations between /l/-/n/ production accuracy in the three linguistic systems. Production accuracy was calculated as the proportion of tokens whose LDA-predicted labels matched their prescriptive labels. Results were adjusted for multiple comparisons. There were no significant correlations between /l/-/n/ production accuracy in any of three linguistic systems (Figure 3).

RQ4: These results are in line with the NEW scenario proposed by ([4]). Specifically, L1 speakers may acquire a phonological contrast that is undergoing merger in their L1, and the contrast between /l/ and /n/ is still developing in their L2 and L3 phonological systems. Overall, it demonstrates that the revised L2LP model ([4]) can be extended to a context of ongoing sound change in multilingual acquisition.

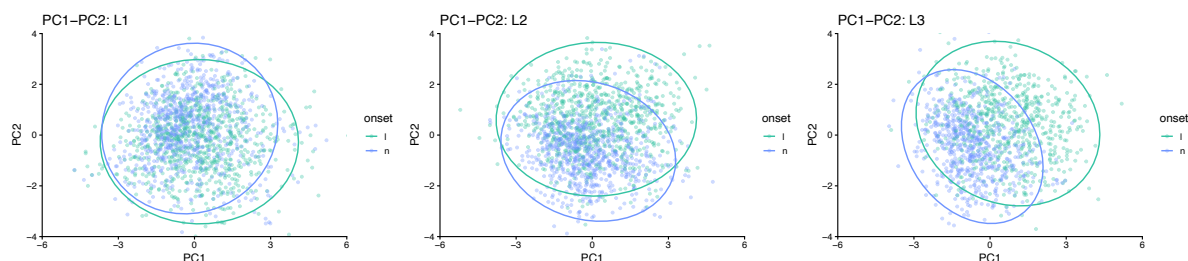


Figure 1 Clustered distributions of /l/-/n/ production based on prescriptive labels

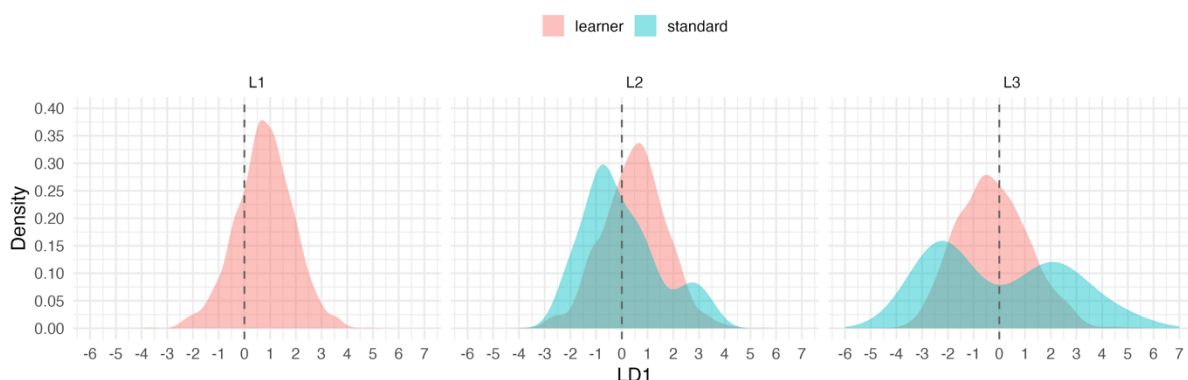


Figure 2 The directionality of /l/-/n/ in L1, L2, and L3 production

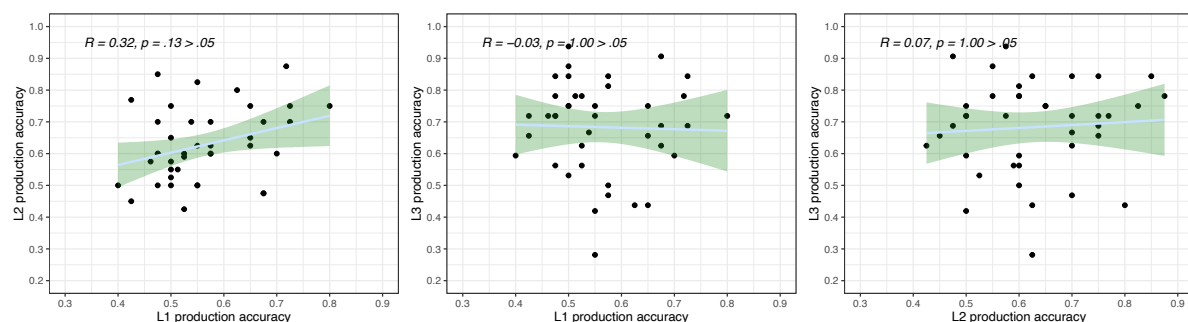


Figure 3 The correlations between production accuracy in L1, L2, and L3

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