

Does language contact influence the direction of production-perception misalignment? The case of vowel length contrast in Long'an Zhuang

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Background: The mapping of production and perception has become a central issue in sound variation and change, and one of the key questions is the direction of misalignment, i.e., which domain goes first, and how the contexts of variation influence this relationship. Although most previous studies found perception led the change in the initial stage [1, 2, 3], these studies assumed internal changes. Therefore, less is known about whether the involvement of language contact can lead to different results compared to internal changes.

Aim & Significance: This study aims to provide insights into this research gap by presenting a new case in the bilingual context, aiming to examine whether L2 influences impact the mapping between perception and production. The existence of L2 impact is suggested by the production-preceding phenomenon found in this case.

Methods: This study investigated 34 (19-71 years old) L1 Zhuang/L2 Mandarin Chinese bilinguals' cue weighting in production and perception of the vowel length contrast of their L1, Long'an Zhuang (a Tai language in Guangxi, China), which includes both duration and spectral contrast. The global language scores (GLS) of both L1 and L2 via the BLP questionnaire [4] were calculated to represent the language power of the two languages. In the production experiment, six stop-final (near) minimal pairs of /a: a/ preceding different codas (-p, -t, -k) were chosen as targets, and were measured for the duration, F1, and F2 of the vowel (Fig. 1) Random forest models were built to calculate the relative cue weight of each cue on each individual's duration, F1 and F2 data (within-speaker normalized). The duration difference and the distance in $F1 \times F2$ space of each long and short vowel pair were also obtained for each individual. In the perception experiment, a 2AFC word identification task was adopted. The target stimuli were synthesized from the naturally produced minimal pair /pa:t 55/ 'basin' and /pat 55/ 'pen' of a middle-aged male speaker. The duration and formants were modified in incremental steps (2 master sounds \times 5 duration \times 5 formant) using LPC resynthesis in Praat, with the duration and formant values of the original audios as the endpoints of the continua. By establishing logistic regression models, the relative weight of each cue was calculated by the formula "the beta coefficient of the cue \div the beta coefficient sums of two acoustic cues" to make the results more comparable between models. For the results of production and perception respectively, Pearson correlations were implemented to examine their relationships with age and GLS of Zhuang and Chinese.

Results: The contrast was remained, but cue use shows individual differences. The production results show a significant negative correlation between duration cue weight and age, and further, no effect with duration difference but significant positive correlations of $F1 \times F2$ distance with age and GLS of Zhuang, as shown in Table 1. This indicates an initiation of merger with strengthened reliance on duration, driven by a reduction in formant distinction in the young speakers, which is facilitated by L1 attrition. However, in perception, there is no age effect but a marginal negative correlation between duration cue weight and the GLS of Chinese. The absence of an age effect suggests a lack of evidence for diachronic change, but there is an effect of L2 transfer on weakening the perceptual reliance on duration.

Discussion: The results show a misalignment in production and perception, and that production first initiates the change, which aligns with findings in dialect acquisition [5, 6] but is different from the perception-leading results found in language-internal changes. These findings illustrate that the direction of production-perception misalignment may vary depending on the involvement of internal or external forces, since language contact can lead to unbalanced effects on production and perception. It can be explained by the mechanisms of the two kinds of changes and the nature of perception: (i) internal changes are about spreading innovations within one system while bilingual cases involve the impact of one language system on another. (ii) perception is more flexible and adaptive to absorb innovations while also more resistant to the L2 influence.

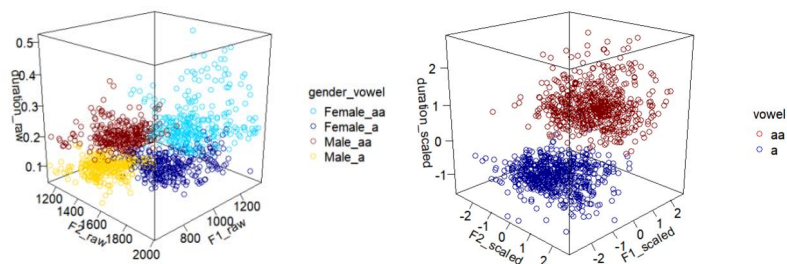


Fig. 1. F1 × F2 × duration spaces for /a:/ and /a/ (left: raw data; right: within-speaker normalized data)

Table 1. Results of Pearson’s correlations between the results of production (duration relative cue weight; duration difference and F1×F2 distance based on within-speaker normalized data) and perception (duration relative cue weight) and age, Zhuang global language score, and Chinese global language score.

Results of production and perception		Bilingual-related parameters			
		age	gls_z	gls_ch	
Production	Duration relative cue weight	Pearson’r	-0.381	-0.301	-0.05
		p value	0.026*	0.083	0.786
	Duration difference	Pearson’r	-0.242	0.076	-0.176
		p value	0.168	0.67	0.319
	F1×F2 distance	Pearson’r	0.604	0.491	-0.049
		p value	0.0002***	0.003**	0.785
Perception	Duration relative cue weight	Pearson’r	-0.025	0.04	-0.329
		p value	0.889	0.817	0.058

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