

Contrastive hyperarticulation of low-rising tones in Changsha Xiang and Plastic Mandarin

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Changsha Xiang (CSX) has two low-rising tones (T2 and T6), which have shown signs of an incipient merger [1-3]. Potential contribution to such a merging process comes from the everyday bilingual practices of young speakers who also speak Changsha Plastic Mandarin (CPM), a Mandarin variety shaped by Mandarin–Xiang contact [4]. The only low-rising category in CPM (CPM T2) encompasses both CSX T2 words and a subgroup of CSX T6 words, some of which also contrast with CSX T2 words in aspiration in CPM. Furthermore, T3 sandhi in CPM changes the low-falling T3 to a low-rising surface tone before another T3 [5]. It is unclear whether CPM sandhi T3 neutralises fully with T2 or, as in Standard Mandarin (SM), retains phonetic traces of its underlying form [6]. In fact, if CSX T2, CSX T6, and CPM sandhi T3 are all subsumed under a single low-rising category in CPM, spoken words would become highly confusable, unless some phonetic differentiation is preserved in representation. Contrastive hyperarticulation, i.e., phonetic enhancement when a minimal pair competitor is present, provides a means to reveal latent distinctions in suspended contrast like this [7].

This study investigated the realisation and representation of the low-rising tones in CSX and CPM, asking if bilingual speakers merge CSX T2 words (henceforth T2) and CSX T6 words (henceforth T6) in each language, how strongly they would hyperarticulate in minimal pair competitor contexts, and whether CPM sandhi T3 (henceforth T3) induces the hyperarticulation of T2 or T6 and vice versa.

Twelve CSX-CPM bilinguals (6 females, aged 20-27) participated in a word naming experiment [8] online in Gorilla [9]. The stimuli were nine pairs of T2/T6-beginning disyllabic words, their corresponding CPM cognates (three pairs of which contrast in aspiration), plus three T2/T3 pairs and three T6/T3 pairs (Table 1). Additionally, some tonally unrelated words served as control. In each trial, participants first saw three disyllabic words, with a purple box indicating the target item. The target appeared in one of three randomised positions, under either competitor-present or competitor-absent conditions. Participants were then instructed to read aloud a prompt (“Please choose the word XX.”) to a simulated interlocutor who should thereby identify the target (Fig 1). Each speaker produced a total of 288 tokens.

Target items were labelled and analysed using ProsodyPro [10], with f0 tracking errors manually corrected. Time-normalised semitone f0 (10 points) were z-score normalised for each speaker. Four Generalised Additive Mixed Models (GAMMs) with AR(1) error structures were fitted to CSX T2/T6, CPM T2/T6, CPM T2/T3, and CPM T6/T3. The independent variables included parametric effects of tone, competitor condition, and their interaction, as well as a smooth for their interaction. For the CPM T2/T6 model, an additional factor of aspiration contrast was included to yield a three-way interaction. Additional smooths modelled the effects of the following tone and time point, with random smooths for speakers and segments.

The results showed that, firstly, young CSX speakers consistently produced T6 with a lower onset and a higher offset than T2, regardless of competitor condition (Fig 2). In CPM, by contrast, no significant acoustic difference was found (Fig 3). Secondly, in CPM, T2 and T3 differed significantly in contour shape, whereas T6 and T3 did not. Plot-difference analyses showed that sandhi T3 was produced with a lower onset, a higher offset, and thus a steeper slope than T2 (Fig. 4). This steeper slope, however, diverges from the SM sandhi T3 pattern [6] and cannot be attributed to residual underlying T3 information. Lastly, regarding contrastive hyperarticulation, sandhi T3 was hyperarticulated (lower onset) with a T2 competitor, and T2 was hyperarticulated (later rise) with a sandhi T3 competitor (Fig 5). However, sandhi T3 induced T6 hyperarticulation (higher offset) but not vice versa (Fig 6). Such asymmetries were discussed in relation to exemplar-based representations and cascading activation [11].

Table 1. Examples of word pairs used in the study

Pair	Lang	Tone	Target/competitor
1	CSX	T2	時薪 /sz2 ɛm1/ (hourly wage)
		T6	實心 /sz6 ɛm1/ (solid)
2	CPM	T2	時薪 /sz2 ɛm1/ (hourly wage)
		T6	實心 /sz6 ɛm1/ (solid)
3	CPM	T2	眉骨 /mei2 ku3/ (brow ridge)
		T3	美股 /mei3 ku3/ (American stocks)
4	CPM	T6	直飲 /tʃz6 m3/ (direct drinking)
		T3	指引 /tʃz3 m3/ (guidance)

*Note: Tone numbers reflect their CSX tone categories, not CPM's surface realisations.

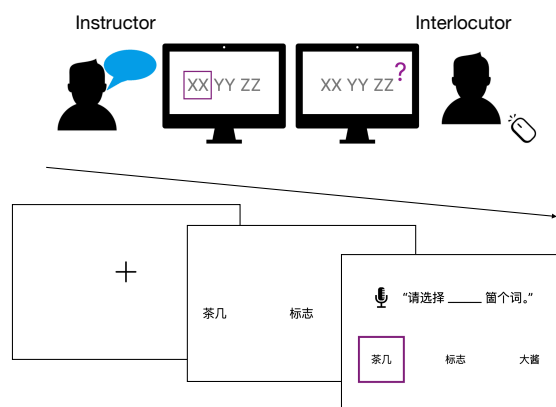


Fig 1. Procedure of the word naming task. Participants were assigned the role of “instructor”.

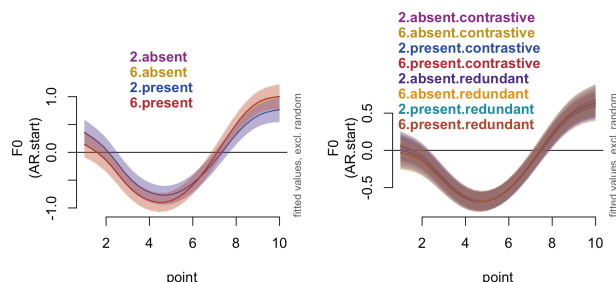


Fig 2. CSX f0 contours: T2 vs T6 in two competitor conditions (absent vs present). Shaded bands show the 95%-confidence interval.

Fig 3. CPM f0 contours: T2 vs T6 across competitor conditions (absent vs present) & phonological status of f0 (contrastive vs redundant). *Redundant: aspiration also serves the contrast.

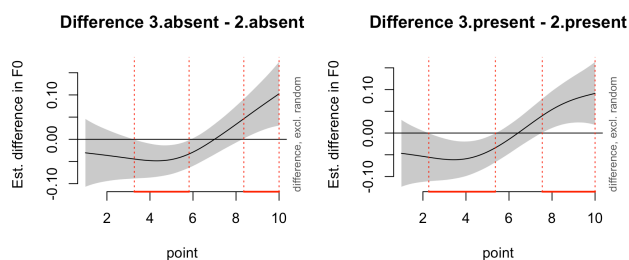


Fig 4. Difference curves between T2 and T3 in CPM. Shaded bands show the 95%-confidence interval; significant intervals are marked in red between dotted lines.

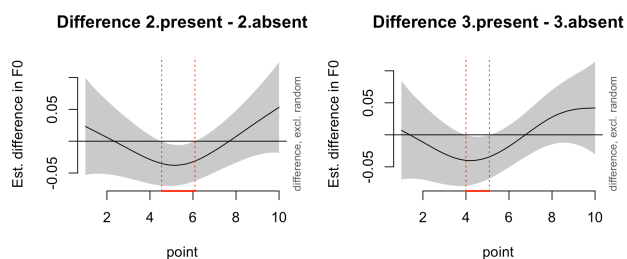


Fig 5. Contrastive hyperarticulation between T2 and T3 in CPM.

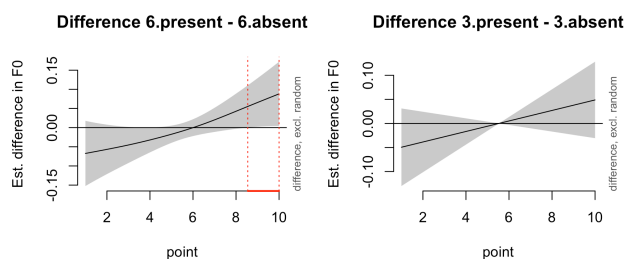


Fig 6. Contrastive hyperarticulation between T6 and T3 in CPM.

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