THE INFLUENCE OF LANGUAGE LOSS ON TONE PERCEPTION: WEAKENED SOUND QUALITY CUES IN THE PRESERVED TONE PAIRS

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Introduction

It has been found that in the perception of non-lexical pitch, individuals from different language backgrounds rely on sound quality[1]. However, lexical pitch perception differs from non-lexical pitch perception. Lexical pitch perception is both influenced by universal auditory mechanisms observed in humans and language experience.

Changsha City, the capital of Hunan Province, is currently undergoing a process of promoting Standard Mandarin (SM), loss of Changsha Dialect (CD), and the emergence of a new language variant known as Changsha Plastic Mandarin (CPM).

The segmental features of CPM are identical to those of SM, with the main differences lying in tone and intonation. Past studies have indicated that the T1 and T4 tones in CPM match those in CD[2]. T1 and T4 common to both CD and CPM differ in F0 height and movement. Additionally, tense voice or falsetto is commonly used during T4 production in CD[3]. This implies that sound quality may impact the perception of T1-T4. To investigate whether the utilization of T1-T4 perception cues differs between individuals who have lost the CD and have only mastered CPM and those who have proficiency in the CD, this study aims to examine this distinction.

Acoustic analysis

The F0 features of the speaker's tone output are shown in Fig. 1, which is similar to previous studies. Previous studies have not confirmed the difference in sound quality between T1 and T4 by extracting acoustic parameters. We used VoiceSauce to extract the H1*-H2* of T1 and T4 in the pronouncers' CD and CPM. The results show that there is a significant difference between the H1*-H2* of T1 and T4 in the pronouncers' CD($p=0.0034$) and CPM($p=0.0008$), which means that there is a sound quality difference between T1 and T4 in both CD and CPM in terms of the spectral features of the pronouncers' tonal outputs in this study.
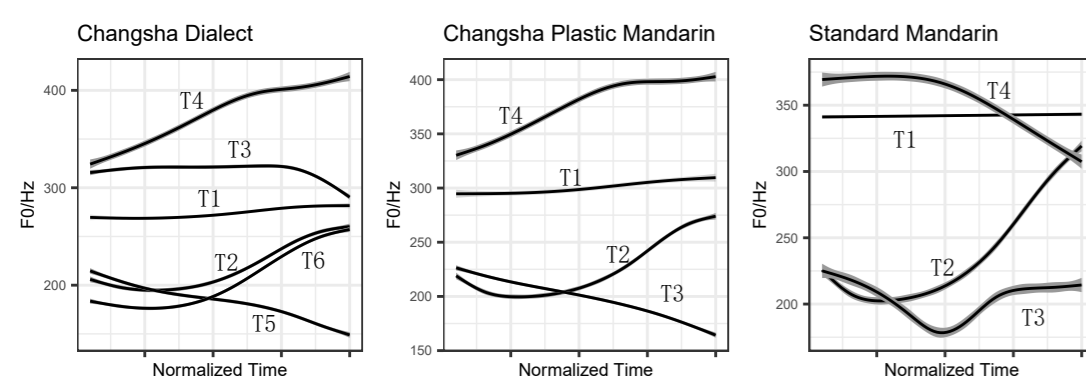

Fig. 1. Tonal pattern of CD (left), CPM (middle), and SM (right)

Methods

Stiumlus

Stimuli 1 and 2 represent the continuous series of T1-T4 tones, with "fu_T1" (夫) and "fu_T4" ("富") as the carrier sounds. Both sets of stimuli were numbered 1-10 based on the order of changing F0 from T1 to the F0 of T4. Stimuli 3 and 4 maintain the F0 movement of "fu_T1" (夫) and "fu_T4" ("富") but vary the F0 height. The stimuli are numbered 1-10 according to the order of F0 height increase. The range of F0 changes for each continuum is shown in Fig. 2.
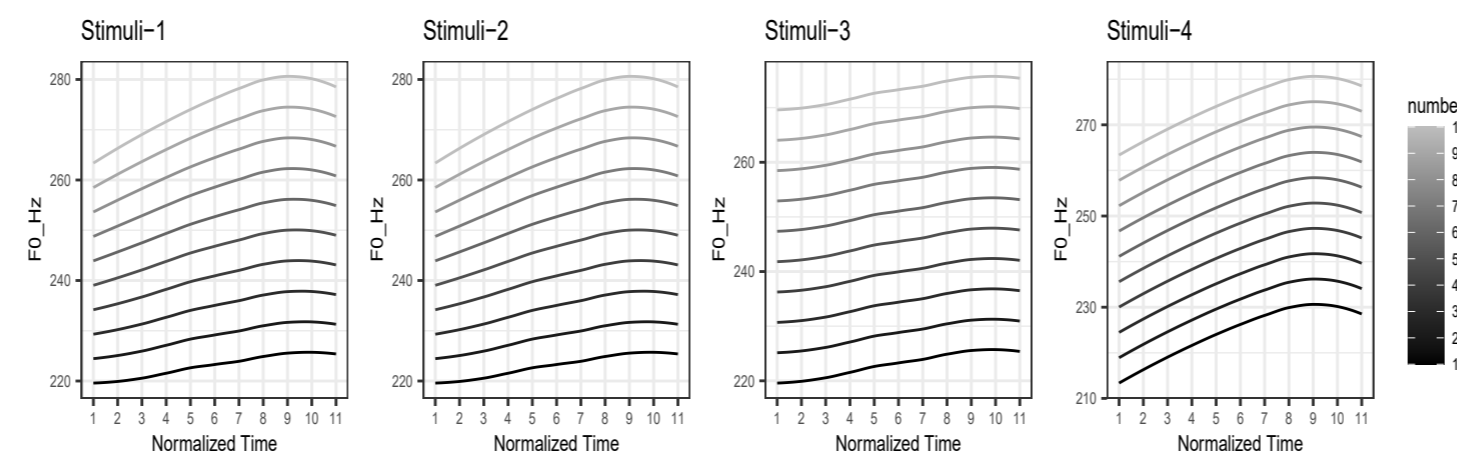

Fig. 2. Pitch range for four sets of stimuli

Participants

Two groups of participants took part in this experiment, all of whom were born and raised in Changsha. Individals in Group A (7M and 7F; mean age 29.6) mastered CD, CPM and SM. Individals in Group B (12M and 14F; mean age 20.3) mastered CPM and SM.

Procedure

Each group of identification tests consisted of 10 stimuli, each of which was repeated three times, for a total of 120 trials across the four groups (10 stimuli × 3 repetitions × 4 groups of experiments). During the experiment, participants were randomly presented with one stimulus at a time and asked to select the stimulus they heard and to make a forced choice by clicking on the on-screen options "夫" (T1"husband") and "富" (T4"rich").
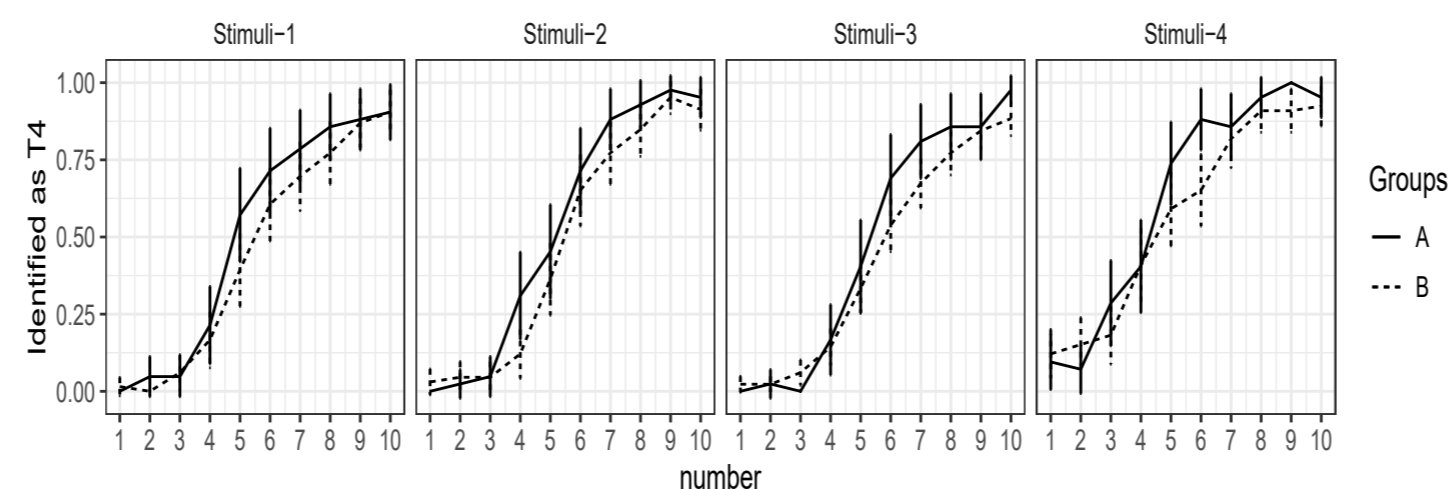
Results

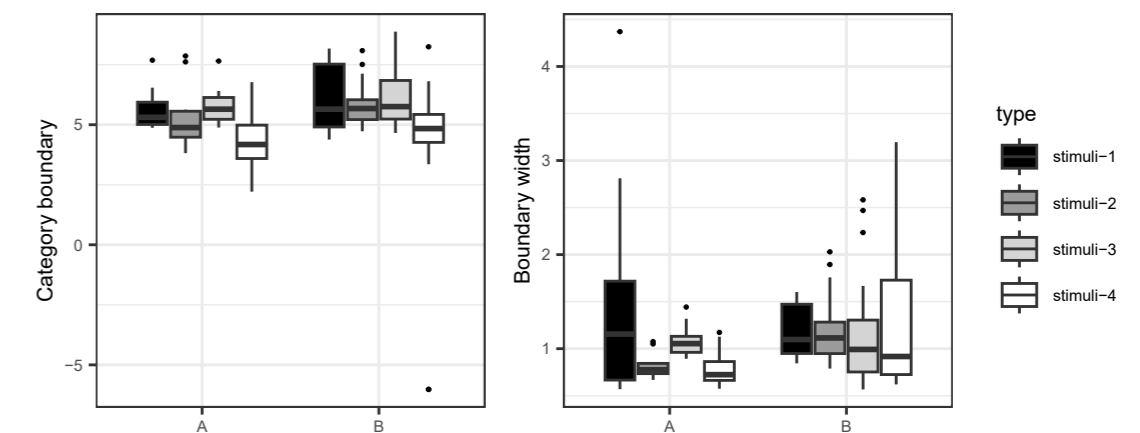Fig. 3. Perception of the 4 sets of stimuli by the two groups

Fig. 4. Category boundaries and Boundary widths of the two groups' perceptions of 4 sets of stimuli.

Fig. 3. shows the perception of two groups to four sets of stimuli. A logistic regression model was utilized to fit the perception results, and the perceived category boundaries and boundary widths [4][5] were calculated as shown in Fig. 4. The significance of the differences was analyzed using linear mixed models. The results show that there is a difference in the boundary width for stimulus 1 and stimulus 2 in Group A, while there is no difference in the perception of stimulus 1 and stimulus 2 in Group B. There is a significant difference in the category boundaries for perceiving stimulus 2 and stimulus 4 in Group B, which indicates that there is an effect of tonal shapes on the perception in Group B, whereas such a difference does not exist in Group A.

Therefore, our main findings are that: in the conditions of the present study, the main cue for T1-T4 perception in both groups was F0 height; there is an effect of sound quality on perception of Group A but not of Group B; F0 movement has an effect on perception of group B but not of group A.

Discussion

Lexical pitch perception is different from non-lexical pitch perception. In Changsha, the loss of the CD has led to differences in the utilization of the perception of tones, although CPM retains the T1-T4 of CD. This suggests that subtle changes in language experience can also cause changes in the perception of tones. Listeners' perception of tones is not only related to the acoustic characteristics of tones, but also to their language experiences.

References

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