The effect of L2 proficiency on pitch and phonation sensitivity in naïve tone perception —A study of Wenzhou dialect tone perception by English learners of Mandarin

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Introduction

Background

- **Linguistic status of phonation**

➢ Mandarin: **Allophonic**

Creaky voice co-occurs with Mandarin T3 in production [1] and serves as an enhancement cue in T3 perception [2].

➢ English: **Indexical**

Phonation is related to mood, gender and attitude [3].

An increasing trend of *creaky voice* among young American and British women [4].

➢ Wenzhou Wu dialect: **Phonemic**

As shown in Table 1, the eight tones in two registers contrast in both pitch and phonation *(breathy vs. modal)* [5].

Table 1 *Wenzhou Wu tone system*

	Pitch	Phonation	
		Breathy	*Modal*
T1	33		√
T2	31	√	
T3	45		√
T4	34	√	
T5	42		√
T6	11	√	
T7	323		√
T8	212	√	

- **L2 proficiency and L3 transfer**

There is mixed results in whether L2 proficiency influences L3 performance.

➢ **Facilitative**: [6] argues that L2 proficiency is positively correlated with L3 performance by testing the perception ability of Japanese phonemes by L1 Korean L2 English speakers.

➢ **No effect**: [7] reported that the level of bilingualism has no effect on the acquisition of L3 phonology.

Research questions

1. Does the exposure to one phonation type (creaky) at a different linguistics level increase the sensitivity to another phonation type (breathy)?
2. Is the enhancement in both pitch and phonation positively correlated with L2 proficiency?
3. Is there a cumulative facilitating effect, i.e., do non-tone language speakers with Mandarin learning experience perform better or worse than native tone-language speakers?

Method

Participants

- Two target groups

➢ **EMH**: 10 Native English speakers with high Mandarin proficiency (mean age: 24.5)

➢ **EML**: 10 Native English speakers with low Mandarin proficiency (mean age: 25.2)

- Two control groups

➢ **MAN**: 10 Native Mandarin speakers (mean age: 22.6)

➢ **ENG**: 10 Native English speakers (mean age: 25.8)

Table 2: *Language background of L2 learners*

Language group	Learning duration	HSK level	Living experience in China
EMH (average learning duration: 5.25 years)	5 years	HSK6	1 year in Beijing
	6 years	N/A	N/A
	5 years	N/A	N/A
	8 years	HSK6	2 years in Lanzhou and Beijing
	7 years	HSK5	1 year in Chengdu
	4years	N/A	N/A
	5 years	N/A	N/A
	3.5 years	N/A	N/A
	5 years	HSK5	1 year in Beijing
	4 years	N/A	N/A
EML (average learning duration: 7 months)	6 months	N/A	N/A
	7 months		
	5 months		
	10 months		
	6 months		
	8 months		
	6 months		
	8 months		
	9 months		
	5 months		

Stimuli

- Two sets of stimuli were used based on the natural production of 3 CV syllables ([tʊ], [tei], and [ji]) in Wenzhou dialect.

➢ Stimuli set 1: Manipulated tones that **differ only in pitch** (T1-T8 in modal voice). There were 312 trials (168 AB trials and 144 AA trials) in total.

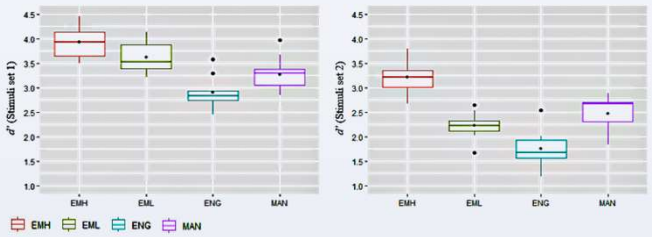
➢ Stimuli set 2: Manipulated tones that **differ only in phonation** (T2, T4, T6, T8 in modal and breathy voice). There were 144 trials (72 AB trials and 72 AA trials) in total.

Procedure

- An AX discrimination task was conducted through the online Gorilla platform. Participants were required to wear headphones in a quiet environment.
- Participants were asked to do 456 trials in 6 blocks (first four blocks: stimuli set1, last two blocks: stimuli set 2) with roughly equal number of AB and AA pairs in each block. They were allowed to take a 1-minute break between blocks.
- The inter-stimulus interval (ISI) was **500ms** for both stimuli sets.

Results

- Participants' sensitivity to stimuli differences using ***d'*** **scores**

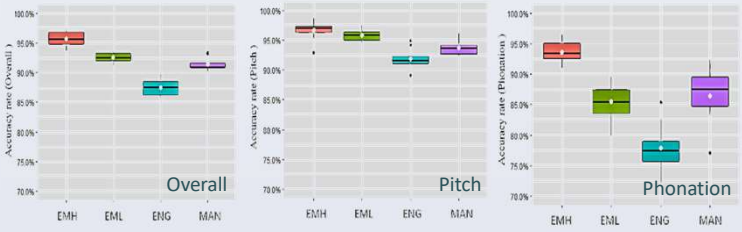


➢ All participants were more sensitive to stimuli differences in pitch than phonation.

➢ For sensitivity to both pitch and phonation, EMH > MAN and ENG ($p < 0.001$).

➢ No significant difference was found between the ENG and MAN groups.

- Accuracy rate patterns (overall, pitch and phonation)



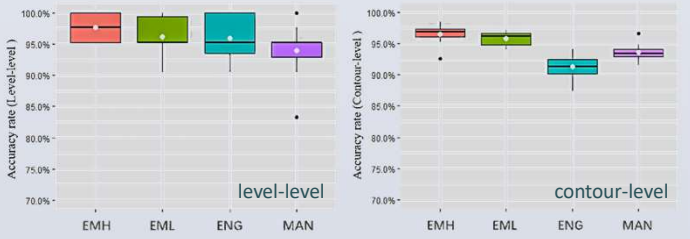
➢ In all cases, EMH > MAN and ENG ($p < 0.001$).

➢ No significant difference was found between the EML and MAN groups.

➢ For the overall and phonation patterns, EMH > EML ($p < 0.001$). No significant difference was found between the EMH and EML groups in terms of pitch.

➢ The overall and pitch accuracy patterns were similar while the accuracy rate of phonation was much lower.

- Accuracy rate pattern (level-level and contour-level tone pairs)



➢ For the level-level tone pairs, all groups have achieved high accuracy rate (> 95%) with no significant difference between groups.

➢ The pattern of contour-level tone pairs was similar to the overall pattern.

Discussion

- From a **within-group** perspective, all participants were more sensitive to pitch than to phonation (the accuracy rate even dropped by nearly 15% for the ENG group).
- From a **between-group** perspective, Mandarin learning experience facilitated the naïve L3 tone perception for native English speakers in terms of both pitch and phonation. L2 proficiency was positively correlated with the overall and phonation sensitivity but with no significant effect on pitch sensitivity.
- The EMH group even **outperformed** the MAN group. Two possibilities:

➢ Cumulative facilitating effect: L2 learners could benefit from both L1 and L2 experience in the process of naïve tone perception.

➢ Increased metalinguistic awareness about tone: L2 learners were fully aware of the difficulty in acquiring lexical tones. As a result, they pay more attention to tone features than native Mandarin speakers.

[1] Belotel-Grenié, "Phonation types analysis in Standard Chinese," *Third International Conference on Spoken Language Processing*, Yokohama, Japan, Sep. 1994, pp. 343-346. [2] R. X. Yang, "The role of phonation cues in Mandarin tonal perception/ 發聲信息在漢語四聲感知中的作用," Journal of Chinese Linguistics, vol. 43, no. 1, pp. 453–472, 2015. [3] C. Gobl and A. Ní Chasaide, "The role of voice quality in communicating emotion, mood and attitude," Speech Communication, vol. 40, no. 1–2, pp. 189–212, 2003. [4] K. Dallaston and G. Docherty, "The quantitative prevalence of creaky voice (vocal fry) in varieties of English: A systematic review of the literature," PLoS One, vol. 15, no. 3, pp. 1–18, 2020. [5] Z. Chen, "Breathy voice and low tone /气嗓音与低调," Journal of Chinese Linguistics, vol. 43, no. 1, pp. 90–118, 2015. [6] H. Onishi, "The effects of L2 experience on L3 perception," International Journal of Multilingualism, vol. 13, no. 4, pp. 459–475, 2016. [7] F. Gallardo del Puerto, "Is L3 phonological competence affected by the learner's level of bilingualism?," International Journal of Multilingualism, vol. 4, no. 1, pp. 1–16, 2007.