

Difficulty of L2 tone acquisition as revealed by the incidental learning of tone-segment mappings

Ricky Chan & Bruce Wang

Speech, Language and Cognition Laboratory, School of English, University of Hong Kong (Hong Kong)

rickykwc@hku.hk, brucexw@hku.hk

1. INTRODUCTION

- L2 sounds present different kinds of challenges to learners at the *phonetic*, *phonological*, and *lexical* levels
- Lexical tones are difficult for L2 learners whose L1 is non-tonal (e.g. English and French) (e.g. [3][4][5]). Most previous studies focused on:
 - explicit processes L2 tone identification/discrimination (phonetic level)
 - using tone categories as lexical cues (lexical level)
- However, no study has focused on learners' ability to establish new abstract tone categories at the syllable level

2. MAIN RESEARCH QUESTION

What are the effects of 1) prior musical training and 2) tonal experience on forming novel abstract syllable-level tone categories, as reflected in the incidental learning of novel tone-segment connections?

3. METHODS

3.1. SUBJECTS

80 participants; 20 in each of the following groups:

Participant Group	Mean age	Mean years of musical training
1) L1 Cantonese musicians	21.3	8.4
2) L1 Cantonese non-musicians	22.6	0.59
3) L1 English musicians	21.8	7.7
4) L1 English non-musicians	23.1	0.71

3.2. LEARNING TARGETS

Two artificial tone-segment mappings between initial consonant & tone:

Initial Consonant	Tone	Example
Aspirated Stops (e.g. <i>t^h</i> , <i>p^h</i>)	Rising (R)	/p ^h o:mR/, /t ^h ɔ:ŋR/
Approximant (e.g. /l/, /w/)	Falling (F)	/lo:mF/, /wɔ:ŋF/

- To fully learn the rules above, participants had to be able to form relevant segmental and abstract tone categories at the syllable level and pick up their connections. No processing of meaning required
- /p^h/, /t^h/ and /k^h/ and /l/, /w/ and /j/ are phonological natural classes of aspirated stops and approximants respectively in both Cantonese and English

3.3. TASKS

a) AX tone discrimination task (rising vs. falling)

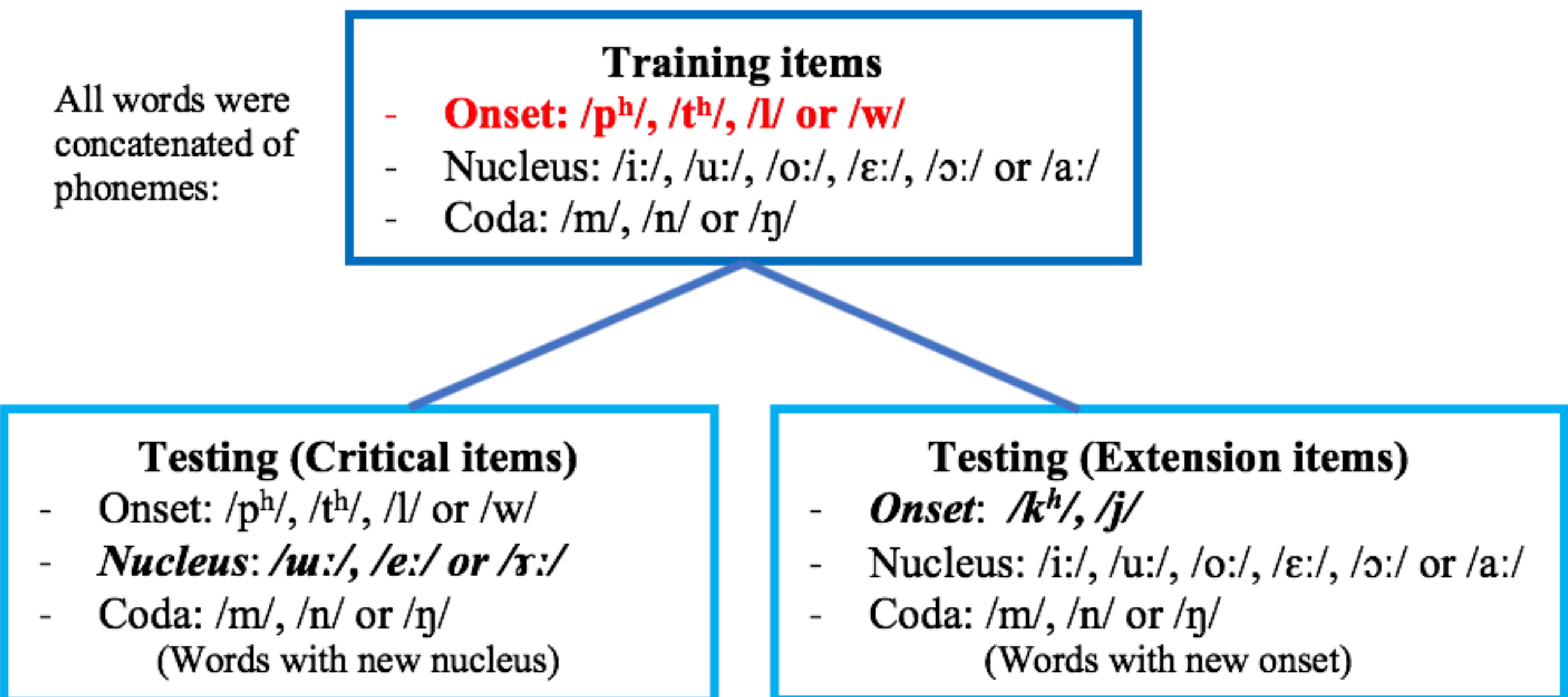
b) Training phase:

- Word learning task (adapted from [1][2]): in each trial, participants listened to a monosyllabic nonce word and repeated aloud; 288 trials
- Subjects paid attention to the pronunciation of the words, but were not informed the connections between the initial consonant type and tone categories (**i.e. incidental learning of tone-segment mappings**)

c) Testing phase:

- In each trial: subjects listened to two possible words and chose the one that sounded better
- Critical items were different from training phase in nucleus, while extension items were different in onset. 36 critical items & 36 extension items
- All stimuli: synthesised monosyllables based on Thai

3.3.1 TRAINING AND TESTING ITEMS



4. MAIN RESULTS

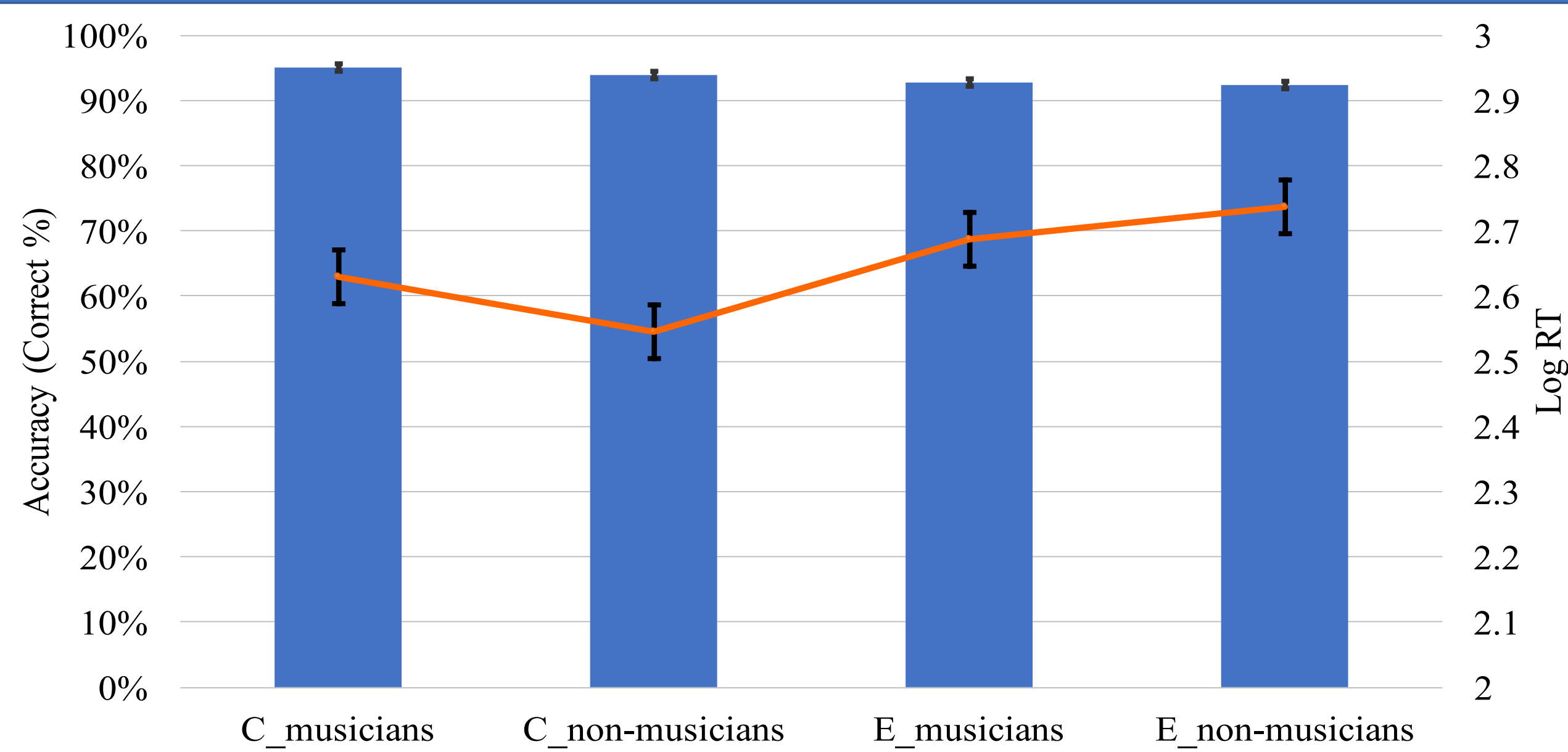


Figure 1. Average accuracy and log-reaction time (logRT) of the four groups for the AB (different) pairs in the AX discrimination task.

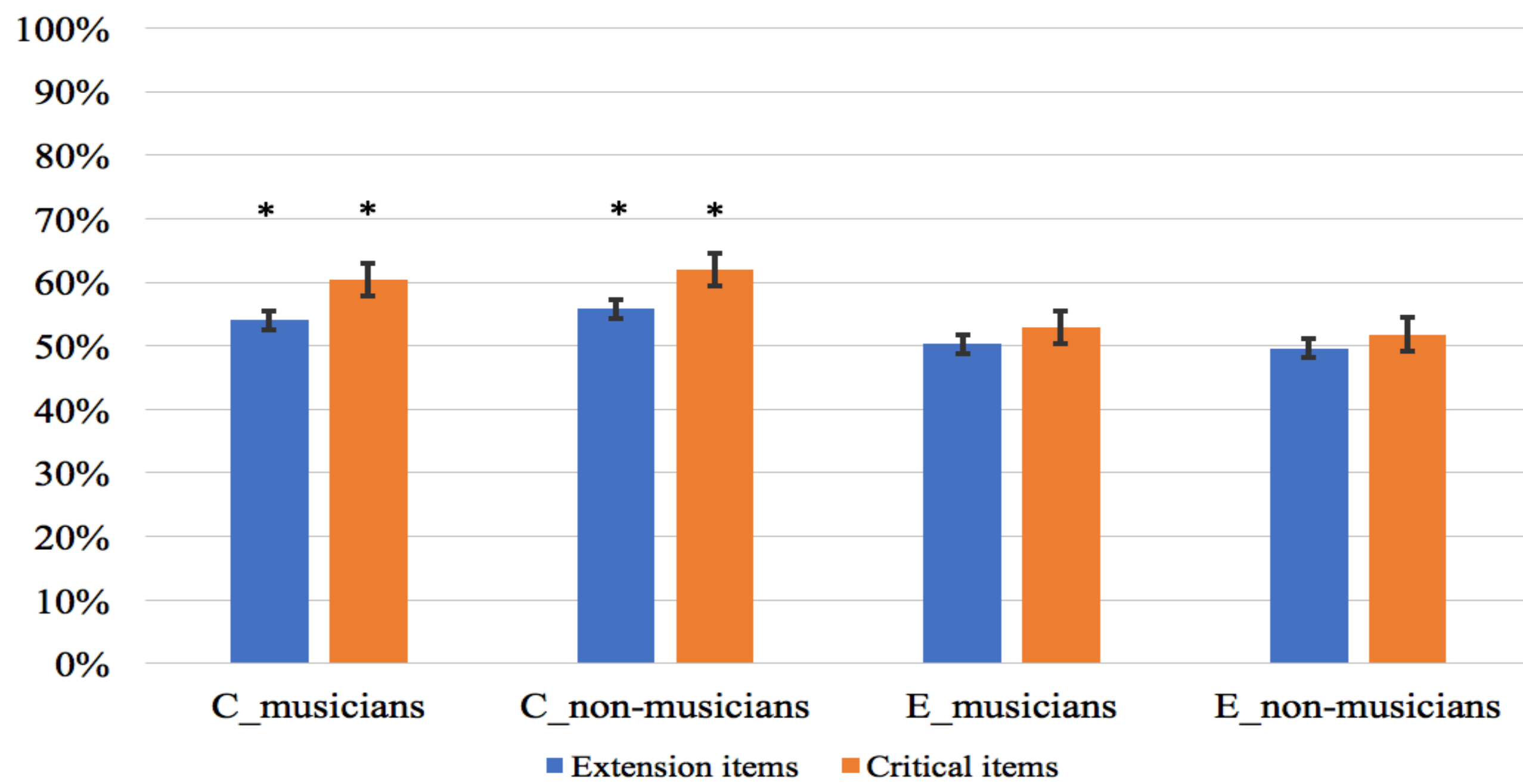


Figure 2. Accuracy of the critical items and extension items (chance level = 50%, * = significant effect based on 95% confidence intervals from GLMM)

5. CONCLUSION

- Both Cantonese and English speakers distinguished the two target tones similarly well (phonetic level)
- Cantonese speakers showed an abstract and potentially rule-like knowledge of the target tone-segment connections but English speakers did not
 - ∴ Tone language experience is crucial for forming novel abstract syllable-level tone categories (phonological level)
- Prior musical training did not seem to facilitate the formation of syllable-level tone categories
 - ∴ An area of separation between music and speech

6. REFERENCES

- [1] Chan, R. & Leung, J. (2014). Implicit learning of L2 word stress regularities. *Second Language Research*, 30(4), 463-484.
- [2] Chan, R. & Leung, J. (2018). Implicit Knowledge of L2 Lexical Stress Rules: Evidence from the Combined Use of Subjective and Objective Awareness Measures. *Applied Psycholinguistics*, 39(1), 37-66.
- [3] Francis, A. L., Ciocea, V., Ma, L., & Fenn, K. (2008). Perceptual learning of Cantonese lexical tones by tone and non-tone language speakers. *Journal of Phonetics*, 36(2), 268-294.
- [4] So, C. K., & Best, C. T. (2010). Cross-language perception of non-native tonal contrasts: Effects of native phonological and phonetic influences. *Language and speech*, 53(2), 273-293.
- [5] Wang, Y., Spence, M. M., Jongman, A., & Sereno, J. A. (1999). Training American listeners to perceive Mandarin tones. *The Journal of the acoustical society of America*, 106(6), 3649-3658.