Cross-language Perception of Parallel Encoded Emotional and Linguistic Prosody by Chinese Learners of English

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Background: Prosody is used to convey not only emotional (e.g., angry or happy emotion) but also linguistic information (e.g., question or statement) [1, 2, 3], both of which are usually encoded in parallel in the same utterance at the same time. Previous studies have demonstrated an interaction effect in the perception of parallel-encoded prosody [3, 4, 5], whereby listeners may have difficulty identifying its emotional and linguistic function. To be specific, linguistic prosody such as sentence-type intonation will affect the recognition of emotion types [6], and conversely, emotional prosody also interferes with the perception of statement/question contrasts [3]. However, these studies are scarce and are mostly focused on native speakers of Indo-European languages like English and German. Very few have considered tonal-language speakers, let alone such speakers who are learning a non-tonal language as L2.

The cross-language study between Mandarin Chinese and English is of great significance since tonal languages have differences from non-tonal languages in using prosodic features such as F0. Since our brain's processing of F0 is closely related to language experience [7], Chinese English learners' processing of their L2 English prosody may have some differences with that of Mandarin prosody. Therefore, the present study aims to explore the interaction between emotional and linguistic function during the perception of Mandarin Chinese and English prosody by Chinese English learners, and to examine how L2 proficiency moderates this interaction.

Method: Forty-four Chinese native speakers participated in this experiment. They all learned English as a second language and were divided into high-level and low-level groups according to their CET-4 and CET-6 scores. The materials consisted of 130 syntactically similar and semantically neutral sentences with the parallel sentences in both English and Chinese versions (e.g., "Mark is watching TV. /?", "小马正在看电视。/?"), and 130 filler sentences. All target sentences were read by a female Mandarin speaker and a female English native speaker, and were recorded in four conditions: emotionally neutral statements, emotionally angry statements, emotionally neutral questions, and emotionally angry questions. In the emotion-identification task, participants were asked to ignore the sentence-type intonation and to identify emotions by pressing the keyboard ("1" for "angry", "2" for "neutral" and "3" for "others"). And in the intonation-identification task, participants should ignore the emotions and recognize the intonations ("1" for "question", "2" for "statement" and "3" for "others").

Results: Participants' average identification accuracy under two tasks and four conditions were analyzed by the linear mixed-effect model in R [8]. The results showed that emotional prosody and linguistic prosody have interactions in the prosody identification process, but in different ways under different prosodic conditions. 1) On the one hand, linguistic intonation affects the perception of emotional prosody. Specifically, in the emotion identification of both English and Mandarin sentences, question intonation reduces the accuracy of neutral emotion identification. The only difference between Mandarin and English lies in the perception of angry emotion. In English, statement/question does not affect the perception of anger, while in Mandarin, the accuracy of angry statements is significantly lower than that of angry questions. 2) On the other hand, emotional prosody also affects linguistic prosody perception, and the results are consistent in Mandarin and English. Angry emotion interferes with the perception of statement intonation, while angry/neutral emotion does not affect the perception of question intonation. 3) In addition, English proficiency has no significant influence on Chinese English learners' perception of English prosody.

Conclusion: In sum, our results proves an interaction effect between different functions of prosody, and this interaction shows a generally similar pattern between Mandarin and English. In both languages, question intonation reduces the accuracy of neutral emotion identification, and angry emotion impedes the perception of statement intonation, indicating that the pitch variability associated with emotion realization interferes with the pitch direction related to linguistic prosody. On the other hand, the perception of questions is not influenced by emotions in both languages, indicating a stable perception of questions. The only difference between Mandarin and English lies in the perception of angry emotion under different intonations, indicating a different mechanism in the perception of emotional prosody in tonal and non-tonal languages. Overall, the present study describes the interaction effect between emotional and linguistic prosody in Chinese English learners' L1 and L2 prosody processing, contributing to enriching the cross-language prosody study.
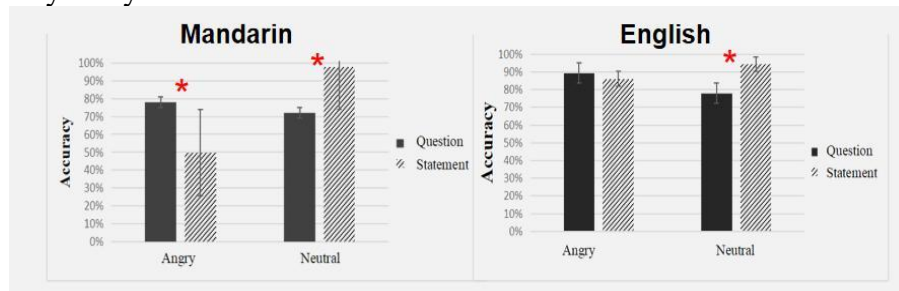
Fig.1 The mean identification accuracy of angry and neutral emotions under different intonations in Mandarin and English utterances.
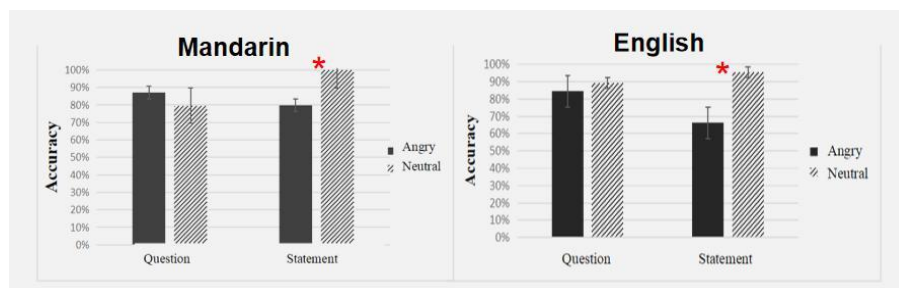
Fig.2 The mean identification accuracy of question and statement intonations under different emotions in Mandarin and English utterances.

References

[1] Eckstein, K., & Friederici, A. D. (2006). It's Early: Event-related Potential Evidence for Initial Interaction of Syntax and Prosody in Speech Comprehension. *Journal of Cognitive Neuroscience, 18*(10), 1696–1711

[2] Pihan, H., Tabert, M., Assuras, S., & Borod, J. (2008). Unattended emotional intonations modulate linguistic prosody processing. *Brain and Language, 105*(2), 141-147.

[3] Paulmann, S., Jessen, S., & Kotz, S. A. (2012). It's special the way you say it: An ERP investigation on the temporal dynamics of two types of prosody. *Neuropsychologia, 50*(7), 1609-1620.

[4] Pell, M. D. (2001). Influence of emotion and focus location on prosody in matched statements and questions. *The Journal of the Acoustical Society of America, 109*(4), 1668-1680.

[5] Zora, H., Rudner, M., & Montell Magnusson, A. K. (2019). Concurrent affective and linguistic prosody with the same emotional valence elicits a late positive ERP response. *European Journal of Neuroscience, 51*(11), 2236-2249.

[6] Scherer, K. R., Ladd, D. R., & Silverman, K. E. A. (1984). Vocal cues to speaker affect: Testing two models. *The Journal of the Acoustical Society of America, 76*(5), 1346-1356.

[7] Gandour, J., Wong, D., & Hutchins, G. (1998). Pitch processing in the human brain is influenced by language experience. *NeuroReport, 9*(9), 2115-2119.

[8] R Core Team. (2017). R: A language and environment for statistical computing (Version 3.4.2) [Computer software]. Retrieved from https://www.R-project.org/