How do Chinese speakers of English process pitch in English words? An ERP study of L1-tone effects on L2-intonation

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Recent ERP evidence (e.g., Kung et al. 2014) showed that in a context of tone-intonation conflict, monolingual Chinese speakers gave preference to a tonal interpretation. These results rise the question of how Chinese-ESL speakers process F0 variation in English words, where F0 expresses exclusively intonation, and consequently, it has been excluded from models of word recognition. Do Chinese-ESL speakers process the rising pitch of the question 'Rose?' – which resembles tone 2 –and the falling pitch of the statement 'Rose'—which resembles T4 – as speakers of non-tonal languages do? Or does their long-term experience with a tonal language shape in specific ways their perception of intonation in English words? While behavioral studies provided general evidence in support for the second option (e.g., Braun and Jonhson 2011, Lin and Francis 2014, Ortega-Llebaria, Nemoga, Presson 2015), the finer time resolution of ERPs is needed to further our understanding of these pitch processing differences and their relation to word recognition. The present study extended previous research by administering a priming lexical decision task in English to 30 Mandarin-ESL and 30 native English speakers in a soundproof room while recording both reaction times and EEG data (Geodesic EEG Systems with a 128 Ag/AgCl electrode array). To control for individual differences, participants also took the O-span working memory task, the Nelson- Denny Vocabulary and Comprehension Tests (Brown, Fishco & Hanna 1993), a language background and musicality questionnaires. The total duration of the protocol was approximately 1 hour and 45 minutes. Reaction times and EEG recordings were obtained for more than 10,000 tokens. Results from reaction times showed both cross-language similarities in pitch processing and a Chinese-only pattern. With regards to the cross-language similarities, speakers from both language groups recognized a target word faster when the prime-target pair did not differ in pitch – namely, target 'mice' was recognized faster in 'mice-mice' than in 'mice?-mice', and target 'mice?' in 'mice?-mice?' than in 'mice-mice?'. Thus, regardless of their language background, speakers could not avoid processing pitch in English words, questioning current models of word recognition and suggesting an early cross-language acoustic stage of pitch processing. The Chinese-only result showed that within each experimental condition, Chinese speakers recognized word targets with a falling pitch faster than targets with a rising-F0. For example, target 'mice' was recognized 77 ms faster in 'mice-mice', the falling-F0 Full Match, than in 'mice?-mice?', the rising-F0 Full Match. This difference was of 40 ms in the Mismatched F0 Condition ('mice-mice?' versus 'mice?-mice'), 54 ms in the Mismatched Segment Condition ('rice?-mice?' versus 'rice-mice'), and 100 ms in the Mismatched F0 and Segment Condition ('rice-mice?' versus 'rice?-mice'). This pattern showed that Chinese speakers had a strong bias for English words with a falling pitch suggesting that they could not avoid processing pitch shape in English words in a way reminiscent of tone. Preliminary ERP analysis provided supporting evidence for this interpretation. Whereas Chinese speakers processed this difference earlier in time in the P3 area, a LH area related to tone processing,

English speakers detected this contrast later in time in the P8 area in the RH, which is related to the processing of intonation (See Fig. 1). While these preliminary ERP results are promising, the entire EEG recordings will be analyzed before giving a full interpretation of pitch processing in English words by Chinese and English speakers and suggesting how pitch could be included into current models of word recognition, in particular those for tonal/non-tonal bilinguals and non-tonal languages.

Cited Work

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