How do native Mandarin speakers process and adapt to non-native speakers’ tone and rhyme errors?

Motivation
Learners of Mandarin make both segmental (vowel, consonant) and suprasegmental (tone) pronunciation errors. Tone errors likely unsystematic—could impact how native listeners process and adapt to tones relative to rhymes. Previous ERP research on foreign-accented speech has shown:
- Increased N400 to unexpected lexical errors [1, 2]
- Absence of late positivities for lexical/syntactic errors [1, 2]
- Adaptation to the presence of errors in native and foreign-accented speech [1, 2]

Research Questions
RQ1: Does foreign-accented Mandarin differentially impact processing of tonal vs. segmental errors?
RQ2: Do listeners adapt to foreign-accented mispronunciation errors after extended exposure?

Methods
Participants (n=18)
20 native Mandarin speakers in Beijing
- Two excluded due to excessive artifacts
Materials
240 constraining sentences
- Four critical word conditions (expected, semantic mismatch, rhyme mismatch, tone mismatch), location of critical word varied across sentences
- Two accent conditions (native, foreign)
- Recorded by 1 native & 1 non-native Mandarin speaker

Procedures
EEG recorded while listening
Judgment task after each sentence
- “Did the sentence sound ok to you?” (yes/no)

Example Stimuli:
Wōmānjìzhúzěxtàozhēnghǎichìle.
“The ___ our family lives in will be torn down.”

Expected word: fàngzǐ ‘house’
Semantic mismatch: xiōngdǐ ‘brothers’
Rhyme mismatch: fàngzǐ (nonword)
Tone mismatch: fàngzǐ (nonword)

References

Conclusions
Tentative interpretation: late positivities index listeners’ immediate attempts to repair pronunciation errors
- Listeners adjust to phonological deviations of foreign-accent by relying more heavily on other cues (broader context) and making fewer attempts to repair specific lexical items
- Listeners adjust to native accent by becoming more confident of individual speaker characteristics and making more attempts to recover specific words based on phonological cues

Limitations & Future Directions
- Judgment tasks may amplify positivities and mask N400s
- Comprehension-based behavioral task to reduce positivities
- Recruit additional participants to consider individual differences in negative/positive response patterns

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Results
Overall
Main effects of condition, no interactions with accent
- 200-500ms: semantic & rhyme sig. diff. from expected (N400s suggest basic comprehension of sentences not an issue)
- 600-900ms: tone & rhyme sig. diff. from expected

By half
Significant interaction of accent × experimental half for the late positivity
- 1st Half: rhyme & tone sig. diff. from expected cond. for foreign-accent; no diffs for native accent
  - rhyme vs. expected: F(1,17) = 8.13, p = .011
  - tone vs. expected: F(1,17) = 10.46, p = .005
- 2nd Half: rhyme & tone sig. diff. from expected cond. for native accent; no diffs for foreign accent
  - rhyme vs. expected: F(1,17) = 4.55, p = .048
  - tone vs. expected: F(1,17) = 6.46, p = .010

Grand average ERPs by experiment half
1st Half
Native
Foreign
2nd Half
Native
Foreign

Grand average ERPs by experiment half
for 200-500ms time interval
- Tone vs. expected: F(1,17) = 9.06, p = .008
- Rhyme vs. expected: F(1,17) = 9.06, p = .008
- Semantic vs. expected: F(1,17) = 9.06, p = .008
- Expected vs. NO: 67.50 (33.10)

Grand average ERPs by experiment half
for 600-900ms time interval
- Tone vs. expected: F(1,17) = 9.06, p = .008
- Rhyme vs. expected: F(1,17) = 9.06, p = .008
- Semantic vs. expected: F(1,17) = 9.06, p = .008
- Expected vs. NO: 57.00 (49.55)