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Tonal coarticulation in Mandarin-English code-switching

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Background
Mandarin lexical tones

Mandarin tonal coarticulation
Mostly dissimilatory anticipatory effects, except Tone 3 assimilatory (Xu, 1997)

Phonetics of code-switching
Code-switched utterances may display distinct phonetic characteristics, cf. unilingual utterances

Selected references

Question: How is tonal coarticulation affected by code-switching?

Speaker 1
Mandarin-English “balanced” bilingual (21yo, F) recorded 58 unilingual and 58 code-switched English sentences

Acoustics
Anticipatory pitch coarticulation preceding English-to-Mandarin code-switch matches tonal coarticulation found in unilingual Mandarin, except Tone 4

Pitch before Mandarin code-switch distinct from pitch before English word, except Tone 4

Pitch as perceptual cue?
In an eye-tracking study, bilinguals looked significantly less toward images corresponding to code-switched targets when the phonetic context preceding upcoming code-switch was withheld (Shen, Gahl, Johnson, to appear)

Speaker 2
Mandarin-English “balanced” bilingual (31yo, F) recorded 37 unilingual and 37 code-switched English and Mandarin sentences

Conclusion
Tonal coarticulation similar in unilingual and code-switched Mandarin, for these two speakers

But degree of tonality can differ in unilingual vs. code-switched Mandarin

Production of tone/pitch affected by code-switching, reflecting interaction of bilingual phonetic systems

Future Steps
How much does this phonetic interaction depend on proportion of switches, dominant language, and individual variation?

Analyzing tone/pitch in recordings from 32 Mandarin-English bilingual speakers