Tone slips in Cantonese: Evidence for early phonological encoding

John Alderete, Queenie Chan, Henny Yeung, Simon Fraser University

Context: Chinese languages raise interesting questions about how lexical tone is encoded phonologically, or how a speech plan is "filled in" for tone. Our research question is if lexical tone is actively encoded in phonological encoding (i.e., the process of assembling a phonological speech plan) or if it is instead mapped directly to a prosodic frame. Contemporary approaches to encoding tone in Mandarin differ on precisely this issue. Wan and Jaeger (1998) argue that tone is actively selected in phonological encoding with a mechanism parallel to segments. An alternative view is that tone is not actively selected, but represented as a diacritic feature on a prosodic frame (Chen 1999), similar to the way many believe metrical stress is encoded (Levelt, Roelofs et al. 1999). These different approaches make strikingly different predictions about how tone will behave in speech errors. If tone is encoded like segments, we expect a non-trivial number of tone slips, and that these slips will be affected by the tone of neighboring syllables. If, on the other hand, tone is processed like stress, we expect tone errors to be exceedingly rare and unaffected by context because frame encoding is insensitive to the form of neighboring words.

Objective: The goal of this work is to test the predictions of these two approaches by examining the structure of tone slips in a different lexical tone language, Cantonese.

Methods: The data come from the Simon Fraser University Speech Error Database – Cantonese 1.0 (Alderete and Chan 2018), a database of speech errors collected from natural conversations. The speech errors were collected by four data collectors who had undergone a month-long training regime designed to master transcription skills, Cantonese linguistic analysis, and criteria for positively identifying errors. Each recording was examined by two listeners, and later vetted by a data analyst to ensure data quality. The errors were then classified by a psycholinguist trained in standard techniques of error classification (Stemberger 1993).

Results: This method produced 2,465 speech errors in total, and uncovered 435 tone errors. At roughly 20% of all sound errors, tone errors are the second most frequent type of error, second to consonant substitutions, but actually more frequent than vowel substitutions. The majority of the tone errors were contextual in the sense that they anticipate or perseverate the tone of a neighboring syllable (assuming a four-syllable window). This is important because the standard analysis of segmental errors is that activation of a preceding or following segment causes the mis-selection (Dell 1986). The fact that tone errors are relatively common and mostly contextual strongly supports the view that tone is actively encoded in a fashion parallel to segments.

Further evidence from this corpus that tone is actively encoded comes from interactive spreading effects, or patterns showing an interaction between the encoding of tone and other production processes. First, tone influences segmental errors in that intruder segments have a greater than chance tendency to come from syllables that have a tone that matches the tone of the target syllable. Second, word errors also tend to share a tone with the intended word, showing that tone encoding interacts with lexical selection. Finally, tone errors exhibit phonological similarity effects in the sense that tones tend to swap with similar tones, showing that the activation of features that cross-classify tones interacts with tone selection. Parallels to all of these patterns are found in segmental errors (Shattuck-Hufnagel 1979, Dell 1984), further supporting the comparison between encoding tone and segments.

Summary: Tone slips in Cantonese are very common and resemble the speech error patterns of segments: they are usually contextual and interact with other language production processes. These facts strongly suggest that tone is actively encoded in phonological encoding.

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