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Title:
Revealing the representation of phonemes through the lens of the probabilistic reduction effect: Psycholinguistics with 'small data'

Abstract:
Informativity is one of the many factors which influence phonetic variation. Informativity, which reflects how predictable a linguistic unit is (in some local environment), has been consistently shown to modulate the phonetic salience of words and other linguistic units in speech production (the probabilistic reduction effect). In this talk I will demonstrate that the probabilistic reduction effect shapes aspects of speech perception and production through top-down factors derived from the lexicon. I argue that it is by examining the precise effect of these top-down factors on phonetic variation, we could get a clearer picture of the stored representation of phonemes.

In the first study, we examine the phonemic representation of consonants in Kaqchikel, a Guatemalan Mayan language, by modelling the perceptual processes. The phonemic inventory of Kaqchikel includes a set of plain stops /p t k q/ as well as a set of 'glottalized' stops /ɓ t' k' ɠ ʔ/. We investigated the perceptual similarity of these stops by means of an AX discrimination task, conducted with Kaqchikel speakers in Guatemala. After connecting the patterns of perceptual confusion observed in this study to the synchronic phonology and diachronic development of Mayan languages, we consider whether perceptual similarity might be conditioned by two factors related to prior linguistic experience: (1) the acoustic similarity between phonemic categories, calculated from a one hour acoustic corpus of spontaneous spoken Kaqchikel; and (2) lexical statistics, calculated from a one million word written corpus. We found that a) speech perception is mediated by phonemic representations which include acoustic detail drawn from prior phonetic experience, as in Exemplar Theory; b) the perceptual distinctiveness of a pair of phonemes is affected by their functional load (the actual degree of contrastiveness: the number of minimal pairs) and relative contextual predictability (the potential degree of contrastiveness). By examining the time-course of the processing, we argue that these factors most likely exert an influence through low-level perceptual tuning during perceptual learning, as opposed to online-computation.

In the second study, we turn to modelling the speech production of phonemes. We investigate how the functional load of two phonemes can predict their phonetic differences. With a focus on the phonetic duration of phonemic geminates, we hypothesized that the size of the duration difference between a singleton and its geminate counterpart reflects the amount of lexical work the contrast has to do. We conducted a meta-study using durational data extracted from existing phonetic studies as well as functional load statistics with two typologically different languages -- Cypriot Greek and Italian. Factually, the durational ratio between singletons and geminates is known to vary considerably, ranging from 1.5:1 to 3:1. What contributes to this indeterminacy? We found that functional load can successfully predict the durational ratios across both languages.

Our overall conclusions are (1) phonemic representations are phonetically rich, as in

Exemplar Theory; (2) these exemplar representations are warped in the perceptual space during language development by informativity; (3) we can determine the indeterminacy of phonetic variation of phonemes by examining how informativity shapes speech production and speech perception; (4) corpus methods can be robustly extended to psycholinguistic research on minority languages even when only limited and imperfect resources are available.