

Acoustic correlates of phonological status and their effect on phonological processing

Recent work has shown that by 11 months, infants process sounds differently depending on whether they are in an allophonic relationship in the infants' ambient language (i.e., nasal and oral vowels in American English) or a phonemic one (i.e., nasal and oral vowels in Quebec French; Seidl et al., 2009). Previous experimental work suggests that adults' perceptual similarity and lexical access is also affected by this phonological status, such that sounds in an allophonic relationship seem more similar to each other and do not block lexical access, whereas those in a phonemic relation appear more distinct and block lexical access (Boomershine et al., 2008). As a consequence, the pressure to hyperarticulate a pair of sounds may be lower when sounds are allophones of the same phoneme, as compared to when the same pair of sounds is phonemically contrastive. In other words, *infants' input might contain less clear contrasts in the allophonic than the phonemic case*; and **less distinct phonetic instantiations may lead to poorer phonological processing**. In an ongoing investigation, we explore these two specific predictions.

To investigate the acoustic instantiation in the infants' input, we gathered a cross-linguistic corpus of speech addressed to infants by female caregivers; half of the families spoke Quebec French and the other half American English. Mothers were provided with toys selected to elicit words where two sets of target contrasts occurred in carefully controlled phonological and lexical environments. The target contrasts involved vowel tenseness and nasality. The tense-lax contrast selected is phonemic in English, but allophonic in Quebec French, while the nasal-oral contrasts is phonemic in French, but allophonic in English. Results revealed that the tense-lax contrast spanned a greater distance in the speech of American mothers than Quebecois ones, whereas the nasal-oral contrast was better instantiated in Quebec French than American English. Thus, the prediction that infants are exposed to more distinct acoustic instantiations in the case of phonemic than allophonic contrasts was supported.

A series of phonotactic learning studies was carried out to assess the prediction that **allophonically-produced sounds are less conducive to phonological processing** in infants and adults. Participants were exposed to an arbitrary phonotactic pattern (e.g., stops followed by tense vowels, fricatives by lax ones) that had been produced by either Quebec French or American English talkers. They were then tested on their learning of this pattern with novel phonemically-produced material. An adult pilot revealed that sounds in the allophonically-produced set were labeled incorrectly more often than the phonemically-produced set. To control for a simple effect of misidentification (which would impair the pattern in one set but not the other), we selected tokens that had similar rates of misidentification across the sets. With these carefully controlled materials, American English 4- and 11-month-olds, as well as adults, implicitly learned the constraint on tense-lax vowels regardless of whether the vowels had been produced phonemically or allophonically.

This investigation was undertaken to assess the possibility that the acoustic-phonetic encoding of phonemes and allophones diverges enough to affect infants' perception, thus facilitating later learning of the phonological status. It is clear that allophones must ultimately be defined functionally, as variants that are contextually conditioned and/or do not trigger a change in meaning. However, experimental avenues may complement formal descriptions in the explanation of how young language learners may come to resolve complex problems.