

Description for the general public

The field of phonetics, concerned with the production and perception of speech, is without a doubt a crucial element in our understanding of spoken communication. At first glance, phonetics may appear to be a straightforward area of study, combining physiology and psychoacoustics, which are fairly well understood. We already know quite a lot about how speech sounds are produced, as well as their acoustic features. Complications arise, however, when we try to characterize speech sounds as symbolic units for cognitive processing. In short, a theoretical challenge that has yet to be resolved may be formulated as follows: what are the relevant phonetic units of spoken language and how are they represented in the minds of language users? This question, which addresses what is sometimes referred to as the phonetics-phonology interface, is complicated by the fact that speech is a continuous physical phenomenon unfolding over time, while the units assumed to be relevant in language processing are discrete and symbolic. Thus, a fundamental challenge for theorists is to define the relevant symbols for speech processing, and the nature of physical information that they encode. This challenge has been a focus of attention for research into phonological theory, in which we often find competing and contradictory theoretical proposals for which empirical evidence may be adduced. Therefore, the theory behind the current project seeks to reconcile competing theoretical perspectives on the phonological representation of speech sounds.

The empirical focus for this project is voicing in consonants, the feature distinguishing pairs of words like *beach-peach* in English or *dom-tom* in Polish. The representation of voicing has been especially problematic for phonological theorists. Some argue that it is encoded as binary feature in which both settings have equal functional status in the representational system. Others argue that plain voiceless stops (e.g. /b/ in English vs. /p/ in Polish) are phonologically unspecified, while the realization of the relevant features in voiced (Polish) and aspirated (English) consonants is unary. Phonetic and phonological evidence may be found to support both claims, so the question that arises is whether they may be reconciled. Such a reconciliation may be envisioned by adopting the assumptions of Modulation Theory (Traunmüller 1994), according to which speech perception entails a process of demodulation of a carrier signal, and phonological features are constructed from salient acoustic modulations to the carrier. Under this view, only voiceless consonants are phonologically specified, while voicing is a part of the carrier. Implementing this view with the non-linear representations of the Onset Prominence model (Schwartz 2016), in which consonants have internal structure, we are able to reconcile the two conflicting theoretical perspectives.

To provide empirical tests of this theoretical proposal, our project will gather both acoustic and perceptual data from Polish, as well as Polish learners of English. Polish and English differ in their phonetic realization of voice contrasts, thereby providing a fruitful testing ground for experimental work. While voicing in these two languages has been studied before, the Modulation-based theoretical reconciliation discussed above makes new predictions that for the most part have not been tested. These predictions concern the perceptual weight of weak vocal fold vibration during the articulation of consonants, and the perceptual weight of voicing effects on the pitch of the voice, among other predictions.

In sum, the project will contribute to our knowledge in a number of ways. First, we shall gain a deeper understanding of the phonetic properties of voicing in Polish, particularly in the domain of perception. Second, we will gain new data on the acquisition of voicing in English by Polish learners. Finally, and most importantly, we will provide important empirical tests of an innovative and original theoretical proposal.