Reorganization of speech perception: the interplay of categories and features

Why do the Japanese find it challenging to distinguish between English /r/ and /l/? It is because Japanese uses different features than English to define this contrast. Speech perception in second language acquisition is challenging: in addition to the normal filtering of environmental effects, the sound categories of the first language filter the sounds of the second language (Trubetzkoy 1939/69): the second language sounds, even if there are more of them or they are different, are perceived in terms of first language categories, or the weight of a given sound feature in a second language is over- or underestimated. The proposed project focuses on acoustic-phonetic features, which when used to distinguish between vowel categories, become phonological. So far second language speech perception has been analyzed in terms of (a) assimilations of these first language sounds which are similar to second language sounds or (b) new category formation for definitely different sounds (Flege 1995, Best 1995, Best and Tyler 2007). Pajak and Levy (2014) postulate an important role for selective attention to features in L2 speech perception, which in addition to categories, might be used in L2 speech perception even if the context for using these features is different. So Polish learners of English, for example, are familiar with features such as vowel height, backness and the degree of lip rounding, and they could discriminate between English /uʔ/ and /ʔ/, but they do not (Bogacka [Balas] 2004)(Polish has only one /u/category), because height, backness and lip rounding distinctions are made in formant frequency ranges not exploited in Polish. There is also a matter of tenseness employed in the English contrast and disregarded in Polish and of length distinctions which are universally well perceived even if the first language does not use them (Bohn 1995). Additionally, it is viable that the tongue height and backness are dominant features in second language perception. The objectives of the present project are the following: (1) examining the interplay of categories and feature clusters in second language speech perception; (2) examining the role of factors influencing second language speech perception and proposing a hierarchy of application of the processes involved; (3) examining how the reorganized speech perception in the course of second language acquisition influences foreign language speech perception, (perception of Dutch with an extensive vowel system by Polish learners of English studying one of the following languages: English, German, French and Spanish, each of whom uses different categories and feature clusters from the ones used in Dutch), (4) examining vowel perception by Polish learners of English. The hypothesis proposed in this project is that an individual familiar feature increases the likelihood of accurate perception of an L2 sound, but a familiar feature cluster increases the likelihood of accurate perception of an L2 sound exponentially. In the speech perception system reorganized by second language acquisition there is a hierarchy of features. The features associated with the tongue position, which are the basis of assimilation to a given first language category, predominate.

Speech perception will be examined with a series of experiments using natural stimuli chosen and processed using Praat (Boersma and Weenink 2014), so that the sounds of a desired length and formant frequency can be obtained. The types of experiments include: categorial discrimination AXB with three different speakers in a trial and long intestimulus interval to encourage phonological processing rather than only detection of acoustic cues, an identification test with goodness ranking of second language or foreign language vowels in terms of Polish vowel categories, a test rating (dis-)similarity of pairs of English vowels.

The proposed research approach is intended to increase the probability with which it can be predicted how a second language sound will be perceived by a speaker of the first language. The existing models, enriched by the role of phonetic features and their clusters, will allow for more precise explanation of second language speech perception. The proposed research will support technological and educational requirements of foreign language learning and teaching by paying attention to second language contrasts which are perceived in a non-native like manner, which can lead to misunderstandings in human communication and which are significant for the design of both speech synthesis and speech recognition systems.