Automated measurement of phonetic distances
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Aims
The method for measuring dialectuality proposed by Herrgen and Schmidt in 1989 is based on the assumption that it can be expressed in terms of the phonetic distance between matched segments. The central idea guiding the method is a straightforward one: that differences between segment pairs along the various phonetic dimensions can be scored simply in terms of the size of the difference. Numerous studies based upon the method have described it in detail (cf. Schmitt 1992, Stein 1994, Purschke 2003, Lameli 2004, Kehrein to appear). Purschke showed that there is a strong correlation between phonetic distances and listener judgment scores. In his study, Lameli was able to show that, by defining a mixed set of exceptions, it was possible to exclude from measurement fast-speech phenomena, which are not motivated by regional rules and are therefore identical across several regions. The mixed set of rules and the ability to measure without specific knowledge of the areal language systems involved make the method relatively easy to master and apply. The weighting built into the method ensures that the various features of a segment are treated differently.

The goal of the project presented here is the development of an automated measurement procedure, a program capable of independently scoring speech samples (consisting of a regional speech transcript and the corresponding orthographic text) and of separating features of regional speech from coarticulatory features. The program should have a modular structure that can incorporate the set of rule exceptions needed for the latter and is also open to the implementation of further rules. The results should be presented in the form of a detailed measurement protocol that also explains the individual measurements to the user. This poster explains how the Programm zur phonetischen Abstandsmeßung (PAM) which I have been developing as a dissertation project, is designed to work.

Phonetic features
In one of the first steps, both measurement samples are first broken down into comparable elements (at the level of the word) and then into individual segments. To enable the program to interpret the phonetic features of and differences between these segments, I have developed a phonetic feature string system. In this system, the phonetic dimensions of a sound segment are combined into a string composed of values for the individual features (e.g., for lip rounding: 0 = no information, 1 = rounded, 2 = neutral, 3 = narrowed/spread).

Simple distance measurement
To calculate the simple distance between two segments, the relevant feature strings are then compared with one another. By measuring the difference at each position along the strings the algorithm can recognize and score the differing phonetic configurations. To this end it is able to draw on an internal set of rules, which details the points to be scored for particular phonetic distances at each of the positions on the strings.

Complex set of exceptions
Phonemes that are not attributable to the regional character of the speech samples are dealt with via a number of complex filters, which identify the relevant exceptions using the feature strings in combination with information about nearby strings (i.e., the segment’s phonetic context, including their position within a word) and then remove them from the calculation. As an example, here is a simplified piece of code which prevents the standard calculation of the absence of a consonant in situations in which an elided passive is identified in either a post-nasal position, between a lateral approximant and a fricative, if it is an apical passive preceding labial or dorsal articulation or preceding or following an apical fricative, or in which it follows [ç] and precedes a closed vowel.

Status quo and initial results
To further develop the program and bring the measurement results closer to those from a manual measurement, the program has been calibrated using existing measurement protocols and studies (including Kehrein to appear). Where necessary, further refinements to the set of exceptions were written into the program. Initial measurements of the REDE corpus show that the measurement essentially works. The diagram to the right compares the measurement results for different samples from a particular location using the manual vs. the automatic procedure and shows the factors by which they diverge from one another. The resultant distribution of the speech levels within the various systems is essentially comparable for the individual speakers. The divergent factors range between 0.92 and 1.16, i.e., roughly a factor of 1, and are thus not markedly divergent.

Bibliography