

Rounded palatal vowels as a model for sound-change processes in dialect-speaking children

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Background: This investigation forms part of a wider study that ultimately aims for a better understanding of the phonetic processes underlying sound change. The more immediate aim here is to study the course of dialectal variation and change in a longitudinal perspective in dialect-speaking children over the first four years of school. Upper Bavaria is used as a model for a linguistic situation that is assumed to be found in many parts of the world. We recruited as subjects children in whose parental background the ambient west central dialect of Bavarian was spoken. From the start of schooling the children are exposed to a much wider variety of German accents, and in particular to standard German to a much greater extent. It is assumed that the first four years of schooling are a particularly interesting time to study shifts in spoken accent (which can become the seeds of more general sound-change) as the new peer-group increases in influence relative to the parental environment.

Specific Aim: Here we will concentrate on one specific part of the German vowel system namely the front rounded vowels. This is the locus of characteristic differences between the relevant Bavarian dialect and standard German. The first syllable of a word such “Hütte” is pronounced with /Y/ (SAMPA notation) in Standard German but with /I/ in the dialect (note that /I/ is also found in the dialect independently of this process, i.e. there are words such as “Spinne” in which the first syllable has /I/ both in the standard form and the dialect). The phonological distinction of rounding for the front vowels is well-known to involve multiple articulatory correlates in addition to lip configuration itself. In particular, tongue position is typically somewhat lower for the rounded cognates (Wood, 1986; Hoole, 1999), and there may also be differences, for example, in larynx height. Disentangling these multiple contributions is scarcely possible with acoustic analysis, particularly when, as here, the focus is on sub-phonemic processes. In other words, we are interested in whether a potential shift from the dialectal to the standard variant can involve intermediate stages, and to what extent changes involve lips and tongue in parallel. Relatedly we ask whether speakers whose vowels in words such as “Hütte” would auditorily be classified as unrounded, nevertheless show phonetic differences between these vowels and vowels that are phonologically unambiguously unrounded in both standard German and Bavarian (as in “Spinne”).

This area is thus also particularly well-suited to our experimental setup which combines ultrasound imaging of the tongue with synchronized lip videos (profile and frontal views)

Subjects and Materials: Ultrasound and lip-video data is available from 16 children (taken from 2 schools in the same town), recorded twice with one year between recording sessions (2 further sessions at yearly intervals are planned). At the time of the first session the children were in first grade (aged 6-7 years). The subjects carried out a picture-naming task based on roughly 60 highly imageable words designed to elicit key features of the German vowel system. Here we concentrate on a subset allowing comparison of unambiguously rounded vowels (high back vowels) with front unrounded and rounded vowels (the latter potentially unrounded for dialect speakers). The complete wordlist was elicited in random order a maximum of 4 times. On average about 3 repetitions were completed.

Recording and analysis procedures: Ultrasound data was acquired with the Articulate Instruments Micro US system, using

a 10mm microconvex probe. For the year1 recording sessions a probe setup similar to that described in Noiray et al. (2015) was used, for year2 the probe-holder system developed by Derrick et al. (2018), modified for use with children. Since both these approaches allow some freedom of jaw movement the video system used to capture lip movement was also used to monitor ultrasound probe movement relative to the skull. By means of reference markers attached to rigid locations on the head and to the probe the ultrasound data were mapped frame-by-frame to a skull-based coordinate system with anatomically defined origin and orientation.

Video data was acquired both in profile and frontally either using a mirror to provide both views in one video (cf. Noiray et al., 2015) or more recently using a dual camera setup. Regions of interest for the lip region were extracted from the video, again using the reference markers to compensate for head movement and map the ROI to a constant origin located between upper and lower lip. A monochrome contrast-enhanced version of the colour image data was then used as the basis for automatic extraction of a measure of lip protrusion.

Pre-processing of the articulatory data as outlined above is virtually complete. All audio tracks have been labelled so that we are now ready to start automated extraction of lingual and labial information at key time-points in the target vowel. In addition, formant measurements are also already available for comparison with the articulatory results.

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