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### On variation and change in diphthongs and long vowels of spoken Dutch

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## ENGLISH SUMMARY

Speech is most commonly and naturally used as an interaction medium in social settings. Along with communicating meaning, the speech signal is a product of physical properties and changes, as well as of generally all factors that form the identity of the speaker, such as social affiliation or family origin. The choice of words but also the way they are realized differs from speaker to speaker, and also within a speaker. Various observations of the lowering of the diphthong /*ei*/ (Polder Dutch) led to the start of this project.

In this study, the phonetic variation in the realizations of the Dutch vowel phonemes /*ei*/, /*au*/, /*œy*/, /*e:*/, and /*o:*/ (as in words like <tijd>, <kous>, <huis>, <zeep> and <boot>) is analyzed in a representative sample of Dutch speakers taken from the Corpus Gesproken Nederlands (CGN). The aim was to find out whether the distribution of sub-phonemic pronunciation variants coincides with attributes of the speakers' background, and whether it changed over time as a function of age. To discover socio-phonetic variation and change, we investigated the apparent distribution of pronunciation variants in the spontaneous speech of 70 speakers, 35 females and 35 males, of different ages and with different socio-economic backgrounds. Presumably, the speakers' socio-economic affiliations go together with diverse speech patterns, and hence, pronunciation variants can be classified according to the speakers' background data.

In addition to the acoustic variation that we were looking for, there is acoustic variation between speakers that is caused by biological attributes, such as the difference between the vocal tracts of females and males. To be able to compare vowel qualities across speakers and sexes we needed an efficient and reliable method that minimizes unwanted variation but keeps the linguistic variation. Two different methods were compared to measure the vowel quality acoustically in our sample of speakers: formant analysis and principal component analysis (PCA) on spectral bandfilters. Differences in vowel quality between the speakers could be captured successfully by the PCA dimensions, and thus this method was used for all vowel analyses. Physiological differences (such as speaker sex) were further factored out by relating vowel differences speaker-individually to the point vowels /*a*/, /*i*/, and /*u*/.

When related to each speakers' individual /*a*/, /*i*/, and /*u*/ vowels, the realizations of the diphthongs /*ei*/, /*au*/, /*œy*/, and the long diphthongized vowels /*e:*/, and /*o:*/ revealed significant differences between socio-economic groups and ages in terms of vowel onset

and degree of diphthongization. Given our analysis we found no significant differences between the vowel phoneme realizations of females and males. Speakers with a higher level of education and occupation showed lower onsets and stronger degrees of diphthongization. Contrary to speakers with an assigned lower socio-economic status, we also found remarkable changes in the vowel pronunciation patterns between speaker generations with an assigned higher socio-economic status.

A perception experiment was run to verify the perceptibility of these acoustic differences. 30 listeners had to judge whether the vowel realizations of several pairs of speakers were similar or different. The results were phoneme-dependent, and indicated that listener age affected the decision. The listener age effects in perception were compatible to the speaker age effects in the acoustics, indicating parallels of social factors in production and perception. The effects in the acoustic and perception data coincide with reported effects in literature on social interaction and imitation, and with literature on the results of investigations on the articulatory-auditory interaction in human beings.

The present research reveals a mutual sound change in the long vowels and the diphthongs of Standard Dutch. The results indicate that social information that is attached to sub-phonemic variation changes over time and affects the pronunciation and perception of the vowel phonemes studied.