

An acoustic study of the devoicing of /v/ and /z/ in Dutch

Mikhail Kissine, Hans Van de Velde & Roeland van Hout

Vrije Universiteit Brussel, Utrecht University, University of Nijmegen

One of the main pronunciation differences between the varieties of standard Dutch as spoken in the Netherlands and Flanders, is to be found in the voice characteristics of /v/ and /z/: the voiced fricatives are in a process of devoicing in northern standard Dutch (Van de Velde, Gerritsen & Van Hout 1996), which might result in a merger with /f/ and /s/. In this paper we present acoustic analyses of /v/ and /z/ and of their voiceless counterparts /f/ and /s/, having three aims in mind: 1. evaluate whether acoustic techniques are useful for quantitative sociolinguistic studies of consonantal variation; 2. develop measurements that uncover the core voice characteristics of the Dutch alveolar and labial fricatives; 3. gain more insight in the process of fricative devoicing in standard Dutch, especially in the devoicing process of /v/ and /z/ observed in Flanders and the Limburg region in the Netherlands (Van de Velde & Van Hout 2001). It will be shown that to get a better understanding of this process, the voiceless consonants /f/ and /s/ are to be included in the analyses too.

The subjects are 160 Dutch language teachers, stratified for community (The Netherlands – Flanders), region (4 in each community), sex (2) and age (2). Data are taken from a reading task (focusing on consonants in word initial position) in which the variables (f), (v), (s) and (z) are embedded in a carrier sentence (e.g., in de vuize horen we v). The total number of tokens in this study is 1280: 160 speakers x 4 variables x 2 realizations per variable.

Three acoustic measurements were performed on each token: the relative duration of the fricative (DURATION), the relative intensity of the friction noise (NOISE) and the F_0 extent throughout the fricative (F_0). All acoustic measurements were done with PRAAT. Also an auditory transcription of the VOICE characteristics (three variants: voiceless, partially voiced, voiced) of (f), (v), (s) and (z) was made.

The high correlations between F_0 and the auditory transcription of VOICE ($r=.784$ for labio-dentals and $r=.884$ for alveolars) support the validity of auditory transcriptions for tracing patterns of variation. But the acoustic measurements show that DURATION and NOISE are concomitant characteristics in fricative realizations, both for voiced and voiceless variants. The analyses show systematic patterns of linguistic variation that are not mentioned in previous discussions on the devoicing of the Dutch fricatives. ANOVA's show that there are effects of the factors community, region and sex for both voiced and voiceless fricatives, but that the patterns differ substantially for (v), (f), (z) and (s). A detailed analysis of the relationship between F_0 , DURATION and NOISE provides a phonetic explanation for the devoicing of (v) and (z) that is observed in Flanders and in the Limburg region in the Netherlands: the contrast (v)-(f) and (z)-(s) is produced differently than in the other regions in the Netherlands where (v) and (z) are strongly devoiced.

By means of a linear discriminant analysis it is possible to check where there is a mismatch between a prediction of voice (on the basis of the three acoustic measurements

of DURATION, NOISE and F_0) and the actual auditory transcription of VOICE. These predicted values agreed in 87% of the cases with our transcriptions. 3% (n=38) were cases in which the predicted value was voiceless and the observed value voiced, or vice versa. Three types of mismatches were detected: 1. wrong coding (n=7); 2. unreliable detection of F_0 between 400 and 500 Hz by the standard procedure in PRAAT (n=15); 3. other (n=16). The first two categories can be easily corrected and result in an increase of the predictive power of our three acoustic measurements. The mismatches in the third category are mainly caused by an extreme value of NOISE or DURATION. This type of errors in the prediction of VOICE can be corrected by an analysis of outliers. It can be concluded that devoicing of fricatives can be analysed more accurately with acoustic techniques than with an ordinary phonetic transcription of the voice characteristics.

References

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