L1 PHONETIC DRIFT IN DUTCH L2 SPEAKERS OF ENGLISH

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1. INTRODUCTION

This longitudinal study examines the development of voice onset time (VOT) for the stops /t/ and /d/ and the central frequency of the /s/ sibilant in a group of fluent L2 speakers of English whose L1 is Dutch, over a period of 3 years.

The speakers are Dutch students who live and study at a residential college where the *lingua franca* is English. The student community is international, with ca. 60% being Dutch L1 speakers, and the remaining 40% comprising over 30 different L1s. A detailed description of the making of this corpus can be found in [5].

The core hypothesis which motivated the collection of this corpus is that, over the three years of these students' undergraduate study, their accents of English will gradually converge to some kind of *UCU Accent of English*, which is not a native accent for any speaker. As part of this convergence, the influence of the Dutch accent of English is expected to play a large role, since the Dutch population forms the majority.

For this study, we look at possible phonetic drift in word-initial /d/ and /t/, and the sibilant /s/, which are realised differently in Dutch and english. In non-clustered word-initial position, typical VOT values for Dutch voiceless stop /t/ and the English voiced stop /d/ are quite similar. Dutch voiced stops have a shorter lag time and English voiceless stops have a much longer lag time, being generally aspirated. Dutch has only one sibilant /s/ whereas English has two, namely /s/ and /ʃ/ [3, 2]. The articulation of the Dutch /s/ is described as being somewhere between the two English sibilants, having a more retracted position of articulation, a flatter tongue, and more lip rounding [3].

Because these particular phonemes exhibit *phonetic*, rather than *phonemic* differences in Dutch and English, it is interesting to explore them in the context of Flege's speech learning model (SLM), which suggests that the ability to perceive within-phoneme differences between an L1 and an L2 may drive the formation of a new phonetic category within a single phoneme [7]. Conversely, if a speaker does not perceive the difference, this new category may not be formed at all, but both L1 and L2 values will assimilate towards each other. We hypothesize that this will be the case for the Dutch L1 speakers' VOT values for /t/ and /d/, and for the production of /s/.

2. METHODS

The first and last recordings for 50 Dutch L1 speakers in the first two cohorts of the UCU Accent Project speech corpus are examined.

2.1. Speakers

The speakers were 50 undergraduate students. Their age range for the first recording was 17 to 19, and for the second recording, three years later, 19 to 21. 10 were male and 30 female. All had started learning English before the age of 8.

2.2. Recording equipment

Recordings were made in a quiet furnished office, using a close-talking microphone (Sennheiser Headset HSP 2ew), via a Saffire Pro 40 multichannel AD converter and preamplifier, using *Audacity*, open source software for recording and editing sounds (see http://audacity.sourceforge.net/.

2.3. Materials

Speech material was taken from recordings 1 and 5, so at the beginning of the first semester and at the end of the last, 3 years later. We extracted2-minute informal monologues in Dutch and English and located the word-initial instances of /d/ and /t/, as well as instances of /s/ are located and used in analysis.

2.4. Parameters

VOT for /d/ and /t/ were measured manually, using Praat [1]. VOT was measured from the release of the stop burst to the onset of voicing.

/s/ was located in a semi-automatic fashion. Candidate /s/ segments were generated with the *Kaldi*

speech recognition system [6], trained on *wsj0* and *wsj1* using the s5 recipe and an *nnet2-online* neural net configuration. Values ranging from English /s/ to /ʃ/ were generated obtain candidates for both Dutch and English /s/. Candidate segments were listened to and accepted or rejected, one by one. The COG was calculated for all of the accepted candidates.

3. ANALYSIS AND RESULTS

3.1. Voice Onset Time (VOT), for /d/ and /t/

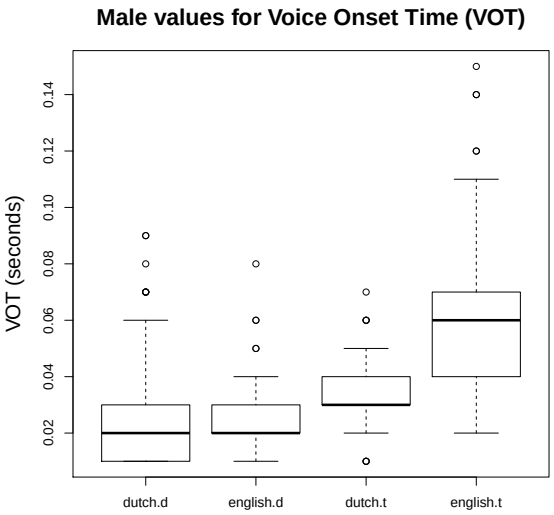

Figure 1: Values for VOT for /d/ and /t/for English and Dutch for male speakers

Figure 1 shows the VOT measurements for Dutch and English for the male speakers for both /d/ and /t/ segments. Similar results can be found for female speakers. For mean VOT values in both Dutch (L1) and English (L2), no notable change was measured between recordings 1 and 5. For /d/, there was no significant language-dependent difference in duration of prevoicing though there were fewer instances of pre-voicing in English. The mean VOT value for /t/ in English was significantly longer by about 28.5 ms, or than in Dutch.

3.2. Centre of Gravity (COG for /s/)

Figure 2 shows the COG for the /s/ segments in the spontaneous monologues for the male speakers, for both English and Dutch, in rounds 1 and 5 of the recordings. Again, similar results can be shown for female speakers.

Using the *lme4* package in R, a linear mixed effects model was constructed to model the relationship between COG, recording and language. Fixed effects were *sex, recording* and *language*, with *speaker* as a random effect, and by-speaker random slopes for the effect of *language*. Significance was

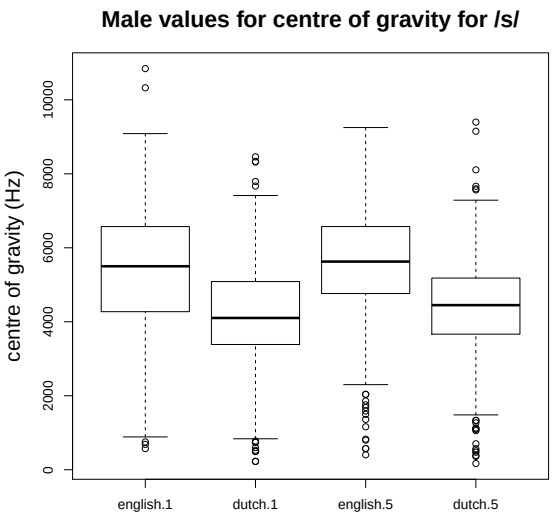

Figure 2: Values for COG for /s/, for English and Dutch in rounds 1 and 5 of the recordings, for male speakers

estimated by likelihood ratio tests on the full model with the effects of *language* and *recording round* against the model without these effects. COG for Dutch was significantly lower than that of English in both recording rounds and for both languages, higher for round 5.

4. DISCUSSION AND CONCLUSION

While the difference in VOT values for /t/ in English was significant, the amount of increase was still small, less than 30ms. This may represent some phonetic drift of /t/ towards more typical English values, but hardly a new phonetic category. COG values for /s/ started and remained lower than those for English. In this case, it seems that a new phonetic category was formed before the first recording. This makes sense, since all students are expected to be competent in English on entry. The significant though slight rise in COG for English *and* Dutch /s/ across recordings indicates some further phonetic drift.

A community of speakers in which L1 speakers are in the minority and there is a dominant L2 is unusual. This may explain the relative stability of these segments over time, despite the English-speaking environment. Since the majority (60%) of the speakers has Dutch L1, it might be expected that, in line with accommodation theory [4], phonetic features of the Dutch are adopted by speakers of other L1s. With English L1 speakers in the minority, we might expect that their influence is less strong.

We might also expect that other L1 speakers, including English L1, may experience accommodation to Dutch values for these segments, and that will be the next step in the investigation of phonetic drift in this community.

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