

Production of English interdental fricatives by Dutch, German, and English speakers

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Interdental fricatives are often difficult to produce for non-native speakers (L2) of English. German and European-French learners of English, for example, often replace the voiceless interdental fricative /θ/ with /s/, while Dutch and Canadian-French speakers are reported to prefer /t/. Phoneme-identification studies show that /θ/ is perceptually most often confused with the acoustically similar /f/ by native (L1) as well as by various L2 listeners, and less frequently confused with /t/ or /s/ (Brannen, 2002; Cutler et al., 2004; Hancin-Bhat, 1994; Miller and Nicely, 1955; Tabain, 1998). Given the acoustic similarity with /f/, it is rather surprising that among the most common substitutions in English L2 speech are /s/ and /t/, even when /f/ is available in the L1 phoneme inventory of the L2 speakers.

Prior research has extensively explored differences in *th*-substitutions across L2 learners based on the dissociation between perception and production (e.g., Brannen, 2002; Hancin-Bhat, 1994; Teasdale, 1997) and/or on phonological theories and language acquisition models (e.g., Flege and Davidian, 1984; Picard, 2002; Weinberger, 1997; Westers et al., 2007). However, even within one foreign accent and within one L2-speaker, different substitution choices are made, but these choices are less systematically studied across L2-speakers. Moreover, little is known about whether the substitutions are phonetically clear instances of /t,s,f/ as they are often labeled. The purpose of our study was therefore to answer the following questions: a) what is the distribution of differential substitutions using comparable materials across different L2 speakers, b) how do /t,s,f/-substitutes differ acoustically from underlying /t,s,f/, and c) how do L2-productions of *th* compare acoustically to native productions. Given that a general explanation for the cross-linguistic differences has not emerged yet, we attempt a phonetic approach to explain language-specific preferences for *th*-substitutions.

We collected a corpus of English containing English L1 speakers from Birmingham UK, and Dutch and German L2 learners of English. The two groups of learners were selected because they not only differ in their dominant *th*-substitutions, but also in fine-acoustic details in fricative and stop production (Mees and Collins, 1982). Participants were asked to read aloud a story that contained instances of *th*-words (including 18 word-initial voiceless *th*-words), as well as *s*-, *f*- and *t*-words (out of which 10 word-initial words were selected). These words, produced by 37 Dutch, 39 German and 32 English speakers, were labeled and classified by three trained labelers. The results showed that within the substituted instances, Germans predominantly substituted *th* with /s/ (72%), while /t/ (16%) and /f/ (12%) were less frequent substitutes. For Dutch speakers, /t/-substitutes (73%) were dominant, followed by the less frequent /s/- (19%) and /f/-substitutes (8%). More than 50% of all word-initial *ths* were pronounced correctly. English speakers never substituted *th* with *f*, and only few times with *t* and *s*. In the presentation, we will discuss results from acoustic measurements (e.g., spectral properties, amplitude, duration) which were conducted to compare L1 and L2 /θ/-realizations, and to compare the L2 realizations of *th*-substitutes /t,s,f/ with the underlying /t,s,f/-phonemes.

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