BETWEEN-SPEAKER VARIATION IN ENGLISH LEARNERS' REALISATION OF DENTAL FRICATIVES

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ABSTRACT

Anecdotally, it has been observed that Swiss Germans speaking English use a plethora of sounds for the dental fricatives /θ/ and /ð/. It is unsurprising that L2 speakers tend to substitute a sound not present in their native phoneme inventory with a sound that is present; however, there is wide intra- and inter-speaker variation in the sounds chosen to replace the dental fricatives. The present study is an initial examination of how speakers of Swiss German differ in their choice of sound substitution when speaking English. We recorded read speech from 45 high school students. Data was coded auditorily and acoustically. Findings confirm substantial variation between the learners, with the most common replacement being [d] for the voiced dental fricative and [f] for the unvoiced counterpart. We discuss potential reasons for the reported between-speaker variation.

Keywords: Foreign accent, second language learning, Swiss German, EFL

1. INTRODUCTION

One aspect that plays a crucial role in second language acquisition is pronunciation. An interesting phenomenon in this context is the use of substitutions: the replacement of a specific L2 phoneme by another phoneme of L1. Thus, the substituted sound is typically acoustically and/or articulatorily most similar sound in the native language to one from the target language [1]. One of the most frequently analysed features in learners of English is the substitution of dental fricatives, which has been studied for a number of typologically different L1s [4, 5, 6, 7, 8, 9, 11, 12, 13, 16, 17]. For learners of English, this sound in particular is difficult as it is very rare: The World Atlas of Language Structures (WALS) indicates only 40 languages to have dental fricatives [2]. Literature suggests that languages are either '*t+ languages' or '*s+ languages' depending on which sound is used most frequently when substituting. Typical 't*+ languages' are Russian, Polish and Dutch [11, 17]. [14] for instance, found that speakers of languages that articulate [s] further back and/or have a dentalised [t] such as Dutch, are very likely to substitute English [θ] with [t] [9]. Languages do not always fit neatly in this 't*+-languages' category – Dutch learners of English, for example, most frequently use [t] and [d], they have also been shown to use substitutions such as [s] and [z] as well as [f] and [v] [9]. Polish learners, too, often substitute the target sounds by [t], [d], [f] and [v] [6]. '*s+-languages', on the other hand, include German – supposedly including Swiss German as well as Austrian varieties – and Japanese, as they substitute [θ] predominantly with [s] [13].

We wanted to explore substitutions by Swiss learners of English in greater detail. From our own experiences as Swiss learners of English, we are not convinced by the result put forth by [13] that Swiss German is an '*s+-language'. To this end we examine what substitutions for dental fricatives Swiss German learners of English use. Secondly – and this appears to be a research gap – we wanted to study how these learners differ from one another in their choice of substitution. Learners of English (n=45) performed a reading task that included voiced and unvoiced dental fricatives in a number of contexts. We expected that (a) most learners would substitute the target sound with a sound that is most familiar to them, probably [d] or [f] (based on our anecdotal impressions), and (b) that speakers would exhibit substantial variation in the substitution strategies chosen.

2. METHODS

2.1. Speakers

Forty-five students from two different Gymnasiums (i.e. high schools) in Thun and Gstaad participated in this study. The majority of students were Swiss German natives (n=29), with some Standard German natives (n=8); data further includes Albanian (n=1), Chinese (n=1), Russian (n=1), Spanish (n=1) and Croatian (n=1) natives who were born in Switzerland and grew up bilingual. Five students were wearing braces at the time of recording.

2.2. Material

Subjects read 21 sentences that included 61 words containing a dental fricative; 32 in word-initial position, 15 word-medial, and 14 word-final (Table 1).

Table 1: List of target words in text.

Phon. context	**[ð]**	**[θ]**
Initial	this the that these those than there the	three Thursday thirty therapy things thanks
Medial	Heather weather northern although rather bathing mother	healthy nothing Nathan cathedral gothic mythical
Final	breathe with teethe soothe writhe	Smith worth both math eleventh

The distribution for phonological environments is 52% for word-initial position, 25% for word-medial and 23% for word-final position. The text read off by the speakers included the target sounds preceding and following front, back and central vowels.

2.3. Procedure

The data was collected using a Zoom H2n mobile digital recorder. To keep background noise to a minimum, one group of participants sat in a small room that had shelves with books, a wooden floor and curtains. The other group was recorded in a classroom, given that no smaller room was available. Metadata on educational background as well as motivation for learning English was collected via a questionnaire before the recording. However, given the scope of this paper, metadata was not addressed in more detail at this stage. Following the recording session, the set of target words was extracted for analysis. Data was coded auditorily and, if necessary, supported by acoustic analyses. Thus, certain unclear sounds were analysed in more detail by inspecting spectrograms. To increase reliability in coding, the data was coded twice by the first author with a three week break in between. Furthermore, a subset of the data was analysed by a colleague and the coding was cross-compared to the first author's, again, to minimize further bias. Using diacritics, we coded for as much phonetic detail as possible. Such as dentalised variations or devoicing of sounds.

3. RESULTS

3.1. Overall distribution

Table 2 shows the overall distribution of realisations for /ð/ (left) and /θ/ (right), collapsed for phonological contexts.

Table 2: Distribution of sound production of /ð/ and /θ/.

Category /ð/	Frequency	Category /θ/	Frequency
d	21.1% (n=398)	θ	38.6% (n=330)
d̪	19.6% (n=370)	θ̪	15.4% (n=132)
ð	13.9% (n=262)	f	12.6% (n=108)
ð̥	12.4% (n=234)	tʰ	11.3% (n=97)
ð̪	11.9% (n=224)	s	6.2% (n=53)
others	6.2% (n=117)	s̪	4% (n=34)
f	4.1% (n=78)	θ̥	3.9% (n=33)
s̪	3.4% (n=65)	affricates	2.9% (n=25)
affricates	2.2% (n=42)	d	1.7% (n=15)
tʰ	1.7% (n=32)	others	1.4% (n=12)
NA	1.3% (n=24)	d̪	1.1% (n=10)
s	1.2% (n=23)	NA	0.7% (n=6)
ɾ	1.1% (n=21)		

In total, we coded 39 different types of variants. 16 of these are shown in Table 2 – the other 27 are summarised in the category 'others' (e.g. [ʃ] or [x]). This is due to their single occurrence within the sound realisations. "NA" includes inaudible sounds or false words that were produced. For /ð/, [d] was the most prominent realisation by far (21%), followed by a dentalised version thereof (20%). 38% of the time students realised the target [ð], including unvoiced and dentalised variants. The voiceless counterpart /θ/ showed a different pattern: 58% of all variants were [θ], also including dentalised and retracted variants thereof.

A closer inspection revealed that speakers exhibited different preferences for variants depending on phonological context, showing intra-speaker variation. For [ð] in word-initial position, [d] was used the most at 30.3%, followed by a [d̪] (26.2%). While [d] featured heavily in initial position, it made up only 10.1% in medial position. In final position, the most common substitution for

/ð/ was [f] (19.1%). For [θ] in word-initial position, in 17% of the cases students articulated [tʰ]. In word-medial position, they predominantly used the target sound [θ] (54.4%), suggesting that a target-like pronunciation is easiest in this phonological context. In word-final position however, [f] is used the most (25.7%). Chi-squared tests of independence revealed significant differences in variants used depending on phonological context for both voiced and voiceless target sounds (/ð/: x^2 (24, 1890) = 1057, p<.0001; (/θ/: x^2 (22, 855) =304, p<.0001).

3.2. Between-speaker variation

3.2.1. Voiced

Figs. 1 (voiced) and 2 (voiceless) show the speakers' relative preferences, collapsed across phonological contexts.

Figure 1: Distribution of sounds used for /ð/.

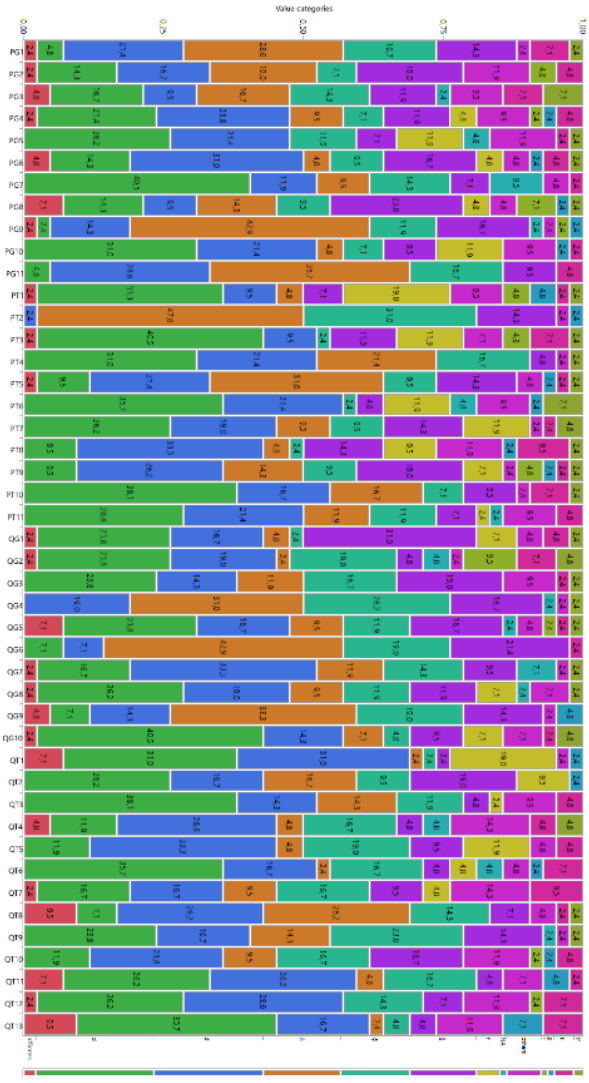
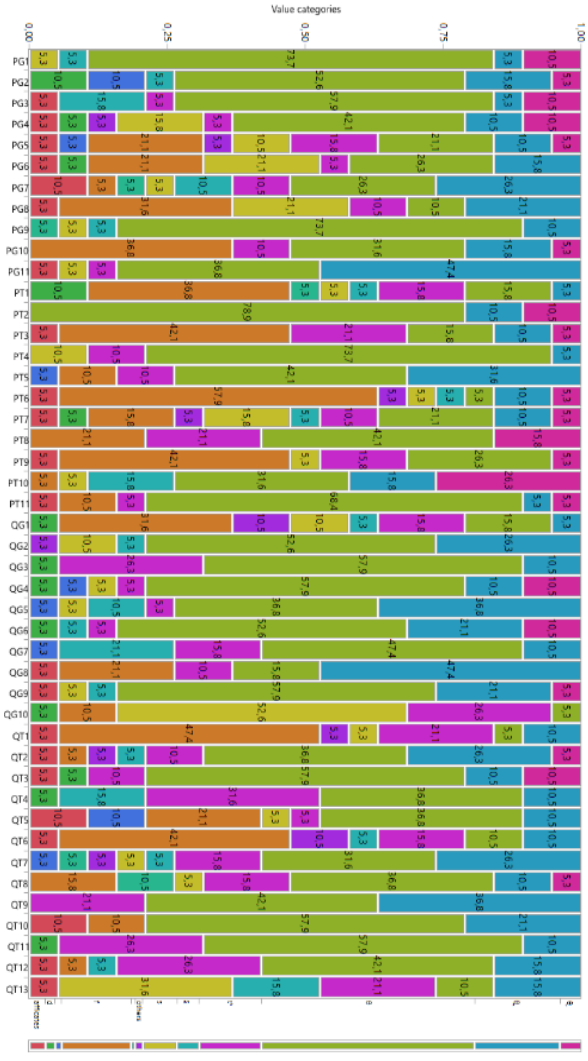


Fig. 1 reveals substantial variation in the production of the target sounds. Most students replaced [ð] with [d], shown in green, as well as [d̪] (blue). Each speaker produced various forms of substitutions – no speaker used only one or two variants. Speaker PT6 (17th speaker from above), for example, produced mostly a [d] (green) (*n*=15, 35.7%), [d̪] (blue) (*n*=9, 21.4%), [f] (yellow green) (*n*=5, 11,9%), [tʰ] (olive green) (*n*=3, 7.1%). Speaker QT6 (8th speaker from the bottom), produced [d] (green) (*n*=15, 35,7%), [d̪] (blue) and [ð̞] (light green) (*n*=7, 16.7%), and [s̪] (pink) (*n*=3, 7.1%). A chi-square test of independence revealed significant differences between the speakers (x^2 (528, 1890) = 1065.88, p<.0001).

3.2.2. Voiceless

Fig. 2 shows substantial variation in production of the target sounds for /θ/.

Figure 2: Distribution of sounds used for /θ/.



Most students replaced [θ] with [f] as indicated by the orange bar, as well as [tʰ] (pink). Speakers use several variants for the target sound. Speaker PG8 (8th speaker from above), for example, most frequently produced [f] (orange) (*n*=6, 31.6%), followed by [s] (olive green) and [θ̪] (teal blue) (*n*=4, 21.1%), or [tʰ] (pink) (*n*=2, 10,5%). QT6 (8th speaker from bottom up), on the other hand, produced [f] (*n*=8, 42.1%), followed by [tʰ] (*n*=3, 15.8%), [θ̪] as well as other variants (*n*=2, 10.5%). A chi-square test of independence, here, too, revealed significant between-speaker variation (X^2 (484, 855) = 815.05, p<.0001).

4. DISCUSSION AND CONCLUSIONS

4.1. Overall distribution

When looking at the overall realisation of dental fricatives, we find that Swiss German learners of English produce predominantly [f] and [tʰ] or [s] for /θ/. This stands in contrast to a previous study that suggested that Swiss German speakers tend to realise /θ/ as [s], as Germans and Austrians do [13]. The voiced counterpart is more frequently realised as [d], [d̪], [f] or [s̪]. This result largely reflects trends found for Dutch learners of English [9, 16]. Thus, perhaps, Swiss German can be viewed as a *t+ language – or even as an *f+ language in line with [10]'s suggestion for a new category, this is particularly true for the voiced allophone. Our results further suggest substantial intra-speaker variation. The type of substitution seems to depend on where in the word the target sound occurs. In the future, constraints such as word or phonological context (preceding and following segments) will be explored further; all the necessary metadata have been collected. At this stage we are gauging different modelling techniques which will enhance our understanding of which factors best predict variation. Our data (nominally-scaled, 16 different variants) pose challenges for straightforward modelling; conditional inference trees may be a viable approach in the future [15].

4.2. Between-speaker variation

The role of variation between learners is an indispensable feature of second language acquisition. [12] showed that not only the speed of acquiring a language but also the level of L2 attainment depends on the individual learner. The findings of our study reveal that speakers vary substantially in the strategies they use for substituting their target sounds (Figs. 2 and 3). [3] mentions a plethora of reasons for between-learner differences, such as aptitude, learning style/strategies, motivation, anxiety, personality and beliefs. Motivation, as one of the explanatory variables for between-learner variation, has been studied extensively [5]. This is not only seen as important for language learning but also for maximising its success, including the attainment of target-like pronunciation [3]. A learner's individual style – i.e. a learner's preferred way of processing information – has also been shown to contribute to between-learner variation [3]. More generally, awareness and consciousness of pronunciation on the part of the learner probably helps explain between-speaker variation. Factors such as motivation can be consciously acted upon (or not acted upon) by learners [3]. Furthermore, it needs to be mentioned that learners might want to attain a certain variation of English, where the pronunciation of <th> is the norm [10]. This variation between targets is another factor that contributes to between-learner variation. All of the factors mentioned (motivation, aptitude, learning strategy, personality, between-target variation etc.) are intertwined with one another and need to be considered when focusing on the individual learner. More sophisticated modelling will allow us to tease apart these factors in greater detail and, in the future, will help us understand which factors (motivation, personality, phonological context etc.) predict use of substitution on the part of the learners. All these variables highlight the difficulty of how English should be taught at school. In this present case, teachers would need to focus on their pupils individually, which is obviously entailed with additional effort. As a first nudge in this direction, this study was sent to the Bernese Department of Education as a recommendation for teachers of English as a foreign or second language.

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