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PRODUCTION OF ENGLISH INTERDENTAL FRICATIVES BY MULTILINGUAL SPEAKERS

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Abstract

This study aimed to analyze the production of the English interdental fricatives /ð/ and /θ/ by multilingual speakers of Brazilian Portuguese, Polish and English. Learners of foreign languages commonly face challenges regarding different aspects of learning, when it comes to phonetics that factor is not different. In case of English, a common difficulty can be related to the interdental fricatives, especially when these phonemes are not part of the inventory of a learner's first language, as is the case of the Brazilian Portuguese and Polish languages. Based on this assumption, the present study obtained five participants, descendants of Polish immigrants, originally from the *Paraná* and *Santa Catarina* states. The target sounds were embedded in English carrier words and then, analyzed acoustically with help of the *Praat* software. To collect the data, individual in-person meetings were scheduled. The participants also answered a background questionnaire, its objective was to gather personal information such as age, languages' proficiency and age of acquisition. The results of the study demonstrated the emergence of the substitution of /ð/ and /θ/ by other phonemes, as appointed by the literature.

Keywords: Interdental fricatives. English learning. Multilingualism. Phonetics.

PRODUÇÃO DE FRICATIVAS INTERDENTAIS DO INGLES POR FALANTES MULTILÍNGUES

Resumo

Este estudo teve como objetivo analisar a produção das fricativas interdentais /ð/ e /θ/ do inglês por falantes multilíngues de português brasileiro, polonês e inglês. Aprendizes de línguas estrangeiras comumente enfrentam desafios em relação a diferentes aspectos da aprendizagem, quando se trata de fonética esse fator não é diferente. No caso do inglês, uma dificuldade comum pode estar relacionada às fricativas interdentais, especialmente quando esses fonemas não fazem parte do inventário da primeira língua do aprendiz, como é o caso das línguas portuguesa do Brasil e da polonesa. Com base nessa presunção, o presente estudo obteve cinco participantes, descendentes de imigrantes poloneses, originários dos estados do Paraná e de Santa Catarina. Os sons-alvo foram incorporados em palavras-veículo do inglês e, então, analisados acusticamente com a ajuda do software Praat. Para coletar os dados, foram agendadas reuniões individuais presenciais. Os participantes também responderam a um questionário, cujo objetivo era coletar informações pessoais, como idade, proficiência nas línguas e idade de aquisição. Os resultados do estudo demonstraram a emersão de substituição de /ð/ e /θ/ por outros fonemas, como apontado pela literatura.

Palavras-chave: Fricativas interdentais. Aprendizagem de inglês. Multilinguismo. Fonética.

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Introduction

Any language learner may face some barriers in producing some sounds in a foreign language. This difficulty may have different origins, Sebastián-Gallés and Bosch. (2005) stress three main points: individual differences, relationship between native and nonnative sound systems and the issue of plasticity of the learning system (Sebastián-Gallés; Bosch., 2005). In case of English, it is not unusual that non-native speakers struggle to produce the bilabial voiceless interdental fricative /θ/ and the bilabial voiced fricative /ð/, especially when these phonemes are not common in a learner's first language (L1), as it is the case of the Brazilian Portuguese (BP) (Silva, 1999) and Polish (Szreder, 2013) languages. In such situations, a common phonological process to emerge is the substitution. In Sieg et al. (2023)'s substitution study, the results indicate that in English, "the most common targets substituted for were the shared phoneme /ð/ and the unshared phonemes /z, θ, v, and ɹ/" (Sieg; Fabiano; Barlow, 2023, p. 4709).

The present study aimed to analyze the production of English words containing the interdental fricatives /θ/ and /ð/ sounds in syllable onset position by multilingual speakers of BP, Polish and English.

The symbol /θ/ comes from the Greek letter 'theta', and is classified by Ladefoged and Johnson (2011) as a voiceless interdental sound, i.e., it is produced with the approximation of two articulations, the tongue and the teeth, the airstream is partially obstructed, producing turbulent airflow. For the /θ/ production, "the tip of the tongue is placed between the upper and lower front teeth" (Yavaş, 2011, p. 7). Examples of /θ/ in English words are 'think' /θɪŋk/ and 'thank' /θæŋk/. The symbol /ð/ is an Anglo-Saxon derived letter, and it represents a voiced interdental sound. Its manner of articulation is the same as /θ/. Examples of /ð/ in English words are 'then' /ðen/ and 'though' /ðoʊ/ (Ladefoged; Johnson, 2011). In the spectrogram, the interdental fricative /θ/ has a similar pattern to the labiodental fricative /f/. Ladefoged and Johnson (2011) state that these two sounds are difficult to be distinguished. The only feature that differs one from another is the movement of the second formant (F2) into the following vowel, while for /f/ there is very little movement; for /θ/, F2 moves down.

When comparing English and Polish, Jassem (1971) affirms that the Polish /t/ and /d/ share some acoustic features with the English /θ/ and /ð/, as the four sounds are articulated with the tongue touching the teeth (dental point of articulation). However, the Polish sounds differ from the English

sounds in terms of manner of articulation, as the Polish sounds are stop consonants, while the English sounds are fricatives. Jassem points out that: "As /θ/ is similar to Polish /t/, /ð/ resembles the articulation of the Polish /d/, the basic difference lying in that the articulation of the English sound, the front rim of the tongue does not come in contact with the incisors, but is placed close to them" (Jassem, 1971). The Polish stop consonants /t/ and /d/ are classified as dental sounds, i.e., they are produced with the tongue touching the teeth (Gussmann, 2007). In BP the stop consonants /d/ and /t/ are classified by Silva et al. (2019) as alveolar sounds, i.e., they are produced with tongue touching the alveolar ridge. However, in some cases they are produced as dental sounds (Silva et al., 2019). Table 1 displays a summary of the place of articulation of the stops /t/ and /d/ in BP, Polish and English.

Table 1: Place of articulation of /t/ and /d/ in BP, Polish and English

	Voiceless stop /t/	Voiced stop /d/	Definition by:
Brazilian Portuguese (BP)	Stop, alveolar and unvoiced consonant	Stop, alveolar and voiced consonant	Silva *et al.* (2019)
Polish	Stop, dental and unvoiced phoneme	Stop, dental and voiced phoneme	Janusz (2002)
English	Stop, alveolar and unvoiced phoneme	Stop, alveolar and voiced phoneme	Ladefoged and Johnson (2011)

Source: the author

Even though the present study focuses only on the production of the English interdental fricatives /θ/ and /ð/, we found relevant to bring the place of articulation of the stop consonants in all the three languages due to their differences and similarities, which may influence on the different production of the multilinguals.

In the case of BP learners of English, they may produce or perceive the interdental fricatives by a phoneme else, e.g. (Ramos; Raymundo; Ney, 2020; Teló; Souza, 2023). This occurrence has been verified by previous research, Trevisol (2010) investigated the production of interdental fricatives /θ/ and /ð/ by L1 Portuguese speakers, the results demonstrated that the participants commonly replaced /θ/ with /t/ and /ð/ with /d/. In 89.55% of word-initial production, /θ/ was produced as /θ/; 8.64% of /θ/ was replaced by /t/, the commonest replacement.

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Similarly, as in the case of BP speakers' learners of English, Polish learners of English also commonly replace the interdental fricatives /θ/ and /ð/ in English by producing the alveolar stops /t/ and /d/. In Polish, Gonet and Pietron (2006) demonstrated that for Pole learners of English, the commonest sound used to replace /ð/ before vowels was /d/ (37%); whereas before consonants, the most common replacement was /v/ (15%). Regarding /θ/, the most common replacement was /f/ (27%), followed by /t/ (19%).

2 Research questions and hypotheses

This study investigated the production of the English voiceless interdental fricative /θ/ and the voiced /ð/, produced by a group of multilingual speakers of Portuguese, Polish and English. Each participant was expected to have individual experiences with the three languages. For this reason, we also intended to examine their linguistic background and age of onset acquisition of each language, attempting to connect their experiences with their interdental production patterns. Thus, the following two research questions (RQ) conducted the study:

RQ1: How is the English voiceless interdental fricative /θ/ and the voiced /ð/ produced by multilingual speakers of Portuguese-Polish-English?

RQ2: How can the language experience and age of onset acquisition of a group of multilinguals cause effect on English interdental fricatives productions?

3 Method

This study is a quasi-experimental, quantitative, and exploratory research. The target fricatives, /θ/ and /ð/, were integrated into carrier words and recorded by five multilingual speakers. These target segments were analyzed both, acoustically and auditorily, using the Praat program (Boersma, Weenink, 2022). Consequently, this research is fitted as a lab-based study. As a cross-sectional study, the data collection involved a single session for each participant.

3.1 Participants

The present study included five participants (P1, P2, P3, P4 and P5), multilingual speakers of Brazilian Portuguese, Polish and English. They were originally from the border of the states of *Santa Catarina* and *Paraná*, around the region of the *Porto União* and *União da Vitória* cities. The way the

participants were recruited was the snowball sampling strategy, in which the researcher identifies potential participants who may attend the necessary criteria to fit in the study. These potential participants are asked about other members of the population that can have a similar profile (Mackey; Gass, 2012). This task was done by e-mail, until the acceptable number of participants was achieved.

Initially, twelve people were contacted, but only five of them completed all the tasks. The first step was sending an invitation by e-mail, followed by a pre-screening questionnaire, to verify the profile of potential participants. Afterward, a background questionnaire was sent, to collect data about participants' background, i.e., age, history language learning and use. The background questionnaire was based on Scholl and Finger (2013). Lastly, a production test was used to obtain the speech samples by recording participants' reading aloud the target words. There were three tests, the first containing BP words; the second containing Polish words and, the third, English words. In this paper, we focus on the results obtained for the production of the English fricatives.

3.2 Production test

For collecting the data, a production test was used in English. The target sounds were embedded in carrier words in syllable onset position. For the present study, the test included three English words containing the interdental fricative /θ/ and three words containing the /ð/, both target sounds in syllable onset position. The main criteria for selecting the words was by verifying their frequency on the Corpus of Contemporary America English (COCA) (Davies, 2008), preferring to have monosyllabic words. Based on that, one disyllabic and five monosyllabic words were chosen. The full test had 30 words, including target words and distractors. Table 2 displays the words of this study and their frequency in COCA.

Table 2: Frequency of the tested words in COCA

	Frequency in COCA
This	5,560,531
There	2,913,123
Though	401,656
Think	1,492,793
Thunder	8,862
Thought	472,238

Source: the author

There were five participants in the study, each word was produced one time. Thus, there was a total of 30 productions, 15 for the voiceless fricative /θ/ and 15 for the voiced fricative /ð/. The analysis focused on individual interdental fricatives patterns for each participant, because the number of participants was small, varying in their English and Polish age of acquisition and also in terms of language use.

The data were collected in the 2023 year. Before the data collection, the participants signed a consent form, which ensured their rights and the procedures of the study. The productions were collected in individually in-person meetings, recorded with help of the *Praat* program, version 6.2.14 (Boersma, Weenink, 2022) and a slide presentation containing the target words. The first step of the meetings was to explain the procedures to the participants. They were asked to avoid producing any kind of noise when recording the tests. Each participant was instructed to sit in front of the computer and to pin the microphone on his/her clothes, taking care to be in a position of around 10 centimeters from the mouth and not touching the clothes. The first task of the test was reading an English paragraph, with the purpose of code-switching for English. Thus, minimizing possible crosslinguistic influences. The recordings were saved in files in .wav format and, then, analyzed later on the *Praat* program, version 6.2.14 (Boersma, Weenink, 2022).

Before contacting the participants, the project, instruments, and Consent Form were submitted to the *Comitê de Ética em Pesquisa com Seres Humanos* (CEPSH/UFSC) at the *Universidade Federal de Santa Catarina*. The documents received approval under protocol number CAAE: 67294423.5.0000.0121

3.3 Data analysis

The spectral analysis was conducted with help of the Praat program (Boersma, Weenink, 2022), with the productions being visualized and inspected by the researcher acoustically. For the voiced /ð/, the commonest replacement by Brazilian Portuguese (Reis, 2006) and Polish speakers (Gonet; Pietron, 2006) is by /d/. Teló and Souza state that, in the spectrogram, waveforms containing weak noises throughout the entire segment are classified as canonical /ð/; whereas the waveforms that contain a silent voiced period followed by an acoustic burst are classified as /d/ (Teló; Souza, 2023).

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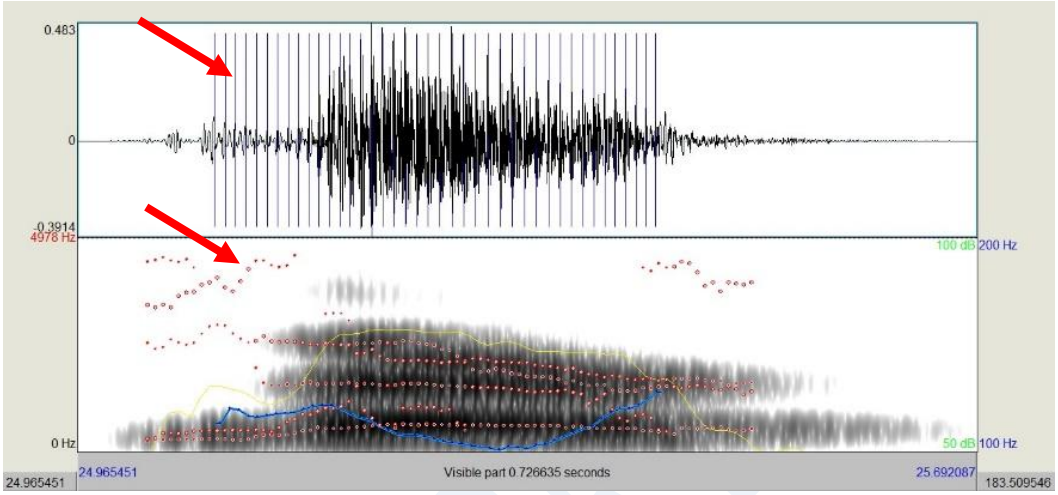
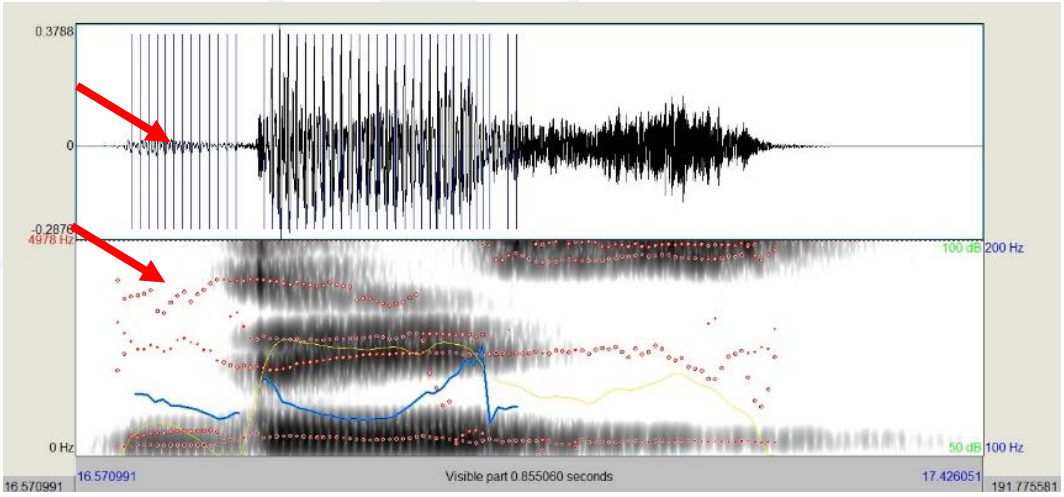
Figure 1 displays P2's production of "there", produced as /ð/. The red arrows indicate the absence of burst. Whereas *Figure 2* displays P2's production of "this", produced as /d/. The red arrows point to the presence of acoustic burst in the transition from the consonant to the vowel.

Figure 1: P2's production of /ð/ in "there"



Source: the author

Figure 2: P2's production of /d/ in "this"



Source: the author

4 Results and discussion

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We start presenting the results by the participants' background, i.e., linguistic profile and age of acquisition. Then, we present the proficiency in the three languages for each participant. Lastly, we bring the findings for the words containing the voiceless fricative /θ/ and the voiced /ð/.

4.1 Participants' profile and age of acquisition

From the five participants, four were female and one male, with age varying from 22 to 59 years old. Four participants had higher education, while one had high school. Regarding the age of acquisition, all the participants had BP as L1. Table 3 summarizes the profile of the five participants, including gender, age, education and age of acquisition (AoA).

Table 3: Participants' profile

Participant	Gender	Age	Education	BP AoA	Polish AoA	English AoA
P1	F	59	Undergraduate	0	45	8
P2	M	22	High school	0	0	15
P3	F	22	Graduate	0	0	11
P4	F	32	Graduate	0	26	10
P5	F	26	Graduate	0	5	12

Source: the author

For the age of acquisition of each participant's language, Table 3 brings the age the participants started learning each language. P2 and P3 started their lives learning both, the BP and Polish languages, thus considered simultaneous bilinguals, having English as L3. P5 had Polish as L2 and English as L3. P1 and P4 had English as L2 and Polish as L3. Concerning the level of education, P1 was had an undergraduate degree; P2 High school; and P3, P4 and P5 a graduate degree. For Polish P1 and P4 started learning it when being adults; whereas for English, the participants started their learning varying from 8 to 15 years old.

4.2 Participants' proficiency

For BP, the L1 of the five participants, all of them reported having six for the four language skills: reading, writing, listening and speaking. The scale corresponded from 0 to 6, whereas 0 = nothing, and 6 = a lot.

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For Polish and English, P1 self-reported a very similar level of proficiency for the two languages, having a better command of reading in English (5) than in Polish (4). The other three skills were equally described for both languages, writing = 5; listening = 4; speaking = 5.

P2 had the same level of proficiency for reading and listening, both 5. P2 masters a better level of writing in English (4) than in Polish (2) and as well for speaking, English = 5; Polish = 4.

P3 self-reported a good level of proficiency for Polish and English, being the participant who had the highest level in the two languages. For English, it was reported 6 for the four skills. For Polish, P3 reported 6 for reading, listening and speaking; and for writing, 4.

Between the five participants of the study, P4 was the participant who self-reported the lowest level of proficiency for English and Polish, having more proficiency in English than in Polish. For English, P4 self-assessed as 4 for reading and writing; and as 3 for listening and speaking. For Polish, P4 declare to own 3 for reading and listening; whereas for writing and speaking, it was 2.

P5 had the maximum assessment for the four skills in English, 6. For Polish, P5 self-reported to have a better command for listening and speaking (5) than for reading and writing (2).

Table 4 displays the level of proficiency of the participants in Polish. The numbers correspond to a scale ranging from zero to six (0 = nothing; 6 = a lot), self-reported by each participant in the background questionnaire.

Table 4: Participants' level of proficiency in Polish

	Reading	Writing	Listening	Speaking	Mean
P1	4	5	4	5	4.5
P2	5	2	5	4	4
P3	6	4	6	6	5.5
P4	3	2	3	2	2.5
P5	2	2	5	5	3.5

Source: Falkievicz (2024, p. 66)

For Polish, P4 self-reported the lowest mean. P5 had a higher mean than P4, but that occurred due to the listening and speaking skills, reported as higher values. On the other hand, P3 was the participant who informed the highest mean, having an extremely high level of proficiency for all the skills, except for writing. Table 5 displays the level of proficiency in English. The numbers correspond to a scale from zero to six.

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Table 5: Participants' level of proficiency in English

	Reading	Writing	Listening	Speaking	Mean
P1	5	5	4	5	4.75
P2	5	4	5	5	4.75
P3	6	6	6	6	6
P4	4	4	3	3	3.5
P5	6	6	6	6	6

Source: Falkievicz (2024, p. 66)

For English, P4 self-reported the lowest mean; whereas P3 and P5, the highest. In general, the level of proficiency reported by the participants on Tables 4 and 5 indicate that there was not a large difference of proficiency from Polish to English. However, all the participants had higher proficiency in English than in Polish. This difference occurred especially because of the reading and writing skills, which were lower in Polish. This fact may come mainly because, as a being a heritage language, Polish may be learned in families orally by the descendants of Polish immigrants.

4.3 Productions of the fricatives

For the fricatives, we first present the results obtained for the voiced /ð/ individually. P1 produced /ð/ twice, in the words 'this' and 'though'. For the word 'there', P1 replaced /ð/ by /d/. Thus, P1 produced 66% of the target productions correctly. P2 also had two correct productions, for the words 'there' and 'though'. P2 produced 'this' replacing /ð/ by /d/.

P3 and P4 had only one correct production, P3 produced 'this' and P4 produced 'there'. P3 replaced the /ð/ in 'there' by /d/ and in 'though' by /t/. P4's replacement was both in 'this' and 'though' by /d/.

P5 was the only participant without any accurate production, the /ð/ in the three words were replaced by the voiced stop /d/.

Table 6 summarizes the productions of each participant, showing whether they produced them correctly, i.e., the /ð/ phoneme, or replaced it with a phoneme else. Taken as reference the Cambridge

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Dictionary for American English, the phonetic transcription of the words of the present study are: this /ðɪs/; there /ðer/; and though /ðoʊ/[2] (Cambridge Dictionary, 2024).

Table 6: Words containing the voiced interdental fricative /ð/ productions

	This	There	Though	Total target productions	Total non-target productions
P1	/ðɪs/	/der/	/ðoʊ/	2	1
P2	/dɪs/	/ðer/	/ðoʊ/	2	1
P3	/ðɪs/	/der/	/toʊ/	1	2
P4	/dɪs/	/ðer/	/doʊ/	1	2
P5	/dɪs/	/der/	/doʊ/	0	3
Total				6	9

Source: the author

Table 6 shows that the voiced interdental /ð/ was replaced for other two phonemes: /d/ and /t/. Most of the words containing the /ð/ phoneme were replaced by the production of the /d/, being a total of 8 productions, which corresponds to 53.33% of the productions. One production (6.66%) was produced as /t/ instead of /ð/. And 40% of the productions were produced correctly, i.e., using the /ð/, being produced by four of the participants, except P5.

As well as presented in the literature, the results from the present study showed that mostly of the /ð/ phoneme replacement occurred by the /d/ phoneme instead. However, the occurrence was larger in the present study (53.33%) than from the ones in the literature: for native Polish speakers: 37%; (Gonet; Pietron, 2006); and for native BP speakers 48.64% (Trevisol, 2010). Differently from Trevisol (2010)'s study, which showed that the only phoneme that replaced /ð/ was /d/; in the present study, there was another event, the occurrence of the voiceless stop /t/. Furthermore, unlike Gonet and Pietron (2006), study that demonstrated the occurrence of the replacement of /ð/ by the /v/ phoneme; in the present study, this event did not occur.

We now discuss the results obtained for the voiceless interdental fricative /θ/. The Cambridge Dictionary for American English has the following phonetic transcriptions of the words used in this study: think: /θɪŋk/; thunder: /ˈθʌn.dɚ/; and thought: /θɑːt/ (Cambridge Dictionary, 2024).

P1 and P3 did not have any voiceless interdental fricative correct production, instead P1 replaced /θ/ by /t/ in the words 'think' and 'thunder', and by /ð/ in the word 'thought'; whereas P3

[2] Different authors may have different transcriptions for these words.

replaced the interdental fricative in ‘think’ by /f/ and in ‘thunder’ and ‘thought’ by /t/. On the other hand, P2 had the three words correctly produced.

P4 and P5 had one target and two non-target productions, they both produced ‘think’ correctly and replaced the /θ/ in ‘thunder’ by /t/. P4 replaced the /θ/ in ‘thought’ by /d/ and P5 by /t/. Table 7 summarizes the individual productions, displaying the number of times that the participants produced the words using the initial /θ/ phoneme, or replaced it for a phoneme else.

Table 7: Words containing the voiceless interdental fricative /θ/ production

	Think	Thunder	Thought	Total target productions	Total non-target productions
P1	/tɪŋk/	/ˈtʌn.dɚ/	/ðɑːt/	0	3
P2	/θɪŋk/	/ˈθʌn.dɚ/	/θɑːt/	3	0
P3	/fɪŋk/	/ˈtʌn.dɚ/	/tɑːt/	0	3
P4	/θɪŋk/	/ˈtʌn.dɚ/	/dɑːt/	1	2
P5	/θɪŋk/	/ˈtʌn.dɚ/	/tɑːt/	1	2
Total				5	10

Source: the author

From the 15 words that should be pronounced with the initial /θ/ phone, 5 (33%) of them were produced accordingly, being three productions by P2, one by P4 and one by P5. One production (P3) replaced the interdental fricative /θ/ phoneme by the voiceless labiodental fricative /f/ (6.66%); one production (P4) by the alveolar voiced stop /d/ (6.66%); and 6 productions (40%) by the alveolar voiceless stop /t/.

From the five words produced with the interdental fricative /θ/ phoneme, three were for the word ‘think’, one for ‘thunder’ and another for ‘thought’. The adjacent vowel of the analyzed phoneme can be important to influence this occurrence. The word ‘this’, which has the same following vowel as in the word ‘think’: /ɪ/, had two production using the voiced interdental fricative. Another assumption could be the frequency of the tested words. As verified on COCA (Davies, 2008), the results presented a lower use for the word “thunder”, but still used significantly, while the rest of the words presented high numbers.

Following, we present the total numbers of productions for each phoneme produced in this study: /ð/, /θ/, /d/, /t/ and /f/. Figure 3 displays the percentages of all the productions.

Figure 3: Summary of all productions

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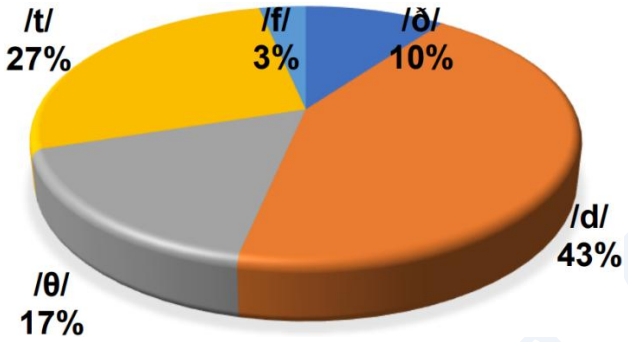

Source: the author

In case all the words were produced properly, i.e., pronouncing /θ/ as /θ/; and /ð/ as /ð/, then, Figure 3 would present 50% of the circle for /ð/ and 50% for /θ/. However, we see that most of the productions were replaced by a phoneme else, being /θ/ replaced by /t/, /d/ or /f/ and /ð/ by /d/ or /t/. This event can be an evidence of the influence of both languages, BP and Polish, since in both languages the alveolar stops /t/ and /d/ are common phonemes. But it still seems that BP has higher influence than Polish. This assumption is due to the fact that, according to the literature, in Polish the interdental /θ/ is more replaced by /f/ than by /t/; whereas for /ð/, the highest replacement is by /d/, but with occurrence of /v/, events which did not occur in this study.

The replacement of the phones /θ/ by /t/ and /ð/ by /d/, obtained in the present study, confirmed previous findings for English speakers, whose L1 was BP or Polish. This event can be related to the proficiency level of each participant. However, even the participants who self-reported to have a strong high level of proficiency in English (P3 and P5), still had /t/ productions for /θ/ and /d/ productions for /ð/.

In summary, P2 was the participant with the highest level of accuracy, producing the three words containing the fricative /θ/ precisely (100%) and two (66%) productions for the fricative /ð/. P1 and P3 were participants who did not produce any /θ/ properly; whereas for the voiced /ð/, the only participant who did not have any accurate production was P5. Table 8 displays a summary of the accuracy for each participant in percentage.

Table 8: Percentage of accuracy for /ð/ and /θ/

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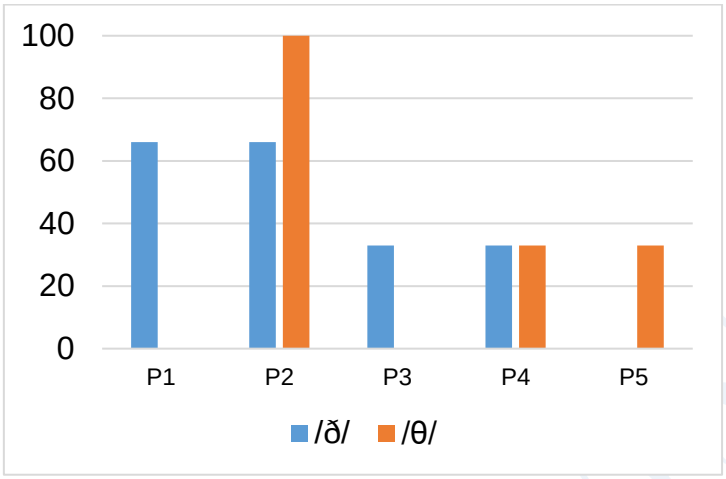

Source: the author

Final Considerations

As appointed by the literature, Trevisol (2010) for BP and Gonet and Pietron (2006) for Polish, the commonest replacement of the interdental fricatives were /d/, /t/ and /f/. The exception was the non-occurrence of the voiced labiodental /v/, reported in previous Polish research (Gonet; Pietron, 2006). A possible causality may come due to the proficiency of the participants, considering that all of them had a better command of BP than Polish. Another point is that for Polish learners of English, the interdental fricative /θ/ was more replaced by /f/ than by /d/ (Gonet; Pietron, 2006); whereas in the present study there was only one replacement by the fricative /f/, produced by P3.

Considering these facts, we could presume that one main variable to influence the production of the interdental fricatives of the participants would be their proficiency. However, it is important to be cautious about such statement, since this study faced certain limitations. One of them was the limited number of productions of the target words. That comes due to the fact that the primary objective involving these multilinguals was not the production of the English interdental fricatives, but something else.

Additionally, the substitution of voiced by voiceless phonemes and vice versa was not appointed by the studies reviewed in the literature. However, it was a present event in this study, as /θ/ being replaced by /d/ and /ð/; and /ð/ being replaced by /t/. A possibility for that could be the participants' unfamiliarity with the words containing them. However, before recording the productions, the participants verified their familiarity with all the words. Thus, other elements may

influence their pronunciation, such as a better knowledge of phonetics or cognitive factors. A deeper and wider study would be necessary to try covering this issue.

The study presented a similar number of accuracy for the interdental fricative /θ/ and /ð/, the voiced /ð/ occurred more times: 40%; and the voiceless: 33%. In summary, the level of accuracy was small. Even though, the limited number of analyzed target-words was small, the results suggest a noticeable difficulty in the correct articulation of these phonemes among the participants. Further research with a larger sample size and also a more diverse linguistic backgrounds would be needed to draw more conclusive insights.

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