| RESEARCH ARTICLE

An Acoustic Investigation of the Production of Interdental Fricatives by Cameroonian ESL Learners

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| ABSTRACT

This study investigates the production of /θ/ and /ð/ at initial, medial and final positions by Cameroonian ESL (CamESL) students using the acoustic analysis method. The words *theme, something, mouth, them, without* and *with* were put on a list and read by 26 undergraduate CamESL learners from the University of Maroua. Their productions were recorded and analysed using PRAAT version 6.3.11 of 17 July 2023. The analysis revealed that at initial and medial positions, the majority of learners were able to accurately render the sounds while at the final position, both /θ/ and /ð/ were systematically substituted with /f/ and the unreleased stops /t̚/ and /d̚/. It was also discovered that the choice of substituting phonemes depends on the linguistic environment sounds since unreleased stops never occurred at initial and medial word positions, and the normal stops /t/ and /d/ also rarely occurred at the final position. It can be concluded that success and deviation in the production of interdental fricatives by CamESL learners depend on the location of the sound.

1. Introduction

The difference between the sound system of English and that of other world languages always poses a significant challenge to learners of English as an additional language. This is due to the numerous speech phenomena, both segmental and suprasegmental, that uniquely occur in English, therefore constituting its markedness. The English interdental fricatives /θ/ and /ð/ fall under the category of challenging sounds to ESL/EFL learners as they only occur in a few languages besides English (Cruttenden, 2008; Jekel, 2012). Maddieson (2013) reported that the sounds only occur in 43 out of the 566 languages surveyed (7.6%) but are distributed worldwide. The current study sets out to investigate the production of the alveolar non-sibilant fricatives in various lexical contexts by CamESL learners from the acoustic analysis perspective.

Given the complexity of the profile of English speakers and the numerous definitions of the Cameroonian English speech community, it is worth highlighting the notion of CamESL. CamESL, as taken in this study, refers to any English language speaker who went through the Anglophone sub-system of education, justified by holding a General Certificate of Education/ Ordinary Level (GCE O/L) and the General Certificate of Education/Advance Level (GCE A/L). Hence, this classification only sticks to the simplest definition of English as Second Language, which is the educational sub-system in which the speaker studied, therefore neglecting their ethnic background and geographical origin. From this definition, CamESL will contrast with CamEFL, which will rather refer to Cameroonian English speakers who studied in the Francophone sub-system of education, proved by holding BEPC, Probatoire and Baccalaureat.

2. Literature review
2.1. The acoustic features of interdental fricatives
The production of fricative consonants, in general, involves a narrow constriction in the vocal tract, which creates frication or a turbulent noise as air from the lungs has to squeeze through that narrow passage (O'Connor, 1998; Cruttenden, 2008; Yavaş, 2011). From the acoustic point of view, frication is marked by a spread of energy all through the sound wave and the sound spectrum. The spectrography of /θ/ and /ð/ indicates a spread of energy at very high frequencies (generally between 1400 Hz and 8000 Hz) without regular horizontal or vertical lines, causing the noise to be relatively weak and only perceivable from transitions between consonant and vowel (Ladefoged, 2001; Cruttenden, 2008; Yavaş, 2011).

The above mentioned features distinguish the interdental fricative /θ/ and /ð/ from the alveolar fricative /s/ and /z/ whose energy concentration is visible between 5000 Hz and 6000 Hz. It was also reported that /s/ and /z/ display more concentration of acoustic energy producing a darker band than the sounds /θ/ and /ð/ (Ladefoged, 2001, p.183). Although no significantly distinctive information can be gathered from the first look, the spectrograms of the sounds /θ/ and /ð/, are also distinct from those of labiodentals /f/ and /v/. According to Ladefoged (2001), the distinction is mainly seen from the movement of the second and third formants of the vowels that follow these two groups of sounds (p. 182). Interdental fricatives /θ/ and /ð/ also differ from stops from spectrographic analysis since the production of plosives involves a silence which is represented by a blank portion, followed by a burst which is marked by a sudden and massive concentration of energy in the sound spectrum (Ladefoged, 2001; Yavaş, 2011; Brozbă, 2012).

2.2. Previous studies on the production of interdental fricatives
Interdental fricatives have always betrayed the majority of ESL/EFL speakers as they replace them with sounds which are relatively similar and more familiar to them. Many studies have revealed that /θ/ is generally substituted by /t/ while /ð/ is produced as /d/ (Wells, 1986; O'Connor, 1998; Cruttenden, 2008; Hattem, 2009; Hanulíková & Weber, 2010; Yavaş, 2011; Owolabi, 2012; Jekiel, 2012; Firdaws et al. 2020; Brigg, 2021). These studies proved that this substitution is neither a recent phenomenon nor is it specific to a given geographical location because it is even found in English L1 contexts like British English. In the latter variety, the substitution of interdental fricatives mainly occurs in some dialects like Cockney English and Gaelic English (Wells, 1986, p. 413). In American English, the rendition of /θ/ and /ð/ as /t/ and /d/, respectively is attested in West Midlands English, New York City English or the African American Variety of English (Wells, 1986; Blevins, 2006).

In ESL/EFL settings in general, the same phenomenon was reported in many English speech communities. Owolabi (2012), who investigated the production of /θ/ and /ð/ by Yoruba speakers of English, discovered that the sounds are substituted at more than 80% in all the linguistic contexts. These sounds were systematically replaced by /d/ for /ð/ and /t/ for the /θ/. Similar results were obtained by Firdaus et al. (2020), who studied the production of /ð/, /θ/ by Indonesian learners and Graeppi and Leemann (2009), who investigated the way German learners of English pronounce these interdental fricatives.

The substitutions of /θ/ and /ð/ with alternative similar sounds are generally grouped under TH fronting and TH stopping (Wells, 1986; Lass, 1994; Blevins, 2006). TH fronting, which is generally associated with London English, refers to the tendency to produce the sound from the TH grapheme as labiodental fricatives due to a strong perceptual similarity between the two classes of sounds (Blevins, 2004; Brigg, 2021). It is indicated that Londoners replace interdental fricatives /θ/ and /ð/with labiodentals /f/ and /v/, respectively (Wells, 1982, p. 328). According to Kerswill (2003), TH-fronting is spreading throughout Britain in the form of regional dialect levelling (p. 1).

TH stopping consists of the substitution of the sound /ð/ and /θ/ by the sounds /d/ and /t/, respectively. It is considered a feature of London English and commonly attributed to the influence of overseas varieties (Wells, 1986; Jekiel, 2012). The confusion between /ð/ and /d/ was said to be traced back to the Old English (OE) and Middle English (ME) periods (Lass, 1992, p. 64). Three main events were reported to have redistributed the sounds /ð/, /θ/ and /d/. These events include pre-sonorant strengthening, post-fricative strengthening and finally, fricative weakening before /Vr/ (Lass, 1992). The relationship between dental fricatives and stops is better explained by Grimm's Law and Verner's Law (See Lass, 1994; Jekiel, 2012).

In Cameroon, many studies have also been carried out on the way /θ/ and /ð/ are rendered by Cameroonian speakers of English as Second Language. It was discovered that the sounds are systematically pronounced as /t/ for /θ / and /d/ for /ð/ (Simo Bobda, 2004; Atechi, 2006; Brozbă, 2012; Kouega, 2013; Djon-Yabe, 2023). The pronunciation of the interdental fricatives was among the sounds studied by Atechi (2006). The researcher studied the production of the sounds at initial, medial and final positions and discovered that words like *thought* are rendered as /tɔt/, *although* as /oldo/ and *mouth* as /maʊt/ (p. 163). It was therefore concluded that inaccurate renditions occur mostly at the initial position while the instances of deviation at the final position were generally attributed to the process of final consonant devoicing, which is typical of CamE and most West African varieties of English (p. 164). Kouega (2013), who also studied the interdental fricatives among other sounds, obtained a similar result, and according

to the researcher, this phenomenon falls under what is referred to as spelling pronunciation (p. 898). Djon-Yabe's (2023) study on the pronunciation of some graphemes by the students of the Department of English at the University of Maroua also looked at the production of /θ/. Although the study did not consider its voiced counterpart, the result was similar to those obtained by Atechi (2006) and Kouega (2013).

Brozbă (2012) used the acoustic analysis method to study the pronunciation of /ð/ and /θ/ from the production of Cameroonians. Although the focus of the study was not only on these two sounds, the result converged with what was obtained by other studies in this area. The researcher reported that these substitutions occur even in the productions of speakers who have been in contact with native speakers of English and are also more perceptible in casual speech (Brozbă, 2012, p. 22). A spectrographic image was also provided to illustrate the difference between the RP and the Cameroonian speakers' realisation of the sounds and to highlight deviations in the realisation of Cameroonian English speakers.

Even though many researchers investigated the production of interdental fricatives in Cameroon, no study focused solely on the sounds. These fricatives were only studied as part of a list of sounds; this is why only the summaries of productions were presented as results, without details on the different renditions with the proportions of both accurate and inaccurate realisations at all the linguistic environments. Again, Apart from Brozbă (2012), play-and-listen was used as a data analysis method in the studies. Djon-Yabe, who provided more details on the productions at initial, medial and final positions, only looked at the pronunciation of TH as /θ/, and did not include its voiced counterpart /ð/ in the investigation.

The present study will therefore be a thorough investigation of the production of /θ/ and /ð/ as the study solely focuses on these sounds and will therefore look at how they are rendered at initial, medial and final positions. The presentation of all the different renditions will better show the proportions of accurate and inaccurate productions of the sounds. This study will also use acoustic analysis as a method of data analysis so as to bring out more details that have not been brought out by human ears.

3. Methodology
3.1. Participants
Twenty six (26) CamESL learners participated in the study. All of them were undergraduate students in the Department of English Language and Literature, the Department of Bilingual Letters of the University of Maroua and holders of a GCE Ordinary and Advanced Levels. As for their origin, the participants came from different regions of Cameroon, namely the Far North, the North, the Littoral, the South and the South West. The respondents were aged between 18 and 28 and manifested no speech deficiency.

3.2. Material and procedure
The words *theme, something, mouth, them, without* and *with* were given to the learners in a list to read, and their readings were recorded. The recordings took place in a campus hall where the participants were taken one after the other. Once in the hall, the list of words to be read was given to them, and they were also given 2mn each to familiarise themselves with the words. When the informant was ready, a jack microphone was placed about 10 to 15 cm from their mouth. Each respondent was also given a pseudonym which they said before starting to read the words from the list. The informants were asked to read and pause after every word. Then, the PRAAT software, which was installed in a Laptop computer, was opened, and the recording was conducted at 44100 HZ with the help of Boya BY-M1 jack microphone. Each recorded file was first played to verify its quality, then saved as a Wav file with the pseudonym of the reader. The 26 respondents read the six words from the list, totalling 156 tokens (78 tokens for the sound /θ/ and 78 tokens for the sound /ð/). The recordings were analysed Using PRAAT version 6.3.11 of 17 July 2023 to check and characterise the acoustic feature of the interdental fricative portion and see the exact sound that has been produced with the help of the general knowledge about the acoustic features of the non-sibilant dental fricatives.

4. Results and Discussions
4.1. The production of the sound /θ/
The sound /θ/ has been produced in diverse ways depending on the position of the TH grapheme in the word. There are both accurate and inaccurate renditions at all the positions of the sound. From the 78 tokens, there were 42.23% accurate productions, 19.23% renditions as /t/, 16.66% renditions as /f/, 10.25% as /tʰ/ and other minor cases, as Table 1 illustrates.

Table 1: Recapitulation of the renditions of /θ/

Sounds	/θ/	/t/	f	Unreleased /t˺/	/s/	/ş/	/tʃ/
Initial	13	6	1	0	4	2	0
Medial	13	8	3	0	1	1	0
Final	7	1	9	8	0	0	1
Total	33	15	13	8	5	3	1
Percentage out of 78 tokens	42.30	19.23	16.66	10.25	06.41	03.84	01.28
		57.69					

a- Production of /θ/ at initial position

The sound /θ/ has been accurately produced at the initial position by 50% of the respondents, while the other 50% rendered it as /t/ (30.76%), as /s/ (07.69%), as /ş/ (07.69%), and finally as /f/ (03.84%). The acoustic features of the renditions of /θ/and /t/, which are the major renditions, are shown in Figures 1 and 2.

Table 2: Renditions of /θ/ at initial position

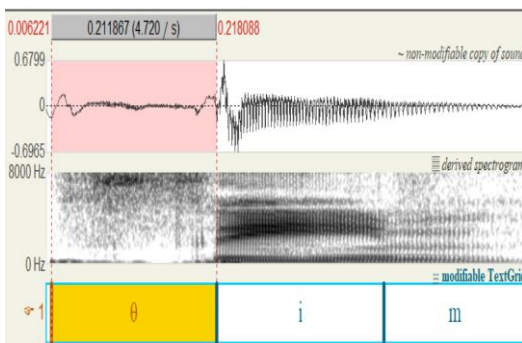| Initial Position	/θ/	/t/	/s/	/ş/	f
	13	8	2	2	1
%	50	30.76	07.69	07.69	3.84
		50			

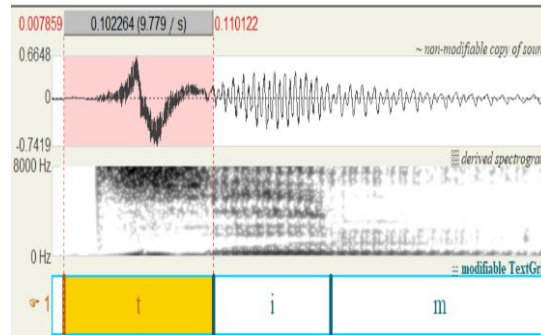**Figure 1:** Correct rendition of /ð/ at initial position   **Figure 2:** /θ/ as /t/ at initial position

The figures clearly indicate the spectrographic difference between the renditions. Figure 1 proves that the respondent accurately pronounced the sound /θ/ since the highlighted sound spectrum presents the acoustic features of the target sound, therefore articulating the word *theme* as /θim/. In Figure 2, the production begins with an obstruction phase which is followed by a burst but without vibration, which is typical of the sound /t/. Therefore, in Figure 2, *theme* was pronounced as /tim/.

b- Production of /θ/ at medial position

The sound /θ/ has been rendered accurately by 50% of the informants at the medial position, as seen in Table 3. Inaccurate productions also total 50% with various deviated renditions. The sound has been pronounced as /t/ by 30.76% of the respondents, while 11.53% of them substituted it with the voiceless labiodental fricative /f/. Other renditions like /s/ and /ş/ have also been recorded, even though not significant (03.84% each). The three main renditions are illustrated in Figures 3, 4 and 5.

Table 3: Renditions of /θ/ at medial position

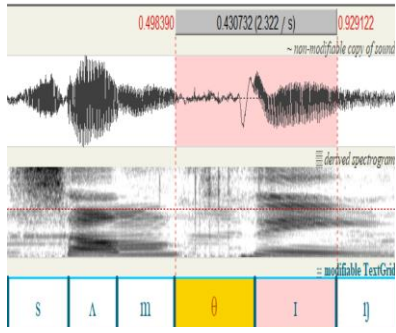| Medial position	/θ/	/t/	/f/	/s/	/ş/
	13	8	3	1	1
%	50	30.76	11.53	03.84	03.84
		50			

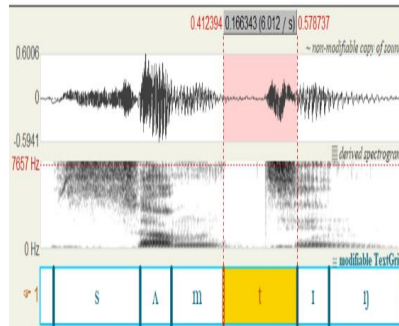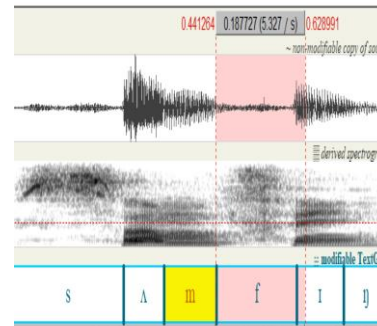**Figure 3:** Accurate /θ/ at medial position **Figure 4: /**θ/ as /t/ at medial position **Figure 5:** /θ/ as /f/ at final position

The three spectrographic pictures show the characteristics of the sound produced by the informants. Figure 4 clearly indicates the presence of /t/ from the articulatory procedure displayed by the spectrum (Total closure followed by sudden burst). The difference between θ in Figure 3 and /f/ in Figure 5 can be seen from the movement of the formants of the following vowel, which indicates that the formants of the vowel after /f/ are almost stable as compared to those after the sound / θ/ which are shown by the red arrow.

c-   Production of /θ/ at final position

At the final position, the sound /θ/ has then been accurately produced by only 26.92%, while 34.61% rendered it as /f/ and 34.61% produced it as /t˺/ and /t/ as Table 4 indicates. Spectrographic pictures are also provided in Figures 6, 7 and 8 to illustrate the production of the sounds.

Table 4: Renditions of /θ/ at final position

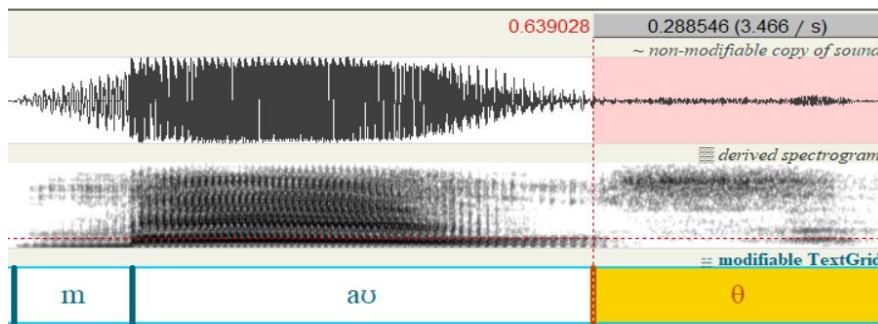| Final position	/θ/	/f/	Voiceless alveolar stop		/t˺/
			/t˺/	/t/	
	7	9	8	1	1
%	26.92	34.61	34.61		03.84
		73.07			

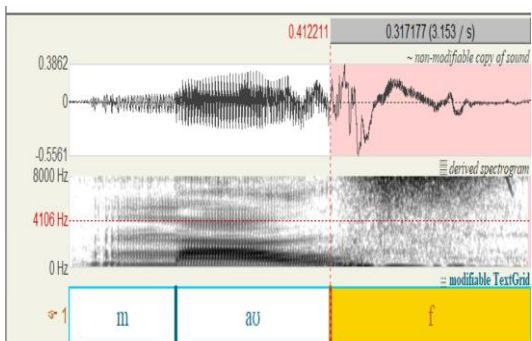**Figure 6:** Accurate final /θ/
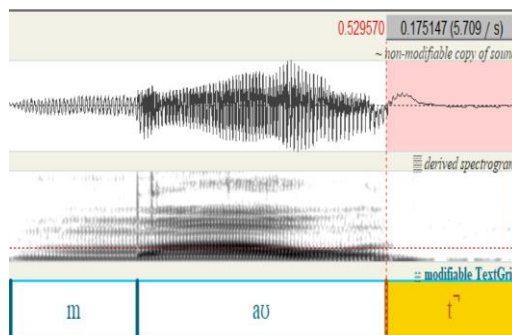

Figure 7: Final /θ/ as /f/   **Figure 8:** Final /θ/ as unreleased /t/

The sound spectrum in Figure 6 displays the features of /θ/, while in Figure 7, the spectral image shows the features of a /f/ sound. The highlighted portion in Figure 8 displays the acoustic features of an unreleased /tˈ/, which is marked by a sudden and complete halt in the flow of air in the final process of the articulation of /t/ as seen from both the sound wave and the spectrogram.

d-   Trends in the production of /θ/

When moving from the initial, medial to the final position of words, it has been noticed that the accurate production of /θ/ oscillated from 50% (Initial and Medial positions) to 19.23% (at final position), as seen in figure 9. From this result, it cannot be said that the sound is systematically produced in a deviated way as previous researchers concluded (Simo Bobda, 2004; Atechi, 2006; Brozbă, 2012; Kouega, 2013; Djon-Yabe, 2023). This sound has also been substituted with the alveolar stop /t/, along with its allophonic variant, the unreleased /tˈ/. The production of the normal /t/ and the unreleased /tˈ/ also varies depending on the linguistic environment in which the TH grapheme is located. The normal /t/ is generally produced at the initial and medial positions, where 30.76% of the respondents rendered TH as /t/. At this level, the result of the present study is similar to the findings of previous studies on the production of interdental fricatives by Cameroonian speakers and the findings of studies on ESL/EFL speakers in general (Hanulíková & Weber, 2010; Owolabi, 2012; Firdaws et al. 2020). The production of the full /t/ sound decreased to 07.69% at the final word position, as displayed in Figure 10. The figure also indicates that the production of the unreleased /tˈ/ was 0% at initial and medial positions but went up to 30.76% at the final position.

These details add more information to what has been previously obtained from non-acoustic studies, which concluded that the sound was replaced by /t/ even at the final position (Atechi, 2006; Kouega, 2013; Djon-Yabe, 2023). Finally, the substitution of /θ/ with the sound /f/ also went gradually from the initial, medial to final positions, therefore moving from 3.84% at initial position to 11.53% at the medial position and finally, it went up to 34.61% respondents at final position, meaning that substitution of /θ/ by /f/ mostly occur at final word position as figure 11 illustrates. The substitution of /θ/ with /f/ was reported in London English by Wells (1986) and Kerswill (2003) called it "merger of /θ/ and /f/ to [f], which was reported to occur in 20% of the speech of teenagers who are aged between 13 and 14 (Stuart-Smith and Tweedie, 2000, cited by Kerswill, 2003, p. 11).
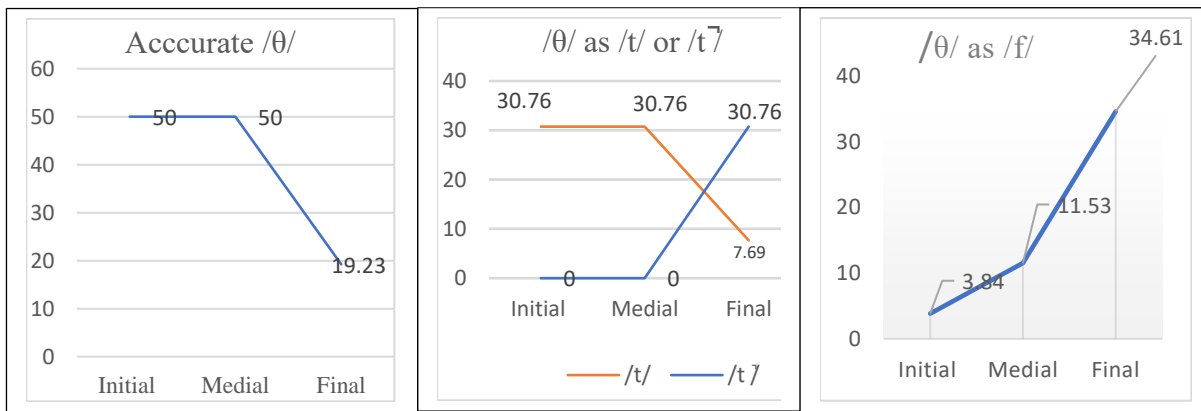

Figure 9: Tendency for accurate /θ/   **Figure 10**: Tendency for /θ/ as stops   **Figure 11**: Tendency for /θ/ as /f/

4.2. The production of the sound /ð/

The articulatory difference between /θ/ and /ð/ also leads to a difference in the substituting sounds chosen by the speakers. This is why the sound /θ/ is generally substituted by /f/, /t/ and /s/, which is not the case for the sound /ð/. This section presents the various substitutions of the voiced interdental /ð/, along with spectrographic evidence. The recapitulation of the renditions of the sound /ð/ is presented in Table 5. The table shows that 43.58% produced the sound accurately, while 56.41% failed to correctly articulate the sound.

Table 5: Recapitulation of the renditions of the sound /ð/

Sounds	/ð/	Voiced alveolar stop		/f/	/θ/	/v/	/tʃ/	/t/
		/d/	/dˈ/					
Initial	16	10	0	0	0	0	0	0
Medial	16	8	0	0	1	1	0	0
Final	02	0	6	14	2	0	1	1

Total	34	18	6	14	03	1	01	01
		30.76		17.94	03.84	01.28	01.28	01.28
%	43.58	56.41						

a- The production of /ð/ at the initial position

At the initial position, the sound /ð/ is rendered as either /ð/ by 61.53% of the informants or as /d/ by 38.46%. These renditions are highlighted in Table 6 and Figures 12 and 13.

Table 6: Renditions of /ð/ at initial position

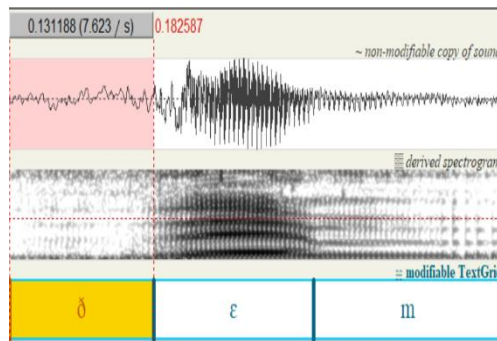| Initial position	/ð/	/d/
Total	16	10
%	61.53	38.46

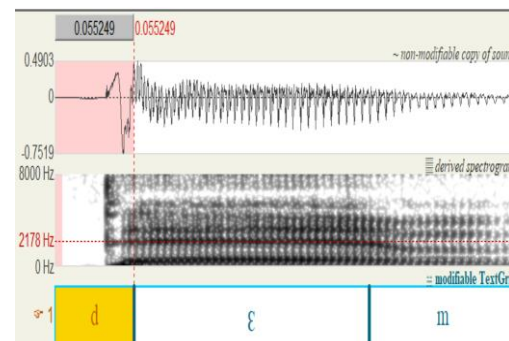**Figure 12:** Correct initial /ð/

Figure 13: Initial /ð/ as /d/

It can be seen that the spectral image of the portion representing the rendition of /ð/ in Figure 12 differs from the one in Figure 13 as far as energy distribution is concerned. In Figure 12, there is a continuous flow of air all through the spectral slice of /ð/ in figure 13, it can be seen that there was a total stoppage of the flow of air before a sudden burst which is indicative of the production of the plosive sound /d/.

b- The production of /ð/ at medial position

Similar to the initial position, the main renditions of TH at the medial position are /ð/ and /d/ and 61.53% of the respondents accurately produced the sound, while 30.76% rendered it as /d/. The sound has also been articulated as /v/ and /θ/ by 1 informant, respectively, as seen in Table 7 and Figures 14 and 15.

Table 7: Rendition of /ð/ at medial position

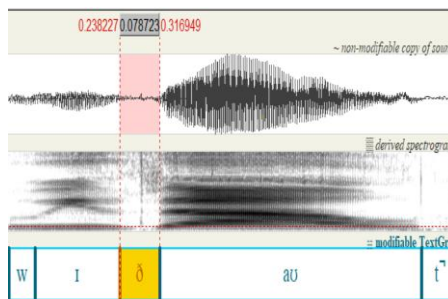| Medial position	/ð/	/d/	/v/	/θ/
Total	16	08	1	1
%	61.53	30.76	03.84	03.84

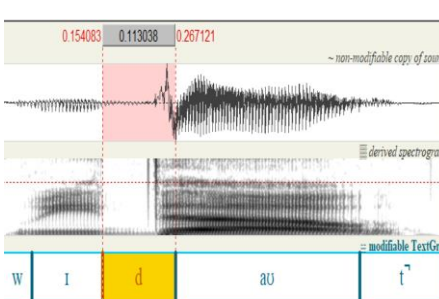
Figure 14: Correct rendition of initial /ð/

Figure 15: Medial /ð/ as /d

The spectrographic pictures in Figures 14 and 15 display the same characteristics as those in Figures 12 and 13, with a difference in the position of the target sound, indicating that the renditions of /ð/ and /d/ at medial positions.

c- The production of /ð/ at final position

The analysis of the renditions of /ð/ at the final position indicates that only 07.69% accurately produced the sound, while 53.84% of the respondents produced it as /f/ and 26.92% rendered it as an unreleased stop /dˀ/. Three informants pronounced it as /θ/, while one informant articulated it as /tʃ/ and /t/ as Table 8 indicates. The spectrograms in Figures 16 and 17 illustrate how the sounds have been rendered at the final position.

Table 8: Renditions of /ð/ at final position

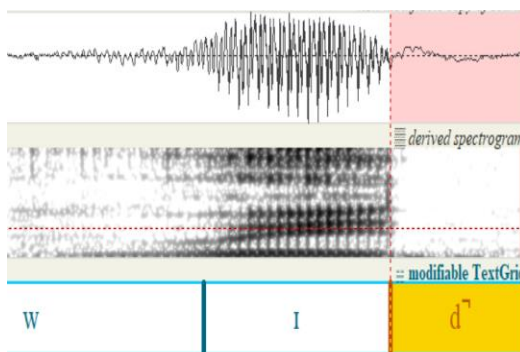| Final position	/ð/	/f/	/dˀ/	/θ/	/tʃ/	/t/
Total	02	14	07	03	01	01
%	07.69	53.84	26.92	11.53	03.84	03.84

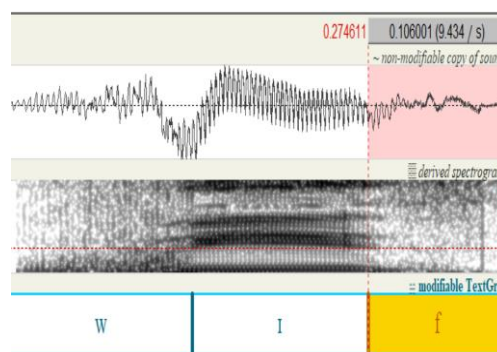

Figure 16: /ð/ as /dˀ/ at final position

Figure 17: /ð/ as /f/ at final position

It can be seen from the spectrogram in Figure 16 that the vowel is followed by a sudden blank space which is prolonged for many milliseconds indicating a complete interruption of the flow of air without release. This is a typical feature of an unreleased stop, and some striations can be seen at the bottom of the spectrum indicating vibration for the sound /d/. In Figure 17, the picture presents a share of intensive energy indicating frication, which is clearly visible for the production of the sound /f/.

d- Trends in the production of /ð/

The tendency of the production of /ð/ is similar to that of its voiceless counterpart. At initial and medial positions, 61.53% of respondents accurately rendered the sound, while at the final position, only 07.69% succeeded in producing it, as seen in Figure 18. It can also be seen that the production of /d/ at the place of /ð/ decreases when moving from initial to medial and final. From 38.46% of informants at the initial position, this went down to 30.76% at the medial position and 0% at the final position; meanwhile, the substitution of /ð/ with /dˀ/ was 0% at the initial and medial positions but 23.76% at the final position as seen in figure 20.
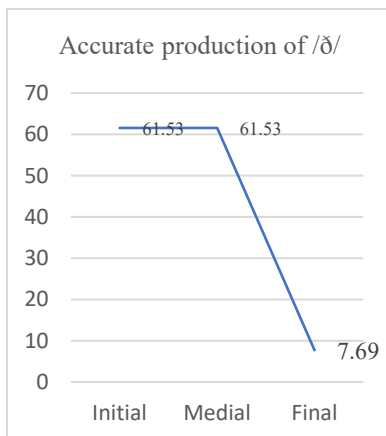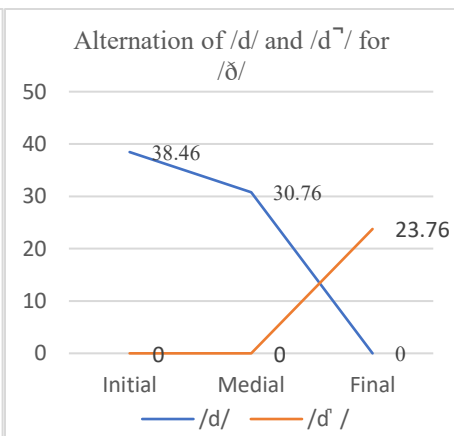

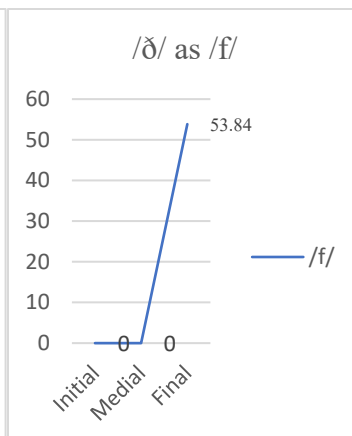**Figure 18**: Final /ð/   **Figure 19**: Substitution with /d/ and /dˀ/   **Figure 20**: Substitution with /f/

The analysis of the overall productions of the sounds /θ/ and /ð/ indicated that it is easier to produce the sounds at initial and medial positions, while only a few informants succeeded in articulating them accurately at the final position. As far as substitutions are concerned, /θ/ and /ð/ are generally replaced at initial and medial positions by /t/ and /d/, respectively, while at the final position, the respondents rather produced the unreleased allophonic variants /t˺/ and /d˺/. It should also be noted that both /θ/ and /ð/ are rendered as /f/ at the final position by the majority of the informants. These results partially contrast with previous studies, which indicated that the sounds were "systematically replaced by /t/ and /d/" (Kouega, 2013, p. 898). The final word position appears to be the most difficult environment for the production of the sounds /θ/ and /ð/as only a few speakers succeeded in correctly articulating them. It is also worth pointing out that at the final position, /ð/ is devoiced to merge with its voiceless counterpart /θ/ and both sounds are produced as voiceless labiodental /f/.

5. Conclusion

This paper explored the production of interdental fricatives /θ/ and /ð/ by CamESL learners from the acoustic analysis perspective. The results indicated that the sounds are easier to produce at initial and medial positions and more challenging at the final position. This justifies the significant number of accurate renditions at initial and medial positions and the systematic substitution of the sounds at the final position. It was also discovered that, at the final position, the bilabial fricative /f/ is the main sound that is produced at the place of both /θ/ and /ð/, while at the final position, it is rather the unreleased stops /t˺/ and /d˺/ that are produced to replace /θ/ and /ð/ instead of the normal /t/ and /d/.

This study brought more details to the general consideration of the production of the interdental fricatives by the Cameroonian speakers of English as Second Language by indicating the linguistic contexts where the sounds are easier to produce and the environments where they are systematically deviated and substituted. The limited sample size and the limited number of words used to test the production of the sounds under investigation constitute its limitations. As Cameroonian speakers generally do not form a homogenous community which is marked by the multiplicity of profiles of English speakers (CamE speakers, CamFE speakers, Anglophones, New Anglophones, CamESL speakers, CamEFL speakers.), there is an urgent need for a sociophonetic study of English in Cameroon, taking into account the various profiles and the marked English features, using acoustic analysis method, which is more reliable for comparative speech studies. A study can also be conducted to compare the performance of Cameroonian English speakers from various linguistic profiles (CamESL, CamEFL)**.**

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Appendix

	Respondents	Theme	Smth	mouth	Them	without	with
1	Info. 1	θ	θ	θ	ð	ð	f
2	Info. 2	θ	θ	f	ð	ð	f
3	Info. 3	s	t	f	ð	ð	f
4	Info. 4	t	t	t	d	d	d˥
5	Info. 5	θ	θ	θ	d	d	f
6	Info. 6	θ	θ	f	d	ð	f
7	Info. 7	θ	θ	θ	ð	ð	f
8	Info. 8	θ	θ	θ	ð	ð	f
9	Info. 9	t	t	t˥	d	d	d˥
10	Info.10	θ	θ	t˥	ð	ð	ð
11	Info.11	θ	θ	t˥	d	θ	f
12	Info.12	t	t	t˥	d	d	d˥
13	Info.13	s	s	f	ð	ð	f
14	Info.14	θ	θ	θ	ð	ð	f
15	Info.15	θ	θ	θ	ð	ð	f
16	Info.16	ts	ts	t˥	ð	ð	ð
17	Info.17	t	f	f	d	d	f
18	Info.18	θ	θ	f	ð	ð	θ
19	Info.19	θ	θ	t˥	ð	ð	f
20	Info.20	ts	t	t˥	d	d	t˥
21	Info.21	s	θ	θ	ð	ð	f
22	Info.22	t	t	t˥	d	d	d˥
23	Info.23	f	f	f	ð	ð	θ
24	Info.24	s	f	f	ð	v	d˥
25	Info.25	t	t	t˥	d	d	t
26	Info.26	θ	t	f	ð	ð	d˥