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Difficulties in Production of Voiceless Interdental Fricative /θ/ Sound for Chinese Learners of English

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Abstract: Chinese learners of English have long been known to have significant difficulties with the voiceless fricative /θ/ sound in English. This study focuses on the challenges and errors faced by Chinese learners of English while producing the voiceless interdental fricative sound /θ/, and aims to find out the speakers' error rate and possible reasons when pronouncing it. In this study, six Chinese adult learners of English were selected as a sample for pronunciation recordings, and the average pronunciation accuracy of /θ/ and the accuracy of each individual were calculated. Next, a short interview is conducted with each of them, containing possible reasons for the mispronunciation. The results of the study showed that the overall average correct pronunciation rate of the six Chinese English learners was only 37%. There was a positive correlation between the learners' long-term exposure to a pure, full English environment and the accuracy of their pronunciation. And the correct position of the tongue during pronunciation determines correct pronunciation.

Keywords: Pronunciation, Chinese learners of English, Phonology, Voiceless Interdental Fricative

1. Introduction

This paper is focused on the difficulties of the Voiceless Interdental Fricative /θ/ Sound among Chinese Learners of English. /θ/ sound is so rare that it is not found in more than 95% of the world's language systems [1]. The Chinese sound system will not contain certain English consonants and vowels [2]. This is a challenge for both early childhood native English speakers and second English learners in China [3]. In China, the context of exam-oriented education prevents Chinese learners of English from receiving systematic and professional pronunciation instruction, and students are completely confined to learning English in written form. Therefore, English fricative consonants have long been a problem for Chinese learners [4]. [s] is claimed to be the most frequent substitution for /θ/ in production among L2 learners of English from Asian countries such as Japan, Korea and China [5, 6, 7]. For example, think will be pronounced as sink, thin will be pronounced as sin, etc. In this study, a sample of six adult Chinese learners of English will be selected for pronunciation recordings, with the aim of finding out the participants' error rate when pronouncing /θ/. Secondly, the six participants will be interviewed individually about the reasons that may have influenced the mispronunciation. This study hopes to provide a picture of the /θ/ pronunciation problems and

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possible causes of Chinese English learners (those who have been receiving native Chinese education and those with study abroad experience) at this stage.

2. Literature Review

This will be followed by a consolidation of previous relevant studies to determine the credibility of the research. A series of studies have indicated that Chinese learners of English often use [s] in place of /θ/. For example, Deterding analysed the pronunciation of 13 young Mandarin speakers reading a short text and taking part in a short interview, and the replacement of /θ/ with [s] is determined [4]. The same substitution error was confirmed by Cheng & He [8]. In 2009, a survey by Rau et al. recorded participants' production of /θ/ from mainland China and Taiwan through story reading, story retelling, reading word lists and short interviews [6]. It was found that /s/ was the most frequently substituted variant of /θ/ in both populations (99% in mainland China). Not coincidentally, Chung's study similarly shows that [s] is often used in place of /θ/ in Taiwan (part of China) [9]. More recently, a study by Huang & Evanini found that the most common substitution of the phoneme /θ/ remained [s] in some adult populations of Chinese second language learners of English [10]. Even though the participants in this study are long-term residents of the United States (a native English-speaking country). However, As Deterding said, as China develops at a rapid pace, with more people using English and teaching becoming more advanced and rigorous, it is difficult to predict whether this feature will disappear as more and more people become fluent in English [4]. Whether this feature still exists today is worthy of further study.

It is noteworthy that all these studies seem to attribute to some extent the mispronunciation of /θ/ by Chinese learners of English to the difference between Chinese and English. As Wu said, Chinese speakers produced the sound /θ/ incorrectly since there isn't a Chinese equivalent for that sound [11]. Whether the influence of the teacher's teaching level or the living environment is also the cause of Chinese English learners' /θ/ mispronunciation seems to be worth some research.

To conclude, this study's research questions are listed:

(1) What is the correct pronunciation rate of /θ/ (at the beginning, middle and the end of words) for Chinese second language learners of English;

(2) Does the place of the tongue during pronunciation correlate with correct pronunciation;

(3) Is there a positive correlation between correct pronunciation and prolonged exposure in an English-speaking environment.

3. Methodology

3.1. Speakers

Three males and three females aged 18 to 20 years participated in this study. They were all Chinese learners of English and Chinese are all their native language. Some of them are about to enter university studies, while others are already in university life. They come from different provinces and geographical locations in China.

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Table 1: Basic background information about the speakers.

No.	Gender	Age	Origin	Current education
Speaker 1	Female	18	Jiangsu	Foundation course before university
Speaker 2	Female	19	Hunan, moved to Guangzhou	University year 1
Speaker 3	Female	18	Beijing	University year 1
Speaker 4	Male	18	Shanghai	University year 1
Speaker 5	Male	19	Jiangsu	About to enter university
Speaker 6	Male	20	Zhejiang	University year 2

3.2. Materials

This study contains two parts of the material. The first is a list of words (20 words in total) given to the speakers to read. These words all contain the phoneme /θ/, in the beginning, middle and end of the word. All speakers' pronunciations will be recorded via mobile phone.

Table 2: The word list.

Place of the phoneme /θ/ in a word	Words
Beginning	Think, Three, Thin, Thread, Theme, Through, Thick, Thunder
Middle	Birthday, Everything, Healthy, Strengthen, Earthquake, Ether
End	Both, Youth, South, Truth, Forth, Path

Additional are the interview questions, which will contain the following questions：

(1) How do you pronounce the sound /θ/? Where do you place your tongue when you pronounce it ;

(2) Do you usually watch English TV series or movies on a regular basis;

(3) Are you often surrounded by native English speakers;

(4) Are you studying in a country where English is their first language? If yes, how long;

(5) During your English learning career, did your teachers systematically teach English pronunciation, for example, the sound /θ/.

3.3. Procedures

The entire study was divided into four steps, starting with six participants reading the word list (Table 2) and recording the whole thing on mobile phone. They were expected to read the words quickly and independently without checking the pronunciation of the words at all. Next each person's pronunciation of /θ/ will be carefully identified, determine the correctness and calculate the average accuracy of all and the accuracy of each person. In the third step, another person will be recruited to identify the participant's pronunciation and recalculate the correct pronunciation rate. The purpose of this is to improve the correctness of the identification and to avoid individual misjudgments. In the end, there will be a short one-to-one interview which will also be recorded by mobile phone. The interview questions are listed in 3.2. As participants came from different provinces and some were abroad, it was not possible to conduct face-to-face radio and interviews, so these were conducted online.

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Table 3: The procedures of the study.

Steps	Methods of collecting data	Materials
Step one: Ask the speakers to read the word list	Recording by mobile phone	The word list
Step two: Determine the correctness and calculate the accuracy	Listening by person	Recordings
Step three: Get another person to listen to the recordings and determine the correctness	Listening by person	Recordings
Step four: A short one-to-one interview	Recording	The interview questions

3.4. Data Analysis

Quantitative and qualitative analyses were carried out to answer the research questions well.

3.4.1. Quantitative Analysis

The quantitative analysis focused on calculating the accuracy of pronunciation of /θ/ for all participants and the accuracy of /θ/ pronunciation for each participant. There will be two listeners to judge the accuracy and the final average will be taken.

Listener 1 (author): Speakers 2 got all 20 words right, and speaker 3 got 19 words right (ether is wrong), speaker 5 got none right, speaker 1 got one right (strengthen), speaker 4 got two right (thick, thunder) and speaker 6 got two right (theme, thunder). A total of 44 sounds were pronounced correctly, so the average accuracy is：

$$\text{average accuracy} = \frac{44}{20 * 6} = 0.367 * 100\% = 36.7\%$$

This meant that the overall pronunciation of /θ/ was just under 37% accurate for the six participants.

For individual pronunciation accuracy, which is the following：

Speaker 1: 5%; Speaker 2: 100%; Speaker 3: 90%; Speaker 4: 10%; Speaker 5: 0%; Speaker 6: 10%

Listener 2: According to listener 2's judgement, speaker 1 got all the /θ/ sounds wrong, while speaker 2 got them all right, speaker 3 got two wrong, speaker 4 got four right (thread, theme, thick, thunder), speaker 5 got one right (thread) and speaker 6 got two right (birthday, earthquake). A total of 45 sounds were pronounced correctly, so the average accuracy is :

$$\text{average accuracy} = \frac{45}{20 * 6} = 0.375 * 100\% = 37.5\%$$

For individual pronunciation accuracy, which is the following：

Speaker 1: 0%; Speaker 2: 100%; Speaker 3: 80%; Speaker 4: 20%; Speaker 5: 5%; Speaker 6: 10%

The final average accuracy is averaged to be 37.1%. So the overall /θ/ pronunciation accuracy was only 37%, with most of these speakers having a low accuracy rate and only two pronouncing it with close to 100% accuracy.

3.4.2. Qualitative Analysis

A qualitative analysis will collate and analyse the speaker's interview responses.

Interview question 1 is ‘How do you pronounce the sound /θ/? Where do you place your tongue when you pronounce it?’.

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Table 4: Interview question 1 responses.

Speakers	Responses
Speaker 1	'My tongue is on my lower teeth.'
Speaker 2	'My tip of the tongue is in between of my upper and lower teeth and then the air will flow out when pronounce it.
Speaker 3	'My tongue is between my upper and lower teeth.'
Speaker 4	'The tongue is placed against the palate, the tip of the tongue touches the teeth and the breath is exhaled from the inside out.'
Speaker 5	'The tip of the tongue is on the lower row of teeth and the tongue rests against the palate.'
Speaker 6	'Basically the tongue is resting against the palate.'

Interview question 2 is 'Do you usually watch English TV series or movies on a regular basis?'.

Table 5: Interview question 2 responses.

Speakers	Responses
Speaker 1	'I basically don't watch English movies or TV shows.'
Speaker 2	'Basically no'
Speaker 3	'Yes, but not regularly, I will watch when that interests me or when I need to watch it.'
Speaker 4	'I occasionally watch, for example, documentaries or American dramas, about once a week.'
Speaker 5	'I watch occasionally, once every fortnight.'
Speaker 6	'Occasionally.'

Interview question 3 is'Are you often surrounded by native English speakers?'.

Table 6: Interview question 3 responses.

Speakers	Responses
Speaker 1	'Yes, I'm studying abroad.'
Speaker 2	'Yes.'
Speaker 3	'Yes.'
Speaker 4	'I studied in Singapore and was not surrounded by many native speakers, the language in Singapore is very mixed.'
Speaker 5	'I usually chat with native English speakers on the internet, like once every two days.'
Speaker 6	'No.'

Interview question 4 is 'Are you studying in a country where English is their first language? If yes, how long?'.

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Table 7: Interview question 4 responses.

Speakers	Responses
Speaker 1	'Yes, I studied in Scotland and have been in the UK for two months.'
Speaker 2	'Yes, I'm studying in the UK, and have been for a year.'
Speaker 3	'I went to high school for 4 years in the US and am currently studying for a year in a UK university.'
Speaker 4	'Not really, there are four common languages in Singapore and English is only one of them. I've been in Singapore for half a year.'
Speaker 5	'No.'
Speaker 6	'No.'

Interview question 5 is 'During your English learning career, did your teachers systematically teach English pronunciation, for example the sound /θ/?'.

Table 8: Interview question 5 responses.

Speakers	Responses
Speaker 1	'No.'
Speaker 2	'No.'
Speaker 3	'Yes, I was taught in first and second grade.'
Speaker 4	'Yes, but only for one term of primary school, and it is interspersed with the daily curriculum.'
Speaker 5	'Yeah, for just a short period when I was studying for IELTS, a systematic correction by my teacher.
Speaker 6	'No.'

It is clear that speakers 2 and 3, who pronounce /θ/ with almost 100% accuracy, describe the correct way of pronouncing /θ/ (tongue position) when they produce /θ/. The descriptions of the mispronunciation ways of the other speakers give a good indication of their low pronunciation accuracy of /θ/. So, to a certain extent, the correct way of pronouncing a phoneme and the placement of the tongue determines whether the pronunciation is correct or not.

Exposure to the English environment seems to have a very important link with pronunciation accuracy. Speakers 2, who pronounced 100% correctly and speaker 3 , who pronounced 80-90% correctly had been in a native English-speaking environment for a long time and, speaker 2 even had five years of study experience in a native English-speaking country, even though speaker 2 had not been systematically trained in pronunciation from a young age. For speaker 4 who studied in Singapore, even though he had been studying and living there for almost half a year, the local language in Singapore was confusing, English was not their mother tongue and his pronunciation accuracy was very low. It is also worth noting that speaker 1 is studying in the UK, but her pronunciation is still very low, perhaps because she has only been in an all-English environment for less than two months. The answers to the interview questions show that speaker 5, who often enjoys chatting with native English speakers online and has a small experience of studying for IELTS, has a low accuracy in his /θ/ pronunciation. It is not known whether this is the result of the informal chatting environment and chatting for entertainment purposes, the exact reasons for which are yet to be investigated.

It seems that the factor of watching English movies and TV shows does not affect the correct pronunciation. Speaker 2, who pronounces 100% correctly, does not watch many English movies. The answers to the fifth interview question suggest that in China, basically, students' English

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pronunciation is not taken seriously, or is only covered for a short period of time for exam purposes. However, this does not seem to correlate directly with the accuracy of pronunciation at a later stage.

4. Results and Discussion

This paper briefly examines the pronunciation errors and difficulties of Chinese learners of English in relation to the /θ/ sound. The average pronunciation accuracy of the six speakers was around 37%, with only one speaker being 100% accurate, while the other four speakers were basically only 5-20% accurate. Those two speakers who pronounced /θ/ with 100% accuracy were in an English-speaking environment for a long time (studying abroad). So, to a certain extent, there is a positive correlation between correct pronunciation and prolonged exposure in an English-speaking environment, and the correct way of pronouncing /θ/ and the position of the tongue determines whether the pronunciation is correct or not. It is important to note that it does not seem possible to pronounce /θ/ accurately in a short period of time in an English-speaking environment, and that only learners of English who have been in a native English-speaking country for a long time will receive correct pronunciation.

Also of note is the word ‘ether’ in the word list, in which most speakers mispronounced the /θ/ sound contained in the word. They seemed to pronounce it as /z/. According to Zhang & Xiao, the most common alternative pronunciation of the voiced interdental fricative consonant /ð/ among Chinese learners of English is precise/z/ [12]. The reason why participants would try to pronounce /θ/ as /ð/ in the word ‘ether’ seems to merit deeper investigation.

This project actually has several limitations. First of all, this is a very small research project. Only two people who studied abroad in a native English-speaking country for a long period of time pronounced /θ/ with 100% accuracy. Whether this can be placed in a larger database and its generalizability is open to question. Conversely, it is not possible to say with any certainty that people who receive exam-oriented education in China will all pronounce /θ/ inaccurately. Second, because of the Covid-19 and the fact that the participants in this study were from abroad and different provinces in China, it was not possible to conduct offline face-to-face recordings and interviews, so the collection of participants' pronunciations was likely to have been affected by some technical reasons, which affected the accuracy of determining the correctness of pronunciation. Third, according to Rau et al., Chinese speakers behaved differently in various situations. In particular, they produced the interdental fricative more accurately in formal speech than in informal speech [6]. As a result, the online pronunciation collection and interviews seem to be less formal than face-to-face.

Despite the fact that in today's so developed and internationalized China, and despite the fact that there has been a lot of literature pointing out the pronunciation problem of Chinese English learners, we still don't seem to pay much attention to it, with a pronunciation accuracy rate of only 37% for /θ/. If we remove two of the participants who had studied in a native English-speaking country for a long time, and if we only study students who were educated in China itself (without a long period of study abroad), would the results still be so is questionable. We continue to study English for exam purposes and learn written English.

5. Conclusion

This paper focuses on the pronunciation difficulties and errors of Chinese learners of English on /θ/, who usually use /s/ as a substitute. Six Chinese adult learners of English were selected for this study, and the findings were that the average pronunciation accuracy was only 37%, with two of the participants having studied in a native English-speaking country for a long time and their pronunciation accuracy was almost 100%, thus showing that there is an important correlation between the pronunciation accuracy of English learners and exposure to an all-English environment. In addition, there was a positive correlation between the exact placement of the tongue during

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pronunciation and correct pronunciation. It was found that participants attempted to pronounce the /θ/ sound in some words as /ð/ (e.g. Ether), the reason for this is not known yet. In addition, there are many limitations to this study, such as the small number of people and the fact that the radio was conducted over the internet. Future studies could be expanded to include more researchers from different provinces in China to produce more general results, and could also examine the pronunciation associations between /θ/ and /ð/ in Chinese learners of English.

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