Laidlaw Scholar Program Research Report

Influence of First Language on Learning English as a Second Language (ESL)
- A study of Mandarin-English Bilingual Speakers

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Contents

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Abstract

In the field of English learning as a second language (ESL), the influence of one's mother tongue on second language (L2) production is evident. Such influence may manifest in various aspects of L2 learning especially perception and production of L2 sounds. With English being the international language, in China alone, over 400 million native speakers of Mandarin Chinese are currently learning L2 English, the so-called ESL speakers. The present study mainly attempted to investigate how L2 English sounds produced by these ESL speakers are affected by their L1 Mandarin.

Keywords: *acoustic analysis, bilingual speakers, error patterns, ESL, mother tongue influences*

Introduction

Language is a way for people to communicate, exchange information, and express feelings to others. More than 7100 languages are currently being spoken around the world nowadays. Mother tongue, or vernacular, is one's first language that imbibes from his mother. However, half of the world's population has been estimated to speak multiple languages, and learning foreign languages has been linked to cognitive benefits throughout one's life. (Zoubi, 2018).

Acquisition of a language, especially a second language, can be both exciting and challenging. Pronunciation accuracy is one of the essential language skills that most multilingual speakers are striving for. For most ESL learners, accurate English pronunciation like native speakers can be a challenging task, especially for individuals whose first language is vastly different from English. Thus, most bilingual speakers prefer to express themselves in their mother tongue compared to L2 English because they have been using it since childhood and feel confident about it. This preference for first language can be a result of the lack of exposure to English, which may make them feel embarrassed when their pronunciation sounds different from the native speakers'. Even those who have been familiar with English for an extended period,

they may also have to struggle with the nuances of English phonetics. To overcome these challenges, bilingual speakers can seek professional advice on improving their L2 English learning and communication. One such approach is using acoustic analysis, a scientific study of language acquisition that analyzes one's sound patterns of speech to identify areas where improvement is needed. Acoustic analysis can provide bilingual speakers valuable insights into the scientific ways to improve specific areas of L2 English pronunciation and achieve higher accuracy.

Literature review

The study of forward transfer from first language (L1) to second language (L2) has been the interest of linguists and educators alike for a long time and profound research has been analyzed from various angles.

An individual learns the mother tongue from birth. It is difficult to eliminate the influence of L1 on learning other languages as bilingual speakers tend to transfer everything from one's L1 to the L2 learning (Delbio et al., 2018). This indicates that L1 is the translation medium to help us express our ideas using L2. It is obvious that the mother tongue can play a role in the learning of a foreign language. L1 may interfere with the speech production of bilingual speakers in some way (Suliman, 2014). In the study of Malaysian, it was found that Malaysian students heavily rely on the translation method from their L1 in comprehending specific instructions apart from producing utterances. On the other hand, instead of concentrating on negative roles of L1 on the learning process of L2 English, there are many researchers discovered it in the positive ways. The mother tongue plays a significant positive role in learning the target language (Kelleher, 2013). According to his findings, the mother tongue was a great help for L2 learners to explore their second languages. Therefore, the effect of the mother tongue on the L2 acquisition is both positive and negative for ESL learners (Rahmatullah, 2020).

Pronunciation errors are usually found in speech production by bilingual speakers. They occurred during L2 acquisition because of the difference between the English sound system and the mother tongue (Sriprabha, 2015). In order to overcome L1

interference, he suggested that L2 learners can get more exposure to the English environment such as reading books in English, listening to the English channels, chatting with native speakers, etc. Chinese ESL learners have difficulties with English vowels as there are some differences in articulating the vowel sounds of these two sound systems. The phonetic transcription system widely accepted by linguists is the IPA (International Phonetic Alphabets), a system designed for transcribing the phonemes of the world's languages. In IPA format, Mandarin vowel sounds have 6 distinct phonemes ([a], [u], [i], [y], [ə], [ɤ]), while English vowels have 20 phonemes (/ɪ/, /e/, /æ/, /ʌ/, /ɒ/, /ʊ/, /iː/, /ɔː/, /uː/, /ɑː/, /aɪ/, /eɪ/, /ɔɪ/, /aʊ/, /əʊ/, /ɪə/, /ʊə/, /ɜː/, /ə/, /oʊ/) (Wood, 2019). They often encounter challenges in acquiring certain English vowel sounds that do not exist in their native language. Thus, it is reasonable that bilingual Mandarin speakers may demonstrate wrong pronunciation.

To sum up, the previous studies have provided evidence of how one's L1 positively and negatively affects L2 English acquisition. Based on them, this study investigated L1 Mandarin's influence on English speaking class. The pronunciation errors were examined to find certain patterns and help get rid of mother tongue influence on the use of acoustic analysis.

Methodology

The study used both qualitative and quantitative research methods. Qualitative research involves collecting non-numerical data and identifying patterns in language, topic, and structure, to understand people's experiences (Chris, 2021). Standard instruments for this method include questionnaires, interviews, and observations. Firstly, to probe the deeper connection between one's L1 and L2 English, a face-to-face interview was conducted among the participants and divided into three parts. The first part was to let the participants have a short English self-introduction, including their names, ages, how long they have learned English, how much they like English, etc. The self-introduction guideline was designed based on the research questions. The second part asked them to read 45 standard English words with vowel contrasts. After getting their approval for using their pronunciation as research data, I used an

M-audio track machine to record their interview. Subsequently, Praat, a signal analysis software, was used to analyze their pronunciation recordings and help create specific spectrograms for every participant. The advantage of this method is that it allows quick and closer access to the participants and can help me get a deeper analysis. Finally, a comment session was added to allow respondents to express their concerns and problems in learning L2 English in more detail. The whole process was delivered in 10 minutes for each participant.

Quantitative research includes collecting numerical data and making mathematical analyses to observe tendencies, make predictions and run experiments. According to the spectrograms produced by using Praat, the first and second formants were obtained from speech produced by all participants and they were used to compare with the formants data obtained from native English speakers previously reported in the literature. Based on basic calculation, the potential impact of L1 on L2 was quantitatively revealed through acoustic analysis.

Primary research conduction and analysis

1. Background

The present acoustic analysis attempted to determine the potential impact of L1 Mandarin on learning L2 English, and relevant pronunciation error patterns committed by participants were revealed. The underperformance of oral pronunciation in English can be attributed to numerous factors. The participants included 60 L1 adult Mandarin-English bilingual speakers (30 are males and 30 are females) who were native speakers of Mandarin Chinese randomly selected from universities in mainland China. Their English proficiency levels varied from basic to advanced. Convenience sampling was adopted (Gaille, 2019), and it is anticipated that the present sample was likely to be representative of the entire population of bilingual speaking adults.

2. Objective

The purpose of the research is to explore the influential aspects and extent of mother tongue on L2 English speaking and measure the number and types of pronunciation errors that bilingual speakers produce in the acquisition of L2 English speech. The proposed study aims to answer the following questions:

Q1: Whether and how one's pronunciation of first language (L1) would affect acquisition of L2 English?

Q2: What is the amount of errors in L2 English would be produced by non-native speakers?

Q3: What are the error patterns of speaking L2 English sounds related to L1 sounds made by non-native speakers?

3. Research design

First of all, a poster of recruiting experiment participants was posted online. The requirement of participants is bilingual adults (native: Mandarin, second language: English). The participants were required to complete face-to-face interviews including self-introduction, reading word list (see Figure 1) and a comment session. In the word list, there are 45 English words with vowel contrasts and the participants were asked to read each word twice. The whole process was recorded by M-audio track with their advance approvals for research use. Then Praat was used to create spectrograms for analyzing their formants and other acoustic parameters. By comparing with the standard formants of native speakers, we can get the results of first language impacts and error patterns.

Beat	Bit	Bait	Bet	Bat	Pot	But	Bought
Boat	Put	Boot	Bert	Bite	Bout	Voice	
Heed	Hid	Aid	Head	Had	Odd	Hud	Awed
Owed	Hood	Who'd	Heard	Hide	How'd	Hoyd	
Be	Sick	Day	Get	Fat	Stop	Up	Talk
No	Good	New	Her	I	Now	Boy	

Figure 1: Speech Stimuli Word List (Vowel contrasts)

4. Acoustic analysis

4.1 Formats

In speech science, formants of vowels are usually analyzed to help us find pronunciation errors and determine relevant error patterns. A formant is a concentration of sound energy around a specific frequency in the sound wave. We can determine the vowels we hear with the frequencies of the formants. In general, the most informative are the first three formants and we will analyze the first two of them. The first formant (F1) is the lowest frequency resonance of the vocal tract during sound production. When we produce a vowel sound, the shape and size of our vocal tract affect the frequencies of our produced sound waves. The first formant frequency corresponds to the frequency of the first resonance peak in the vocal tract, which can be determined by the length and shape of the vocal tract. The second formant (F2) is the second lowest frequency resonance of the vocal tract. It often works with F1 together to help differentiate among different vowel sounds. Both of them can be seen directly in the spectrograms.

4.2 Formant plots

The first two formants are important to determine the quality of vowels, and are correspond to open/ close and front/ back dimensions. They are often plotted against each other in vowel diagrams (see Figure 2). F1 has a higher frequency for an open vowel such as [a] and a lower frequency for a closed vowel such as [i]. However, F2 has a higher frequency for a front vowel such as [i] and a lower frequency for a back vowel such as [u].

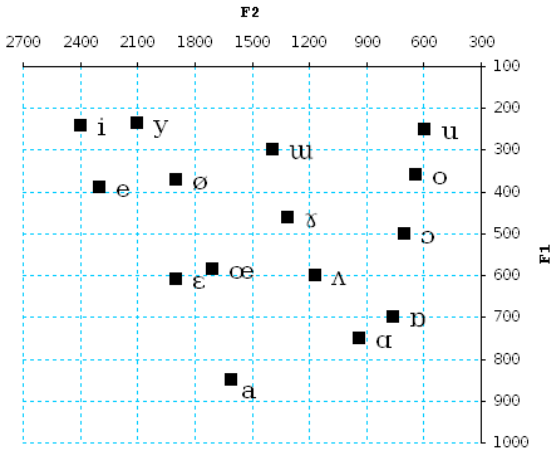

Figure 2: Average vowel formants

4.3 Spectrograms (graphical representation)

A spectrogram is the graphical representation of three dimensions of sounds according to their component frequencies. We can upload the sound recording files in Praat, and then the spectrograms can be created. In a spectrogram (see Figure 3), the x-axis represents time in seconds, and the y-axis represents frequency in Hz. The top part is a waveform, it shows that energy changes with time and what the vocal cords are doing. The low part shows frequency changes with time, including acoustic parameters such as formants and pitch. The relative darkness of the frequencies shown depicts intensity.

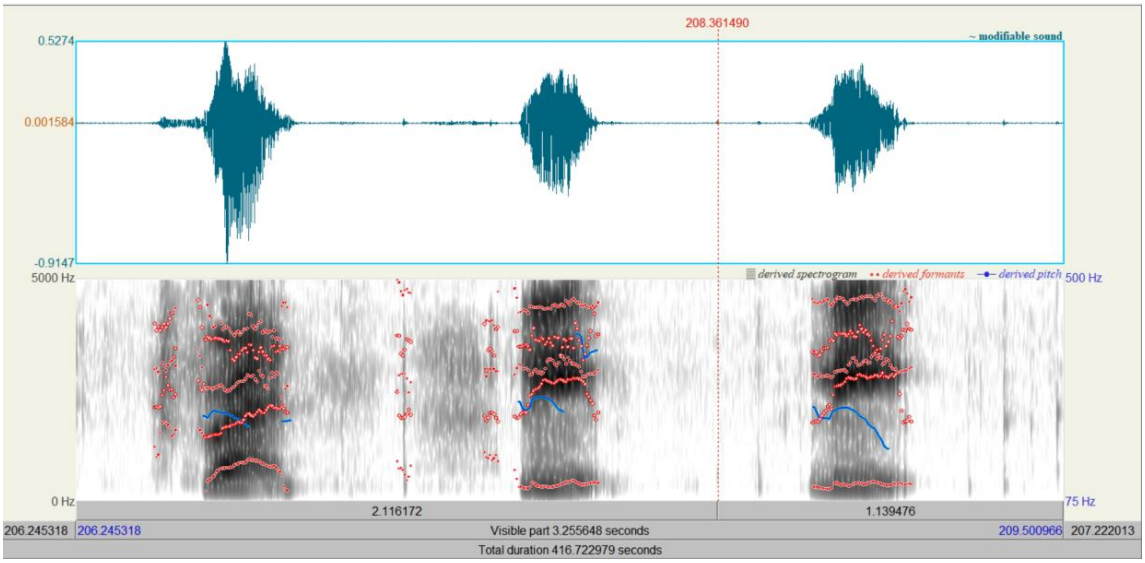

Figure 3: Spectrogram in Praat

For example, in the spectrogram of the word “beat” by one speaker (see Figure 4), we can see his first formant is the lowest red dot line in the low part (around 410 Hz), and the second formant is the second lowest red dot line (around 2456 Hz).

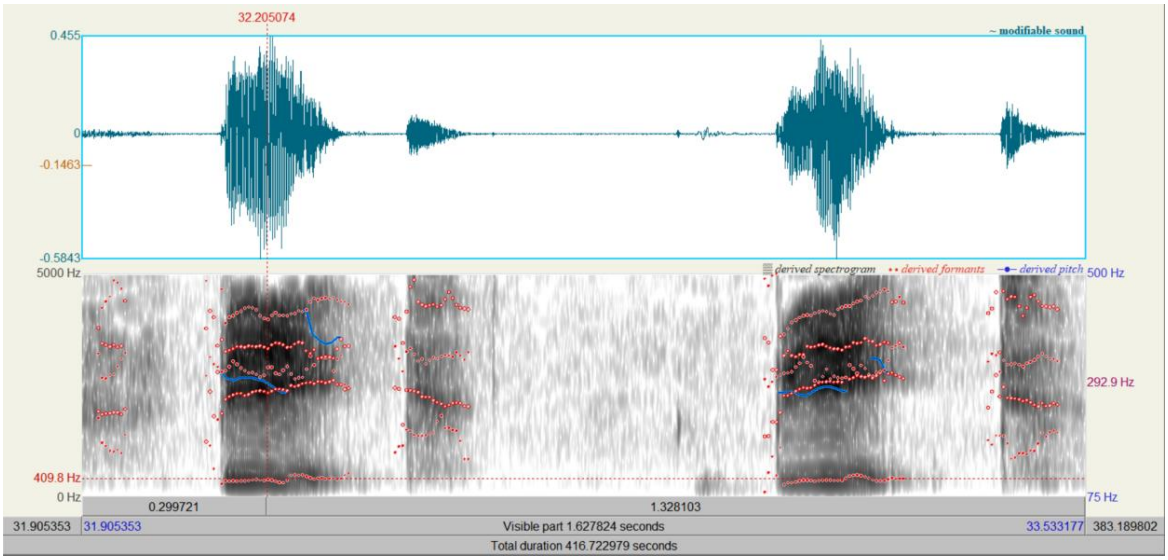

Figure 4: Spectrogram of the word “beat” by one speaker

F1 has a negative relationship with vowel height (see Figure 5). The higher vowel height, the lower formant frequency F1 (and vice versa).

Vowel height	F1 (Hz)
High [i]~[u]	280~310
Mid-high [I]~[U]	400~450
Mid-low [e]~[ç]	550~590
Low [æ]~[a]	690~710

Figure 5: F1 and vowel height

In Figure 6, red part indicates high vowels with low F1; blue part indicates mid/low vowels with high F1.

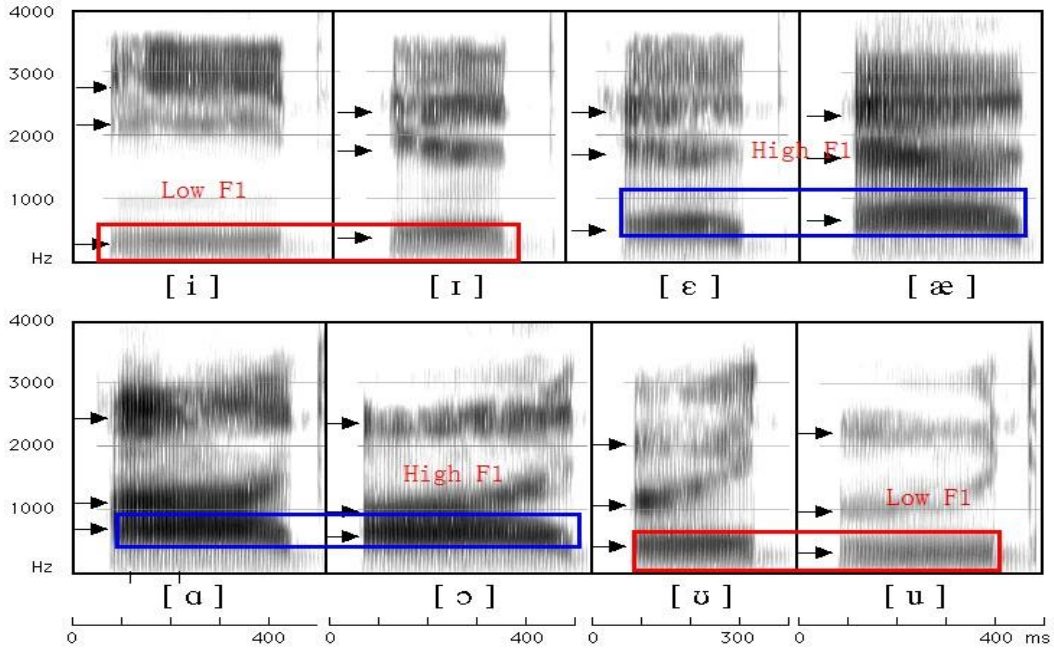

Figure 6: First formants illustration

F2 in vowels is related to backness, the more front is the vowel, the higher is the F2 value. In Figure 7, the red part indicates front vowels with higher F2; while the blue part indicates back vowels with lower F2.

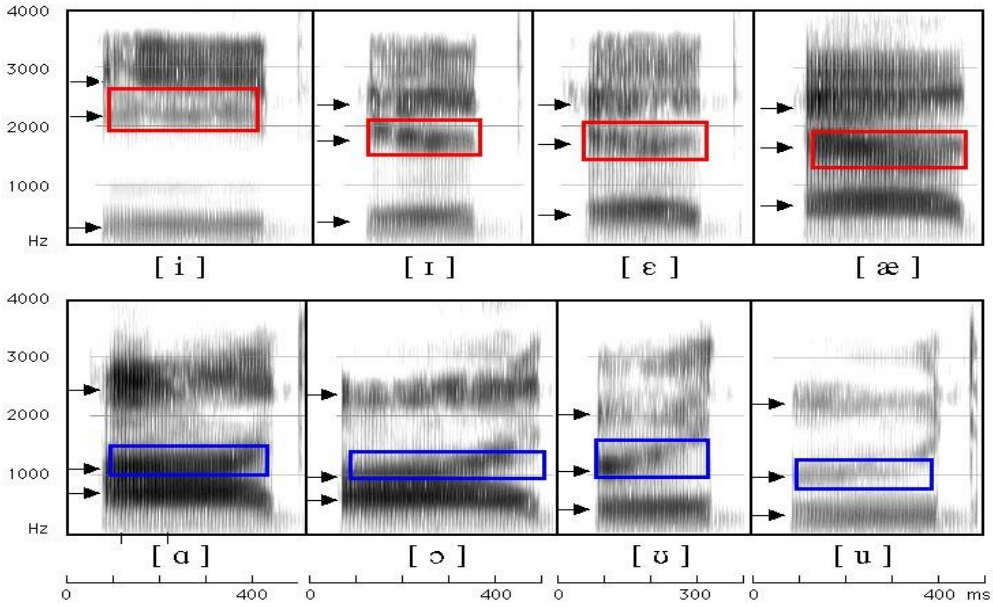

Figure 7: Second formants illustration

Results

The analytical data collected from these recordings and relevant spectrograms reveal that L1 Mandarin bilingual speakers make pronunciation errors in L2 English speech with the effects of their mother tongue. By recording their formants of vowel contrasts, it can be found that L1 Mandarin bilingual speakers' average F1 and F2 are higher than the standard native-speakers formants (see Figure 8).

		/i/	/I/	/e/	/ɛ/	/æ/	/a/	/ɔ/	/o/	/ʊ/	/u/	/ʌ/	/ɜ/
F1	**M**	342	427	476	580	588	768	652	497	469	378	623	474
	F	437	483	536	731	669	936	781	555	519	459	753	523
F2	**M**	2322	2034	2089	1799	1952	1333	997	910	1122	997	1200	1379
	F	2761	2365	2530	2058	2349	1551	1136	1035	1225	1105	1426	1588

Figure 8: Standard vowel formants table

More specifically, the average formant frequencies of females are higher than the males, while children's are the highest. The following tables show one female participant's formants data on the left and one male participant's on the right.

Words	F1	F2	F1	F2
Beat	410	2456	258.8	2121
Bit	393	2624	258.8	2104
Bait	896.2	1800	661.4	1735
Bet	460.1	2750	661.4	1668
Bat	830	2070	594.3	1617
Pot	560.7	1350	460.1	879.4
But	812	1500	795.6	1450
Bought	630	1200	460.1	929.8
Boat	644.6	1300	426.6	812.3
Put	443.3	1400	426.6	1014
Boot	678.2	1165	393	913
Bert	661.4	1550	527.2	1701
Bite	527.2	2691	527.2	1634
Bout	845.9	1450	493.6	913

The results align with the standard formants table (see Figure 9).

Words	F1	F2	F1	F2
Beat	300	2800	270	2300
Bit	430	2500	400	2000
Bet	600	2350	530	1850
Bat	860	2050	660	1700
Pot	590	900	570	850
But	760	1400	640	1200
Boot	470	1150	440	1000
Pert	500	1650	490	1350
Part	850	1200	730	1100

Figure 9: Standard formants for some words

Discussion

From the findings, it is obvious that one's mother tongue influences L2 English pronunciation significantly. Mandarin has a smaller vowel inventory compared to English, which means that Mandarin speakers may have difficulty perceiving and producing English vowels that fall outside their L1 system. Then they may exhibit differences in the formant frequencies of these vowels when speaking English. For example, English has a distinction between tense and lax vowels, such as the vowel pairs /i:/ and /ɪ/, this error can be called vowel merger. Mandarin does not have this tense-lax vowel distinction, so Mandarin speakers may struggle to differentiate and produce these vowel sounds accurately in English. Additionally, there are differences in articulatory techniques between Mandarin and English. Mandarin has relatively high and relatively level tongue positions for most of Chinese vowels, while English has a more varied and dynamic tongue position. This variation in tongue position can affect the formant frequencies produced by Mandarin bilingual speakers when they attempt to produce English vowels. In terms of the limitations of the study, the data from the participants may not be completely accurate. The sample size is limited and a little small. Most of them are from the north of China, and they may not reflect the whole native Mandarin speakers. With recommendations for further study, some

directions are worth studying: the English consonant quality, sentence intonation and the establishment of typical Chinese speech.

Conclusion

The overall objective of this research was to prove that L1 of bilingual speakers has influences in producing speech of L2 English. According to the experiment of ESL learners with L1 Mandarin, we can find that the existence of interference of bilingual speakers' mother tongue with some pronunciation errors is undeniable. Acoustic phonetics plays an important role in learning L2 English pronunciation. The formant values of participants can be the basis to evaluate their L2 English pronunciation errors. Therefore, acoustic analysis is believed to hold much promise for learning pronunciation. After examining the error patterns behind, it can help bilingual Mandarin speakers to get rid of mother language accent and become more English-native-like.

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