Chinese Learners' Phonetic Transfer of /i/ from Mandarin Chinese to General American English: Evidence from Perception and Production Experiments

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Abstract
Ever since the development of Contrastive Analysis (CA) in the 1950s, which focuses on comparing and contrasting two language systems, linguists have started to systematically explore the influence of the mother tongue on acquiring a second language. This phenomenon is later defined as "language transfer". The current paper concerns language transfer at the phonetic level and concentrates on the transfer phenomenon existing in advanced-level Chinese learners' acquisition of English vowels /i/ and /ɪ/. By determining whether advanced-level Chinese English-language learners (ELLs) can accurately distinguish between /i/ and /ɪ/, and pronounce them in English words precisely, this paper serves as a reference for further studying Chinese ELLs' language transfer. Two objectives were to be met: firstly, learners' perceptual ability to distinguish between vowels /i/ and /ɪ/ should be examined; and secondly, the effect of the phonetic transfer should be determined. A perception test and a production test were used to attain these two objectives. Both tests were completed by six advanced-level Chinese ELLs, three males and three females. Results indicate that both male and female participants could consciously distinguish between /i/ and /ɪ/. All participants have signs of experiencing negative phonetic transfer in their pronunciation, except that the current data do not decisively reflect an impact of the phonetic transfer on female ELLs' acquisition of /ɪ/ in English words.
Keywords: second language acquisition, language transfer, phonetic transfer, Chinese English-language learners (ELLs)

1. Introduction

Linguists including Charles Fries, Edward Sapir, Charles Hockett, and Burrhus Skinner conducted research in the 1950s that led to the development of the CA technique, which focuses on comparing and contrasting two language systems of second language learners [1]. According to Richards and Schmidt (2010), CA is built on a number of assumptions, one of which is that the CA approach can predict which challenges for language learners would arise [2]. For example, Chinese ELLs may struggle to pronounce the English consonant /v/ since the sound does not exist in Chinese. In many cases, the /v/ sound is replaced with /w/.

Such mispronunciations occur due to what is known as the negative transfer. Negative transfer - defined as "an improper influence of the first language structure or regulation on the second language use" [3] - is one of CA's basic assumptions. Since then, the phenomenon of language transfer has been

the focus of myriad researchers, and even now, when CA has long been overshadowed by new theories, studies on language transfer have been continuously carried out. It is generally acknowledged that the first language (L1) does affect the acquisition of the second language (L2).

This paper concerns language transfer at the phonetic level and focuses on the transfer phenomenon existing in advanced-level Chinese ELLs' acquisition of English vowels /i/ and /ɪ/. In the Chinese pronunciation system, the tense high front vowel /i/ does exist, however, its lax counterpart /ɪ/ does not. Under this circumstance, a phonetic transfer might happen.

While there are studies addressing the issues of Chinese ELLs' phonetic transfer from Chinese to English vowel systems, very few of them have studied the phonetic transfer of individual vowels among high-level Chinese ELLs. In this case, by determining whether advanced-level Chinese ELLs can accurately distinguish between /i/ and /ɪ/, and pronounce them in English words precisely, this paper serves as a reference for further studying Chinese ELLs' language transfer.

2. Phonetic Transfer of /i/ from Mandarin Chinese to General American English

2.1 Background

In China, English education used to be taught in British English. The prominence of American English, however, has significantly increased in recent years as a result of the United States' achievements in various areas. Furthermore, a great number of American English teaching materials, along with American entertainments like dramas and TV shows, have flown to China and developed an American accent among many Chinese ELLs.

American English is also officially recognized in university English education in China. In College English Test Band 4 and Band 6, listening materials in American English prevail. The situation not only proves that the status of American English is widely recognized in China, but also encourages Chinese ELLs to take American English as a subject of study.

The current paper examines this learning process at the phonetic level and focuses on the acquisition of specific vowels. It is foreseeable that the number of American English learners will continue to boom in the future, and researches on Chinese learners' second language acquisition process of American English will continue to be conducted.

2.2 Mandarin Chinese /i/

There is no definitive conclusion about the number of Mandarin Chinese vowels. Duanmu (2007) claims that Chinese possesses 13 vowels ([i], [y], [u], [o], [E], [ɤ], [e], [ə], [A], [ɑ], [a], [æ], [ɐ]) formed from 5 vowel phonemes (/i/, /y/, /u/, /ə/, /a/), with the exception of the two 'apical vowels' and the retroflex vowel [ɚ]) [4]. This paper adopts Duanmu's argument. Among these vowels. /i/ is the high front unrounded vowel.

2.3 General American English /i/ and /ɪ/

The American English pronunciation can vary from region to region in the United States. The American English studied in this paper is based on the criteria proposed by Kenyon, J. S. and Knott, T. A [5]. There are 17 vowels in American English: [i], [ɪ], [e], [ɛ], [æ], [a], [ɝ], [ɜ], [ɚ], [ə], [ɑ], [ɒ], [ʌ],

[ɔ], [o], [ʊ] and [u]. Among which, /i/ (as in "*beat*") is the high front unrounded tense vowel and /ɪ/ (as in "*bit*") is the high front unrounded lax vowel. It can be noticed that these two vowels share a certain degree of similarity, therefore mastering them might be challenging for ELLs.

2.4 Language Transfer

Scholars in the field of applied linguistics have continued to look for strategies to overcome the challenges of language acquisition and teaching for over a century. Linguists such as Charles Fries, Edward Sapir, Charles Hockett, and Burrhus Skinner did research in the 1950s that led to the development of the CA method, which focuses on comparing and contrasting two language systems [1]. The primary goal of this type of comparison was pedagogical, that is, it was used to create teaching and learning materials, examinations, and so forth [6].

According to Richards and Schmidt (2010), CA is built on a number of assumptions, one of which is that the CA approach can make predictions about which challenges for language learners would arise [2]. The mechanism behind such predictions is known as the negative transfer.

There are two forms of transfer: positive transfer and negative transfer. Positive transfer is defined by Dulay, Burt, and Krashen as "the automatic use of the L1 structure in L2 performance when both languages' structures are the same, resulting in correct utterances." Positive transfer occurs when the native language and the target language share some linguistic components in common. Negative transfer, also known as interference, occurs as a result of the discrepancies between the two language systems. Such disparities make learning the target language difficult and increase the likelihood of the learner making mistakes in the interlanguage [7].

However, CA was challenged by the notion that language acquisition is an active rule building behavior rather than a habit formation behavior, which eventually led to its demise [8]. Nevertheless, researches on language transfer have not ceased. In various new theoretical frameworks and models, transfer possesses the same important status as in CA. For example, in Error Analysis, linguistic interference, according to Corder (1973), is the clearest evidence to explain learners' errors [9]. Many other studies also rely on the premise that learners' errors can be caused by transferring L1 elements into L2.

The present study represents an attempt to focus on the language transfer of advanced-level Chinese ELLs at the phonetic level. Through a perception test and a production test, and analysis of the results, this article aims to provide a useful reference for future studies of language transfer of Chinese ELLs.

3. Methodology

The phonetic transfer of the vowel /i/ from Mandarin Chinese to American English vowels /i/ and /ɪ/ is the subject of this thesis. The negative transfer might make it harder for Chinese ELLs to learn English /i/ and /ɪ/, even if they are advanced learners. In order to further address the issue, two objectives must be met: firstly, learners' perceptual ability to distinguish between vowels /i/ and /ɪ/ should be examined; and secondly, the effect of the phonetic transfer should be determined. A perception test and a production test were used to attain these two objectives. These two tests were completed by six advanced-level Chinese ELLs.

3.1 Participants

The perception and production tasks were completed by six advanced-level Chinese English learners, three males and three females. All of the participants are adults aged 22-24 that passed College English Test Band 6 or equivalent tests. Besides, all of them have completed one or more non-subtractive bilingual education programs according to the definition given by Ofelia García regarding models of bilingualism[10], and thus their English learning experience was theoretically more comprehensive and in-depth than the overall English acquisition experience in China.

All participants speak Mandarin Chinese as their mother tongue and learn English as a second language. All of them were recognized as American English speakers. None of them had hearing, reading, or speaking impairments, nor any other disabilities that might affect their performance on the perception test and the production test.

3.2 Experimental tests

3.2.1 The Perception Test

The perception test was designed to examine participants' ability to perceive the difference between /i/ and /ɪ/ in words. It was used as a fundamental task for this study to ensure that all participants in the subsequent production task already had the ability to distinguish between /i/ and /ɪ/ on the perceptual level. Setting such an agenda is imperative, since the ability to distinguish the difference between /i/ and /ɪ/ is a prerequisite for accurately pronouncing them.

3.2.1.1 Procedures

The material in Table 1 was presented electronically to six participants. During the experiment, they typed down the vowel under each one-syllable Chinese or English word. The test takers' answers were compared with the phonemic transcriptions of these words on Collins dictionary. Based on the results, participants' ability to identify /i/ and /ɪ/ could be reflected in the form of accuracy rate.

Table 1. Perception task word set

mead	did	deed	mid	bid	bead	neat
地	避	逆	peat	eat	Tim	pit
nit	it	team	蜜	辟	替	易

3.2.2 The Production Test

The production test was designed to examine the effect of phonetic transfer from Mandarin /i/ to American English /i/ and /ɪ/ by acoustic measurements. By comparing participants' experimental frequency gained by the software Praat with the General American English (GAE) vowel frequency [11], formant-frequency analyses were undertaken to provide direct evidence about language transfer.

3.2.2.1 Procedures

The material in Table 2 was presented electronically to six participants. During this test, they were asked to pronounce Chinese and English words in their natural way of speaking. The pronunciation of

all words in the table was recorded at the same time. Then, the first formant (F1) and the second formant (F2) of the vowels /i/ and /ɪ/ in the words were extracted from their speeches using Praat to perform formant-frequency analyses. Finally, two vowel formant diagrams containing the frequencies of the vowel pronunciation of advanced-level Chinese ELLs and the GAE standard vowel pronunciation were generated separately for each gender. The effect of the phonetic transfer was illustrated in these two diagrams.

Table 2. Production task word set

辟	替	易	地	避	逆	蜜
dip	be	bid	nit	mid	deep	neat
me	peak	tea	eat	pick	tip	it

4. Results and Discussion

4.1 Result of the perception task

The answers of all test takers were collected completely. Based on a comparison with the Collins dictionary phonemic transcription, the average male test takers' accuracy rate is 95.2%, the average female test takers' accuracy rate is 93.7%. This result indicates that both male and female participants could consciously distinguish between /i/ and /ɪ/, and it lays the foundation for studying phonetic transfer in the subsequent production test.

4.2 Result of the production task

4.2.1 Results for male participants

Results from the formant-frequency analyses for male participants are shown in Figure 1. Participants' pronunciations of /i/ in Mandarin (Average F1=317.232, Average F2= 1993.044) and English words (Average F1=297.494, Average F2= 1983.518), /ɪ/ in English words (Average F1=393.583, Average F2= 1792.980) as well as the GAE values of /i/ (F1=342, F2=2322) and /ɪ/ (F1=427, F2=2034) for men are plotted.

The formant frequencies of participants' /i/ pronunciations in Mandarin are distinctively lower than the GAE values of /i/ both by F1 and F2. The formant frequencies of participants' /i/ and /ɪ/ pronunciations in English words are also identifiably lower than their GAE counterparts both by F1 and F2.

The direction of test takers' phonetic transfer for the pronunciation of /i/ and /ɪ/ in English words matched that of the pronunciation gap between their /i/ pronunciations in Mandarin words and the GAE /i/. Therefore, it is reasonable to conclude that negative phonetic transfer occurred, which caused participants' pronunciation of the high front unrounded vowels in their L2 to be affected by L1.

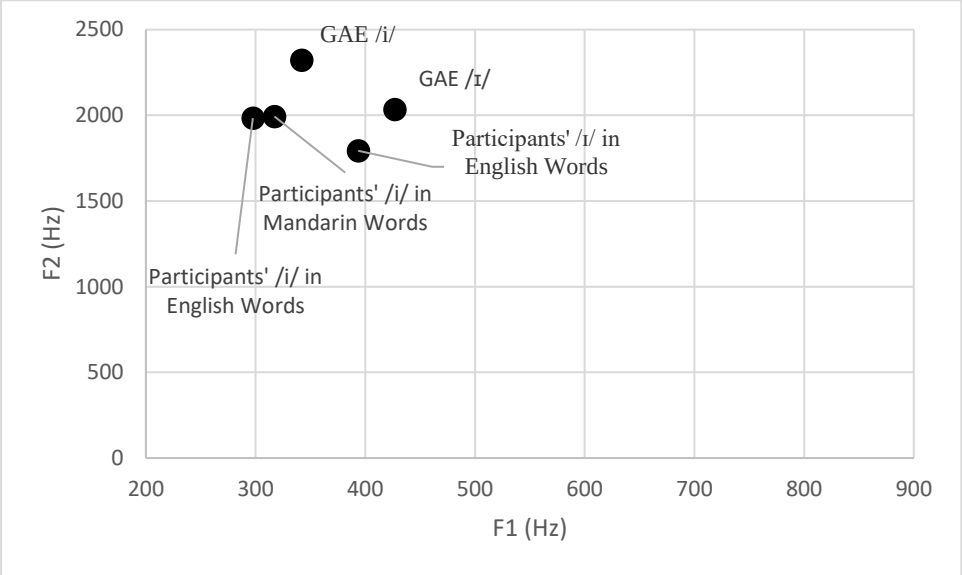

Figure 1. Male vowel formant diagram

4.2.2 Results for female participants

Results from the formant-frequency analyses for female participants are shown in Figure 2. Female participants' pronunciations of /i/ in Mandarin (Average F1= 404.571, Average F2= 2256.731) and English words (Average F1= 418.139, Average F2= 2224.235), /ɪ/ in English words (Average F1= 463.048, Average F2= 2362.780) as well as the GAE values of /i/ (F1= 437, F2= 2761) and /ɪ/ (F1= 483, F2=2365) for women are plotted.

Just like in the case of male participants, the difference regarding formant frequencies between female participants' /i/ pronunciations in Mandarin and English is insignificant, indicating that language change does not noticeably influence participants' pronunciation of /i/. However, the F2 of /i/ both in participants' L1 and L2 is lower than that of GAE /i/, demonstrating a comparatively strong phonetic transfer. The negative transfer from L1 assimilates participants' pronunciation of the high front unrounded lax vowel in L2, which leads to a backward shift of the participants' tongue position during pronunciation compared to GAE speakers' standard position.

Potential evidence supporting that the subjects' pronunciation of /ɪ/ in L2 is possibly influenced by that of /i/ in L1 can be found, since on the F1 level, participants' articulation of /ɪ/ in English words is lower than the GAE /ɪ/, a situation that is also illustrated in the case of participants' pronouncing Mandarin /i/. Nevertheless, this impact of test takers' phonetic transfer from L1 to L2 in relation to the pronunciation of /ɪ/ cannot be fully determined, as the difference in values of the pronunciations is inconspicuous based on the existing data.

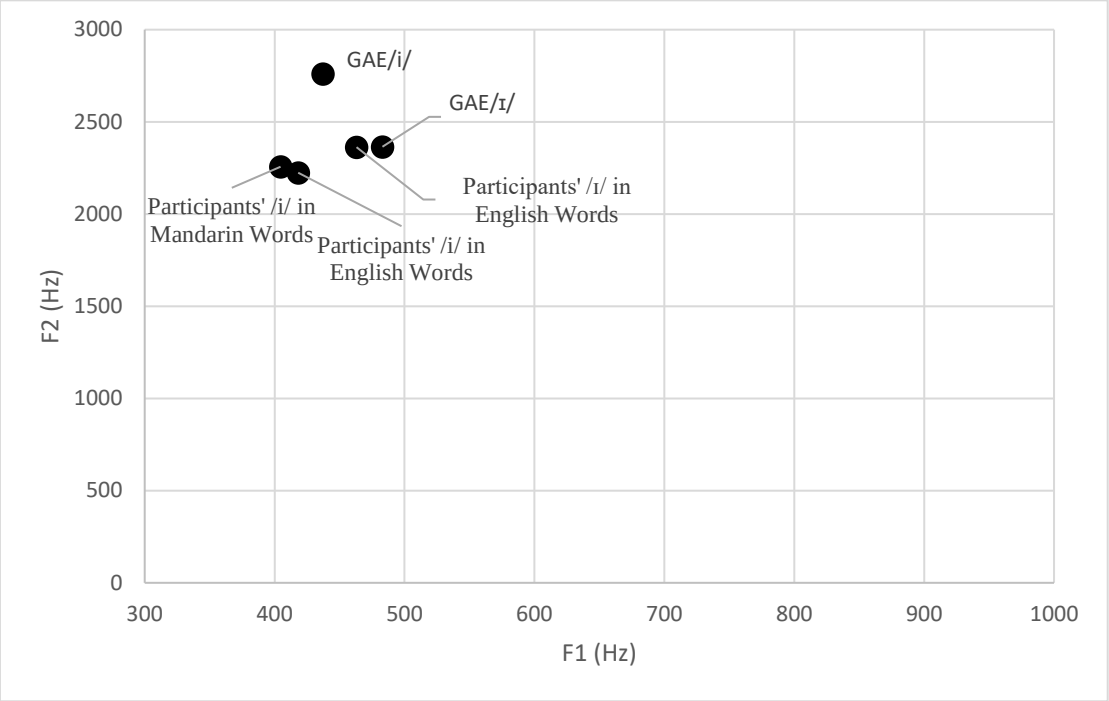

Figure 2. Female vowel formant diagram

5. Conclusion

5.1 Findings

This study, based on the framework of language transfer theory, examines the phonetic transfer of /i/ from Mandarin Chinese to GAE among advanced-level Chinese ELLs. To address the issue, two objectives were set: firstly, learners' perceptual ability to distinguish between /i/ and /ɪ/ should be examined; and secondly, the effect of the phonetic transfer should be determined. A perception test and a production test were designed to attain these two goals.

In the perception test, participants were asked to type down the vowel under each given one-syllable Chinese or English word. By comparing with the Collins dictionary phonemic transcription, the average male test takers' accuracy rate (96.0%) and the average female test takers' accuracy rate (93.7%) were generated. The result justifies the perceptual ability of both male and female participants to distinguish between /i/ and /ɪ/, and it serves as the prerequisite for the validity of the production test's result.

In the production test, both male and female ELLs have signs of experiencing negative phonetic transfer in their pronunciation. The formant frequencies of male participants' /i/ pronunciations in Mandarin are distinctively lower than the GAE values of /i/ both by F1 and F2. Meanwhile, the formant frequencies of their /i/ and /ɪ/ pronunciations in English words are also lower than their GAE counterparts both by F1 and F2. It can be found that the direction of test takers' phonetic transfer for the pronunciation of /i/ and /ɪ/ in English words follows that of the pronunciation gap between their /i/ pronunciations in Mandarin words and the GAE /i/. The effect of negative phonetic transfer on male advanced-level ELLs persisted.

For female participants, as the F2 of GAE /i/ is higher than that of /i/ pronounced by female test takers

both in Mandarin and in English, it can be concluded that a comparatively strong phonetic transfer happened. The negative transfer from learners' L1 assimilates the phonetic realization of the same vowel in L2, which results in a backward shift of the tongue position during pronunciation compared to GAE speakers' standard position. However, the impact of test takers' phonetic transfer from L1 to L2 on the pronunciation of /ɪ/ cannot be fully determined given the fact that the difference in values of the pronunciations is insignificant based on the available data.

5.2 Limitations

Although this study keeps improving its own theoretical framework, participants selection mechanism and experiment design to make the findings more accurate and reliable, it is undeniable that there are still some limitations in this study.

Firstly, there is no solid definition for an "advanced-level" ELL. The criteria for high proficiency of English in this paper are based on both quantitative indicators, i.e., whether the test takers have passed College English Test Band 6 or equivalent tests, and the qualitative measurement, i.e., whether the test takers have been educated in a systematic bilingual manner. Even so, more in-depth assessments are needed to more precisely determine the level of language proficiency of the test takers.

Secondly, the sample size of this paper is insufficient. Although a smaller sample size ensures the accuracy of the acoustic measurement for each test taker, it downgrades the prominence of the results. A larger scale of experiments is needed to testify the findings.

Finally, a more comprehensive acoustic analysis is required. The acoustic measurements in this paper mainly focus on F1 and F2 values of the vowels and do not cover other features. A more thorough acoustic analysis can enhance the significance of the test results.

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