

Phonetic Transfer of Mandarin and English Vowels: Advantages and Challenges for Second-Language Learners

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Abstract: This paper discusses the phonological migration of the Mandarin vowel system to the American vowel system during second language acquisition. To this end, six Mandarin-speaking Chinese students who received English certificates are selected for analysis in this paper. In addition, experimental results from previous studies are utilized for further phonological comparisons, and a perception task and an articulation task are used to compare similar vowel combinations in the Chinese and English vowel systems. The perception task is designed to assess the participants' ability to distinguish similar vowels in different vowel systems, while the articulation task utilized Praat software to acoustically analyze the participants' vowel and word pronunciation, standard English pronunciation, and Chinese vowel pronunciation. The pronunciation values are compared with the standard pronunciation values, and the relationship between similarity and learning difficulty is established to test the hypotheses. The results shows that Chinese students are influenced by the Chinese vowel system and are unable to distinguish similar vowel combinations. Therefore, the higher the similarity between English vowels and Chinese vowels, the better the acquisition effect.

Keywords: Vowel System, Phonetic Transfer, Vowel Pronunciation Comparison, Second Language Vowel Acquisition

1. Introduction

In the context of globalization, the significance of English as a universal language cannot be overstated. English is the primary language utilized in all forms of communication, including diplomatic negotiations, international conferences, international cooperation, and cultural exchanges. With the intensification of China's educational reform, educators are increasingly emphasizing the cultivation of students' practical application of English and cross-cultural communication skills. This paper employs second language acquisition theory and language transfer theory to analyze the current situation of Chinese native speakers' phonological learning in the process of second language acquisition. The design, process, and results of the phonological experiments are used to explore the similarity between Chinese vowels and English vowels, summarize the influence law, and generalize feasible methods. Language transfer is a significant phenomenon in the process of second language acquisition. An investigation into the impact of Chinese vowels on English vowels can facilitate a more nuanced comprehension of the specific manifestations of language transfer, thereby enhancing

the efficacy of second language acquisition pedagogy. In terms of English language teaching, educators can adapt their pedagogical approaches to align with their students' linguistic backgrounds.

2. Theoretical Foundations

The research history of language transfer theory can be traced back to the 1950s, when the concept of “mother tongue influence” was introduced in the field of second language acquisition, and language transfer theory gradually came into people's vision. However, to date there has been little agreement on the influence about the language transfer between the Chinese and English. In 1957, Robert Lado published the world's first comparative linguistics monograph, “Linguistic across Culture”, which comprehensively discusses phonetics, vocabulary, grammar, text and how to make cultural comparison [1]. Some scholars discuss language phenomenon from the conceptual level and put forward the concept of “conceptual transfer”. “The Interlingual Influence of Language and Cognition” summarizes recent advances in foreign research on language transfer, focusing on Conceptual Transfer Theory, a new perspective in language transfer research. Odlin discussed the historical origins of the word transfer, suggesting that it comes from the Latin words *trans* (meaning to cross over) and *ferre* (meaning to carry). The English word transfer with the meaning of “cross-linguistic influence” appeared as early as the 19th century [2].

2.1. Overview of Mandarin and English Vowel Systems

Since different rhythms in Mandarin require different pronunciations of consonant letters, which are similar in Pinyin, the relative complexity of Mandarin vowel system is attributed to the intricate relationship between consonants and phonemes in the surface consonantal segments of the language. Based on the traditional categorization, Mandarin vowels may be separated into three groups: high, medium, and low, depending on how they are pronounced [3]. In contrast to the vowel system of Mandarin, English has more phonemes that can be categorized into four groups: near-middle, near-middle, middle-open and open-middle. And there are twelve monophthongs and eight diphthongs in English. Similarly to the monophthongs in Chinese, the monophthongs are relatively stable in oral form and tongue position [4]. It is evident that there are more vowels in Mandarin than in English, and that not every English vowel can be pronounced in the same way or in the same position in Chinese vowels. For instance, some students use the Chinese ending /ai/ to replace the English front vowel /æ/, pronouncing cat as /kait/, which leads the listener to misinterpret it as “kite” [5]. Consequently, the majority of scholars concur that the Mandarin vowels have a detrimental effect on the acquisition and pronunciation of the English vowels.

The similarity that exists between Mandarin and English is the main reason for phonological transfer in many studies. The positive facilitating effect of the mother tongue on learners' learning of a new language is called “positive speech transfer”; the negative hindering effect of the mother tongue on learners' learning of a new language is called “negative speech transfer” [4]. Students mispronounce words because of the inconsistency between Chinese and English pronunciation. In general, Chinese rhymes have only one consonant (zh, ch, sh) in front of them to combine with. In contrast, English phonemes are more flexible, and words are prone to have more than two ends of syllables consisting of consonant clusters. Examples of such clusters include strength, triumph, and sixth. Due to these differences, many students often insert vowels between English consonants, e.g. clean is pronounced [kə'li:n] [6]. The results of these previous studies suggest that speech transfer is an area worthy of in-depth study. However, there are still many aspects of Chinese-English phonological transfer that have not been fully explored. Therefore, more empirical studies are urgently needed to improve the relevant theories and provide more practical and useful guidance for Chinese second language learners' English vowel learning.

3. Methodology

3.1. Research Design and Methods

The six female students participating in the experiment from the same area of Fujian Province, China, all 21 years of age and without hearing impairment, participate in the experiment. And they speak Mandarin in their daily communication without severe accents (Their Mandarin proficiency levels are up to the HSK Level 2). Therefore, the phonetic transitions from Mandarin to English can be strictly controlled. Participants in the training have already accumulated more than ten years of English learning experience, and all of them have successfully passed the CET 4 exam. They are divided into two groups, with the first group consisting of Participants 1, 2 and 3 who scored more than 560, and the second group consisting of the remaining Participants 4, 5 and 6 who scored less than 560.

There are two tasks in the experiment. The first is the perception task, in which the experiment is designed as a test consisting of ten questions and participants are required to listen to recordings of vowels in two options that are selected from similar pairs of Mandarin vowels and English vowels. They are then counted on how many similar sets of vowels they can distinguish. The second is the production task, in which participants are required to pronounce a representative set of five similar vowels and words containing those vowels. Their English pronunciation is recorded and analyzed by Praat and the F1 and F2 frequencies of each vowel were derived, with data displayed in tabular form.

3.2. Research Process

The Contrastive Analysis Hypothesis posits that learners are more readily able to master similar features between the two languages than different features [1]. Consequently, the acquisition of identical vowels is relatively straightforward, while the learning of similar vowels is more challenging, and the acquisition of different vowels is particularly difficult. The paper aims to figure out the similarities between the two languages and their impact.

3.2.1. Perception Task

In the perception task, the participants need to finish the test, which was designed to evaluate their abilities to distinguish vowels from the two different vowel systems. The recording of Mandarin vowels were taken from Global Chinese Learning Platform (GCLP), created by State Language Commission (SLC) and leading universities [7], and the recording of English vowels were taken from International Phonetic Alphabet (IPA) [8]. Therefore, the recordings represent the standard pronunciation of Mandarin and English vowels. To ensure the accuracy, the vowel recordings were played in a certain order in Table 2. Upon listening to the recording, the participants were required to record the vowels they heard and determine whether they were English or Mandarin vowels. They then proceeded to indicate their responses by checking the corresponding boxes in parentheses. Each participant will have five minutes to complete the test.

3.2.2. Production Task

According to Ringbom, language migration is manifested at three levels: program level, system level, and overall level [7]. System migration can also be referred to as program migration. Program migration is usually native language migration, or migration from another language with which the learner is familiar (i.e., a strong language) to a language with which the learner is unfamiliar. In addition, procedural transfer in language production is usually negative due to the fact that it is difficult for two languages to be functionally and semantically identical. And the purpose of this

production task is to figure out the effect of similar vowels in the two systems on second language learners. In this stage, participants are asked to pronounce a representative set of five similar vowels (as in the perceptual task material) and words containing these vowels. Praat records and analyzes the participants' English pronunciation and derives the F1 and F2 frequencies for each word, as shown in Table 1 and 2. Standard English vowel frequencies and Mandarin vowel frequencies are displayed to measure participants' frequency of pronunciation.

Table 1: Standard English Vowel Frequency

	[i]	[u]	[ʌ]	[e]	[o]
F1	436.5	518.3	753.6	536.2	519.3
F2	2760.3	1225.7	1426.3	2530.4	1225.4

Table 2: Standard Mandarin Vowel Frequency

	[i]	[u]	[A]	[e](i)	[əu]
F1	464.8	385.4	886.4	556.4	865.3
F2	2856.1	1020.2	1630.8	2683.6	1133.1

The table lists the standard F1 and F2 frequencies of English vowels, which can be used as criteria in the following comparative analysis to assess the participants' acquisition results. By comparing the F1 and F2 frequencies of the two groups of similar vowels, the experimental hypothesis can be drawn: the vowel pairs with the highest similarity are [i] and [i], [e] and [e] (i). The vowel pairs with intermediate similarity are [ʌ] and [A], [u] and [u]. The vowel pairs with the lowest similarity are [o] and [əu].

4. Results

4.1. Analysis of the Results of the Perception Task

The two groups of students performed differently on the test, and the test times and scores are shown in Table 3, where the contrast between Participants 1 and 4 is striking (see Table 4).

Table 3: Scores and the Time Spent

Participant	1	2	3	4	5	6
Score	90	80	80	50	60	60
Time	3'07	3'37	3'40	4'10	3'57	4'40

Table 4: Comparison of Participants 1 and 4

	Score	Vowels	[i]	[i]	[u]	[u]	[ʌ]	[A]	[e]	[e](i)	[o]	[əu]
1	80	English	(✓)	()	(✓)	()	()	(✓)	(✓)	()	(✓)	()
		Mandarin	()	(✓)	()	(✓)	(✓)	()	()	(✓)	()	(✓)
4	50	English	(✓)	()	()	(✓)	()	(✓)	(✓)	()	(✓)	()
		Mandarin	()	(✓)	(✓)	()	(✓)	()	()	(✓)	()	(✓)

4.2. Analysis of the Results of the Production Task

The results of all analyses performed by the participants on the selected words were analyzed using Praat software. By comparing the frequencies, the hypothesis can be verified. The results indicated

that there was considerable variation in the participants' pronunciation. For a better comparison of the participants' pronunciation with the standard pronunciation, the average F1 and F2 frequencies of words in each group were compared with that of the standard pronunciation, in an attempt to explore whether the participants' pronunciation can be influenced by their mother tongue. Table 5 presents the typical results for Groups 1 and 2 (namely Participants 1 and 4).

Table 5: Typical Results for Participants 1 and 4

		SMF	PMF	SEF	PEF
Participant 1	[u]	385.4	455.9	518.3	543.5
		1020.2	774.6	1225.7	935.1
	[i]	SMF	PMF	SEF	PEF
		464.8	454.3	436.5	480.5
		2856.1	3009.2	2760.3	2993.7
		SMF	PMF	SEF	PEF
	[A]/[ʌ]	886.4	1066.6	753.6	967.6
		1630.8	1644.65	1426.3	1596.2
	[e]/[e](i)	SMF	PMF	SEF	PEF
		556.4	621.3	536.2	652.35
		2683.6	1889.9	2530.4	1839.1
		SMF	PMF	SEF	PEF
Participant 4	[o]/[əu]	865.3	711.475	519.3	618.15
		1133.1	1089.8	1225.4	1072.35
	[u]	SMF	PMF	SEF	PEF
		385.4	392.97	518.3	370.7
		1020.2	666.675	1225.7	648.75
		SMF	PMF	SEF	PEF
	[i]	464.8	395.525	436.5	425.1
		2856.1	2790.525	2760.3	2832.6
	[A]/[ʌ]	SMF	PMF	SEF	PEF
		886.4	1037.425	753.6	963.625
		1630.8	1850.175	1426.3	1673.525
		SMF	PMF	SEF	PEF
	[e]/[e](i)	556.4	611.575	536.2	626.675
		2683.6	2394.375	2530.4	2357.175
	[o]/[əu]	SMF	PMF	SEF	PEF
		865.3	585.1	519.3	652.4
		1133.1	1207.775	1225.4	1072.35

Note: SMF: Standard Mandarin Frequency; PMF: Participant's Mandarin Frequency SEF: Standard English Frequency; PEF: Participant's English Frequency

As can be seen from the data, there are differences between the participants' average F1 and F2 pronunciation frequencies and the standard pronunciation frequencies. Nevertheless, certain patterns emerge in the observed differences, and the discrepancies in the frequencies of certain speech sounds are not absolute. In order to visualize the data results more intuitively, they are listed below for further analysis: For the vowel pairs [i] and [i], the pronunciation frequencies of the participants in Groups 1 and 2 were almost the same as the standard pronunciation frequencies, the difference between F1 and F1 was within 100, and the difference between F2 and F2 was within 200. For the vowel pairs [u] and

[u], [ʌ] and [ʌ], the participants in Group 1 had a certain difference between the pronunciation frequency and the standard pronunciation frequency, with the difference between F1 and F1 within 200 and between F2 and F2 within 300. In Group 2, the difference was 250 between F1 and F1, and 400 between F2 and F2. For the vowel pairs [e] and [e](i), and [o] and [əu], the difference between the participants' pronunciations and the standard vowels was larger in the first group, with differences of about 300 and 500 for F1 and F2, respectively, while the differences in the Group 2 were about 400 and 600, respectively.

5. Discussion

The experimental results are different from the expected results from standard vowels. In order to investigate the reasons for the difference in the experimental results, this paper will analyze them by using the theory of language transfer and the theory of second language acquisition.

5.1. Reasons for the Difference

In this experiment, the similarity between vowels was determined by analyzing the F1 and F2 frequencies of similar vowel combinations. The vowel pairs [i] and [i] is the most similar of the two vowel systems and has similar frequencies. The results showed that six participants pronounced [i] closest to the standard frequency, which is due to the fact that the vowel [i] produces a positive transfer in language transfer, which makes it easier for the students to learn the [i] vowel, and therefore pronounce it close to the standard. The same reason goes to [ʌ] and [ʌ]. However, vowels with some similarity can be different due to different ways of pronouncing them. There are more vowels in Chinese, and not every English vowel can be pronounced in exactly the same way and in exactly the same position in Chinese vowels [6]. The accuracy of English vowel pronunciation is affected by the degree of oral closure and the degree of tongue position. Therefore, if students directly use the pronunciation of a certain Chinese vowel to completely replace the pronunciation of English vowels, it will cause worse pronunciation. Under the strong influence of the native language, the vowels [u], [o] are often mispronounced as [u] and [əu], and students with a poor foundation in spoken English can easily confuse the pronunciation, thus making it difficult for them to learn standard English pronunciation. In addition, the participants' speaking levels differed. The participants in Group 1 exhibited a higher level of speaking proficiency than that in Group 2. Consequently, their speech frequency in the experiment was closer to the standard speech frequency than that of the second group. This also demonstrates that through the acquisition and correction of language, the pronunciation of Chinese native speakers can be brought closer to the standard. Nevertheless, in the current Chinese language education system, the phenomenon of Chinese-style English teaching persists, and the incorrect pronunciation of teachers can exacerbate the negative impact of the native language on second language learning.

5.2. Possible Improvements

First of all, teachers should help students make a comprehensive comparison of the origins of the two languages, so as to effectively master the pronunciation rules of the two seemingly similar but very different languages and minimize the interference of Chinese [9]. The mastery of phonetic rules is conducive to the establishment of good phonetic learning habits in the primary stage of English learning. Secondly, teachers can make use of all kinds of phonological materials to create real language situations in the classroom, which can help students deepen their understanding of standard pronunciation and guide them to imitate pronunciation and intonation to gradually develop phonological awareness. Finally, the classroom is the main place where students learn English, and teachers' pronunciation has a direct and profound effect on students. Therefore, it is important for

teachers to have a thorough understanding of phonological theories so that they can help students understand the phonological system of a second language and thus improve their phonological skills.

6. Conclusion

This paper elucidates the strengths and challenges of bilingual learners in vowel perception and articulation by analyzing vowel shifts in Mandarin and English. The results demonstrate that there are notable differences in pronunciation and perception between bilingual learners in the acquisition of vowel shifts in the two languages. Specifically, high-level English learners demonstrated superior vowel shift accuracy, while lower levels exhibited a proclivity for mispronunciation and perceptual bias, confirming the important influence of learners' language level on their vowel shift ability. The results suggest that certain instructional approaches in the L2 learning can help learners overcome the challenges associated with vowel switching and facilitate the development of overall language proficiency. Despite the valuable insights this study provides into vowel shift in second language learning, it is important to note that there are still some limitations to this study, including the limited sample size and insufficient consideration of individual differences. Therefore, future studies should expand the sample size and investigate more deeply the vowel shift patterns of learners from different language backgrounds to promote further development of second language acquisition theories and to enhance the effectiveness of teaching practices.

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