Difficulties with Mandarin Tones: Learners' Perspectives and Speech Data Analysis

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Abstract

This study investigates beginning level adult Chinese as a Foreign Language (CFL) learners' difficulties with Mandarin Chinese tones. Twenty CFL learners enrolled in a first semester CFL course in a U.S. university participated as speakers. Their productions of Mandarin phrases and sentences were judged by native Mandarin listeners for pronunciation and tone problems and were also rated by native Mandarin listeners. A post course survey questionnaire was also analyzed to investigate the learners' learning experience and their perception of difficulties with Mandarin pronunciation and tones. Results suggest the speakers' productions of Mandarin phrases and sentences were judged to be most problematic with tones. Learners also reported tones to be the most difficult aspect in learning Chinese at initial stage of learning.

Index Terms: Mandarin tones, production of tones, difficulties with tones, survey

1. Introduction

Mandarin Chinese is often considered to be one of the most difficult foreign languages to acquire in the western world. However, which aspects of Chinese learning cause particular difficulty for Chinese as a Foreign Language (CFL) learners have not yet been examined systematically [1, 2]. Previous studies on CFL learners' perception of difficulties in learning Chinese have mostly focused on the acquisition of the Chinese orthographic system and reading comprehension skills and strategies. Very few studies have investigated the students' difficulties with pronunciation, in particular, the lexical tones. Of the few studies that did investigate learners' pronunciation difficulties [3, 2] the researchers relied on survey questionnaires and classroom observations only. Speech data were not collected and analyzed to support the learners' self-report of difficulties with Mandarin pronunciation and tones in these survey studies. This study aims to fill the gap by investigating beginning level adult learners' difficulties with Mandarin tones in production. Twenty CFL learners enrolled in a first semester CFL course in a U.S. public university were the participants. Their speech data were collected and analyzed for their production problems with Chinese tones. A post course survey questionnaire was also analyzed to investigate the learners' learning experience and their perspectives of difficulties with Mandarin pronunciation and tones.

1.1. Tone Perception Studies

Learning to perceive and produce the lexical tones of a second language has always been challenging. Previous research on CFL learners' problems with Mandarin lexical tones mostly dealt with perceptual test that focused on individual syllables [4, 5]. The findings of these studies suggest that learners had difficulties with the perception of Mandarin tones regardless of their L1 prosodic experience. For example, Wang [6] found native Hmong speakers, whose L1 contrasts lexical tones, performed significantly worse than native English and native Japanese speakers who had no L1 experience with lexical tones. Despite the difficulties of perception of nonnative tone contrasts, past studies have also shown that perceptual training using discrimination or identification paradigms were effective in improving learners' perception identification of Mandarin tones in isolated syllables in laboratory settings [4, 5]. In a most recent study [7] that dealt with training study on learning Mandarin tones beyond the unit of syllable, using Kay Elementric's Sona Speech II software with real time display of pitch contours along with speech output on a PC computer, the trainees had both auditory and visual input when they recorded and compared their own productions with the training stimuli during the training. The trainees' productions of Mandarin tones were judged by native Mandarin listeners to be significantly better at post test than at pretest. Production studies on L2 tones, especially productions of tones beyond the isolated syllables are still very limited in CFL literature. This study will examine the beginning level CFL learners' production problems with Mandarin pronunciation and tones using natural productions of phrases and sentences by the learners at initial stage of learning.

1.2. Learners' Perceptive of Difficulties with Tones

Survey studies are commonly used to investigate learners' experience with L2 learning. Very few studies have investigated the learners' difficulties with pronunciation and the learners' perspectives on CFL pronunciation acquisition. In one such study, Huang [4] combined a survey with classroom observations and selective interviews of the students in investigating CFL learners' difficulties with Chinese. Fifteen intermediate to advanced learners of Mandarin Chinese with English (6) and Cantonese as their strong languages (9) in a western Canadian university were asked to rank eight areas of potential difficulty: pronunciation; tones; grammar; writing Chinese characters; vocabulary building; oral communication; delivering a prepared oral presentation; and written compositions in a survey questionnaire. Learners' L1 background was found to have a huge effect on the major difficulties as they perceived: none of the 6 English speakers chose tone as their major problem. Only one of them chose pronunciation as a major difficulty but classroom tape recording suggest otherwise. The Cantonese speakers mostly reported pronunciation (78%) and tone (56%) as their major difficulty. Huang's study, though limited with a very small sample of native English speakers, suggest that advanced English learners no longer perceive tones and pronunciation as their primary problems in learning Mandarin. On the other hand, while the native Cantonese speakers still struggle with Mandarin tones, they did not pay much attention to improve their tones because they felt

inaccurate tones did not hinder communication with proper contexts.

In another survey study on intermediate level learner's perception of the difficulties of the Chinese language learning, Chiang [1] found that tones were the most cited difficulties by the learners and the learners wanted to have more instruction on tones at the beginning level (first year) of learning in order to learn more accurate tones. The findings of this study were not in agreement with the previous studies as the students at the intermediate level still regarded tones the most difficult aspect of learning Chinese. Therefore, the difficulties with tones as perceived by the students beyond the beginning level of learning were not consistent.

It is important to note that these survey studies relied on the learners' self-report only. Therefore, one limitation of the previous studies is the lack of support of actual speech data for the learners' perceptions of difficulties with tones.

1.3. The Current Study

This study investigates beginning level CFL learners' production problems with Mandarin Chinese pronunciation, in particular, lexical tones. An additional goal is to examine the learners' perspectives of the difficulties with Mandarin Chinese. The research questions are:

1. What are beginning level CFL learners' speech production problems with Mandarin Chinese?

2. Which aspects of Mandarin Chinese language or skills are perceived as the most difficult for beginning level CFL learners?

2.   Production Test

2.1. Method

2.1.1. Participants

The speakers were 20 (10 male and 10 female) beginning level learners of Mandarin Chinese enrolled in a first semester Chinese as a Foreign Language course in a U.S. public university. Their mean age was 22 (range 18-38) at the time of this study. The learners' first languages consisted of English (7), Hmong (6), Cantonese (3), Vietnamese (2), Japanese (1), and Spanish (1). With the exception of the Japanese speaker, all the nonnative English speakers were early bilinguals who learned to speak English from kindergarten as most of them were either born in the U.S. or moved to U.S. before they started school. The three native Cantonese speakers were heritage speakers who were exposed to both English and Cantonese at home. They had basic conversation skills in Cantonese but none were literate in Chinese characters. They had no knowledge of Mandarin. The Japanese speaker was an exchange student in the U.S. at the time of the study. The background information of the 20 speakers is given in Table 1.

Six native Mandarin listeners (3 male, 3 female) living in the U.S. participated as listeners. All listeners reported having normal hearing.

2.1.2. Material

The reading list consisted of phrases and sentences with all the vocabularies selected from the textbook that was covered during the semester. It was selected from a longer list that was used as the oral exam review material. The long list was distributed to the students one week before the oral exam and they were told that a shorter list with phrases and sentences selected from the long list would be used for reading for their oral exam a week later. Therefore, the participants were familiar with all the vocabulary in the list and they were expected to prepare for the oral exam. All the words and sentences were written in Chinese character with Pinyin on top of each word. Before the oral exam in which each individual speaker read the list and answered questions, the actual short list for the reading tasks were given to each participant three minutes before the exam that was recorded. They had the chance to practice the short reading list for about 3 minutes before the recording.

Table 1 The 20 participants' background information

ID	Gender	L1	Age
C01	M	Cantonese	20
C02	M	Cantonese	19
C03	M	Cantonese	19
E01	M	English	26
E02	M	English	28
E03	F	English	21
E04	M	English	22
E05	M	English	19
E06	F	English	18
E07	M	English	38
H01	F	Hmong	20
H02	F	Hmong	19
H04	F	Hmong	20
H05	F	Hmong	20
H06	M	Hmong	20
H07	F	Hmong	19
J01	F	Japanese	23
S01	F	Spanish	19
V01	M	Vietnamese	28
V02	F	Vietnamese	19
			Mean=22

2.1.3. Procedure

Individual recordings were made in a sound booth on a Macintosh computer using Praat speech software. Each speaker read the list of words and sentences on a Shure SM 48 microphone connected to an M-Audio MobilePre USB preamplifier. The readings were recorded and saved at a sampling rate of 22050 Hz with 16-bit resolution. Each stimulus was normalized for peak amplitude for presentation. Two phrases: 你好 'Hello', 生日 'birthday' and two sentences: 我爸爸是老师. 'My father is a teacher.', 今天几月几号？ 'What date is today?' were selected for the evaluation by the native Mandarin listeners. These items were not intended to assess the whole range of difficult sounds of Mandarin Chinese. However, the phrase 你好 was one of those most commonly used greetings that was also easy to produce. In contrast, 生日 was more difficult to produce because of the difficult initial consonants. Similarly, one sentence, 我爸爸是老师， with common vocabulary was also relatively easier to produce than the other sentence, 今天几月几号， which contained difficult initial consonants and tone sanhdi rules for the third tone and therefore is more difficult to produce for the learners.

2.1.4. Native Mandarin Listeners' Judgment

Individual listening sessions for the six listeners were performed on a Macintosh computer using Praat speech software. Each phrase and sentence was assessed in a separate block, producing four listening blocks. In each listening block, the 20 speakers' productions of the same phrase or sentence was mixed and presented randomly one by one for the listener to identify. One native Mandarin' speaker's productions of the same phrase or sentence was also included in each block to assess whether the native listeners were able to judge the stimuli effectively. The listeners' assessment tasks were to determine whether the speech they heard had problems with the tones, problems with the sounds (initials and finals), or problems with both tones and sounds, or, no problems. The corresponding labels used for these problems are "Tones", "Sounds", "Both", and "None". In addition, if the speech they heard had problems other than these items, they had the option of "Other" (problems). These five labels appeared on the computer screen as five separate buttons. During each listening assessment block, each time a stimulus was played back, the listeners would assess the speech they just heard by clicking one of the 5 buttons. "None", "Tones", "Sounds", "Other", and "Both" on the computer screen. In the same trial after the identification task, the listeners also rated the overall pronunciation of the phrase/sentence along a scale of 1 (good) – 7 (poor). For each stimulus, in the case of uncertainty after hearing the item once, the listener could choose to replay the stimulus again up to three time by clicking the "Repeat" button on the screen before making the judgment. After the stimulus was played back for a third time, the "replay" button was disabled.

2.2. Results

2.2.1. Types of Speech Problems

The mean identification scores of the speakers' types of speech problems with each phrase and sentence as identified by the six listeners were summarized in Table 2. The mean error scores were 43% for Tones, 10% for Sounds, 5% for Other, and 13% for Both tones and sounds. Overall, 56% and 23% of the speech had problems with tones and sounds respectively, if the percentage of those speech identified as "Both" (problems with both tones and sounds) were tallied along with those identified with "Tones" and "Sounds" to double count them. Thirty percent of the speech was perceived as no problems by the native listeners. Paired T-tests were carried out on each phrase and sentence between the speakers' problems with Tones and Sounds. (Speakers' whose productions were identified with both problems were counted for both variables.) The differences between tones and sounds were significant (alpha <.01) for both sentences and for 你好 but not for 生日.

As seen in Table 3, the learners' productions of 生日 and 今天几月几号？ were perceived to have problems with both tones and sound considerably more than the other two items.

2.2.2. Rating Scores

The Mandarin speaker's stimuli included in each of the four blocks were rated as "7" by all the six listeners indicating that the listeners were able to perform the rating tasks. The native speaker's speech was excluded from the subsequent analysis. The 20 speakers' mean rating scores by each of the six listeners were summarized in Table 3. Paired T-tests established significant differences (alpha <.01) on rating

scores between 你好 and 生日, between 我爸爸是老师 and 今天几月几号, between 生日 and 我爸爸是老师, and between 你好 and 今天几月几号. The differences between 你好 and 我爸爸是老师, between 生日 and 今天几月几号 were not significant.

Table 2. Mean percentage of speech problems as identified by native listeners

	None	Tones	Sounds	Other	Both
你好	41	49	3	8	0
生日	22	33	19	3	23
我爸爸是老师	38	45	10	4	3
今天几月几号	19	43	8	4	27
Mean	30	43	10	5	13

Table 3 Mean rating scores of each speech item (1= poor, 7= good) by each listener

	L1	L2	L3	L4	L5	L6	Mean
你好	4.9	5.2	4.3	5.6	5.1	4.5	4.9
生日	3.5	3.2	3.3	4.4	3.9	4.6	3.8
我爸爸是老师	3.7	5.2	4.3	5.5	4.6	5.1	4.7
今天几月几号	3.4	3.5	3.3	3.8	4.6	4.9	3.9

3. Learners' Perspectives: Survey Study

3.1. Method

At the end of the semester, the 20 participants completed a post course online survey questionnaire that consisted of 10 questions. The first part of the questions asked about the students' background information and the time they spent on studying Chinese after class. The second part of the questionnaire asked the learners' perspectives of the difficulties with different aspects of learning the target language. They were asked to choose which was the most difficult for them to learn among the four categories: pronunciation, grammar, character, and reading comprehension. Also, on pronunciation, they were asked to choose which of the three was most difficult to learn: tones, initial consonants, and finals. The participants were also asked to rank order which of the skills, they felt, were emphasized the most in class and which they would like to have more emphasis in class: listening comprehension, speaking practice for fluency, pronunciation drills for more accurate pronunciation, reading comprehension, and writing. Finally, there was an open –ended question on the strategies they used when they had problems with the pronunciation.

3.2. Results

Eighty percent of the learners responded that "pronunciation" was most difficult for them while 20% chose "character". None of the twenty participants chose "grammar" and

"reading comprehension" as the most difficult aspects of learning. For pronunciation difficulties, as presented in Table 4, 70% of the participants chose "tones", 25% chose "initial consonants", and 5% chose "vowels" as the most difficult for them to learn. Another related question on pronunciation asked which element influenced their intelligibility the most, 80% of the students responded that "tones" were more important for themselves to be understood by the listeners while 20% chose "initial consonants."

Table 4 Results (in percentage) of selected questions from the survey questionnaire

Questions	Tones	Initials	Vowels
Most difficult to learn	70	25	5
Most important for you to be understood	80	20	0

To assess the factor of classroom instruction on the students' perceptions of the degree of difficulties with different aspects of learning, the questionnaire also asked the students to choose which skills were emphasize *the most* in class, based on their classroom experience. The responses on the five items were: reading, 30%; pronunciation, 25%; listening 10%, speaking, 20%, and writing 15%. When asked which skill/area they *wanted to* have more practice in class, the responses were reading, 10%, pronunciation, 20%; listening 25%, speaking, 10%, and writing 35%.

4. Discussion

The results of both the production test and survey study show that Mandarin lexical tone is most problematic for beginning level CFL learners. Both research questions have the same answers: The 20 speakers' productions of Mandarin phrases and sentences were judged to have the most problems with lexical tones and the speakers themselves also reported that Mandarin tones were the most difficult for them to learn. The findings suggest that at initial stage of learning, lexical tones pose significant challenge to beginning level learners. Due to the small sample size of the participants in the current study, the influence of listeners' L1 background, if any, on the problems with Mandarin tones were not analyzed in detail. However, the overall data appear to suggest that both tone language speakers such as Hmong and Cantonese speakers, as well as non-tone language speakers such as English and Spanish speakers had problems with the production of Mandarin tones as judged by the native Mandarin listeners.
In the survey study, 80%, the overwhelming majority of the listeners reported that pronunciation was the most difficult for them to learn while only 20% felt that Chinese characters were the most difficult. For pronunciation problems, 75% of the students reported tones were the most difficult, significantly more than the 25% of those who reported sounds (initial consonants and vowels) was the most difficult to learn.

The results of the production test also showed that there were differences across the four speech items as judged by the native listeners. Both the percentage of identifications and rating scores show that 你好 and 我爸爸是老师 were better produced than 生日 and 今天几月几号. It appears that difficult speech sounds such as certain retroflex sounds in the initials of 生日 might influence the differences in the learning results. Similarly, certain tone types and tone combinations, such as the tone sandhi rules for the third tone, as represented twice in the sentence 今天几月几号 are

probably much more difficult to master by the beginning level learners. More detailed acoustic analyses of the learners' productions, which is beyond the scope of the current study, are needed to identify the learners' specific problems with Mandarin tones and tone sandhi.

The overall rating scores of the speakers' productions ranged between 3.8 and 4.9 along the scale of the 1 (poor) -7 (good). Though not to be compared with the native speaker's perfect score of 7, the mean rating scores were not that low, especially considering the fact that majority of the speech were labeled to be problematic with tones and sounds. It is possible that the native listeners, though very good at identifying the speech problems, were relatively mild in assigning rating scores for the nonnative productions. Based on the researcher's (a native Mandarin speaker) own judgment, these nonnative speech were mostly intelligible and easy to understand despite their noticeable problems with tones. Of course, the listeners were provided with the phrases and sentences they were to assess before the listening sessions and were all very familiar with what they would hear. In real life situation outside the classroom, tone errors do often cause intelligibility problems and therefore can interfere with communication.

However, it is interesting to note that, though 80% of the learners stated that tones were most important factor for the others to understand their speech (see Table 4), only 20% of the speakers wanted to have more practice on pronunciation (including tones) in class. Also, as reflected in the survey data, the classroom time was divided relatively evenly to cover the four skills in this beginning level college Chinese course as it was supposed to be because the course goal was develop learners' communicative skills. It appears that the students understood the importance of developing the four skills for communicative purposes even though they considered tones to be the most difficult for them to learn. The researcher, who is the instructor of the course in the current study, felt the urgent need to deal with the learners' tone problems outside the classroom instruction, as the limited class instruction needs to deal with all the four skills. Extra curriculum class activities focusing on tone training using speech software have yielded positive results in learning Mandarin tones [6]. Future studies need to explore different ways of teaching L2 tones efficiently both in and outside classrooms.

5. Conclusions

Beginning level adult CFL learners' productions of Mandarin phrases and sentences were judged by native Mandarin listeners to be most problematic with tones. Learners also reported tones to be the most difficult aspect in learning Chinese at initial stage of learning. Although learners were fully aware of the importance of more practice on tones for intelligibility purposes, they did not choose to have more class time to be devoted to tone practice. CFL educators face challenges to help students improve their tone perception and production skills during limited classroom instruction time at no cost of improving other skills. As the sample is small for this study, the current findings may not be generated to broader scopes.

6. References

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