An Experiment on Mandarin Single-character Tone Perception of Bangladeshi Students

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Abstract. Based on the perception experiment of Bangladeshi students in distinguishing and recognizing mandarin single-character tones, the perception ability of tones is investigated. The experimental results show that the perception ability of Bangladeshi students in mandarin single-character tones gradually increases with the increase of Chinese level, especially in advanced level. The order of difficulty for Bangladeshi students in perceiving mandarin single-character tones is rising tone > level tone > falling tone > falling-rising tone (">" means "more difficult"); There are many types of errors and it is easy to confuse level tone/rising tone and rising tone/falling-rising tone. On this basis, this paper puts forward some teaching suggestions on tone perception.

Introduction

Tone in Mandarin is a challenge for learners of Chinese language, especially for non-tonal language native speakers whose native language has no tone background. Bengali is non-tonal language, and Bangladeshi students whose mother tongue is Bengali have the same problem. In teaching, students said that Mandarin tones were not only difficult to pronounce, what was worse, they cannot clearly distinguish the four tones. As early as the 1980s, Flege pointed out in his research that there is a close relationship between pronunciation and perception. People begin to realize that the study and teaching of language errors should not only focus on learners' pronunciation, but also their perception of pronunciation.

Method

Participants. A total of 58 students were involved in the experiment, 15 of whom were junior learners and had studied Chinese for about one year, with HSK level 3 and below. Medium-level, 30 people, studying for 1-3 years, HSK level 4; Senior 13, learning Chinese for more than 3 years, HSK level 5 and above. The speakers are basically from Dhaka district of Bangladesh, aged between 18 and 32, with normal hearing and Bengali as their mother tongue. Therefore, their acquisition of mandarin is regarded as a dynamic acquisition process of the same group.

Materials. This experiment is divided into two experiments of discrimination and identification, so the perceptual experimental materials are divided into the following two.

Distinguish experimental materials. Select two syllables in mandarin that have no meaningful connection but have the same sound and vowel to form a group of stimuli, and the tones of the two syllables are the same or different (e.g. lì-lì, liù-liú). The four tones and two ambiguities of mandarin form 16 combinations. Each combination contains 2 groups of stimulation items, totally 32 groups of stimulation items (see appendix for details). The 32 groups of stimulation items will be made into test questions. However, because the research focuses on the discrimination ability, the items of the four combinations (totally 8 groups of stimulation items) of level tone/level tone, rising tone/rising tone, falling-rising tone/falling-rising tone, falling tone/falling tone are only regarded as interference items instead of inspection items. Therefore, the statistical items only include 6 types

of stimulus combinations: level tone/rising tone (level ton-rising tone and rising tone-level tone), level tone/falling-rising tone (level tone-falling-rising tone and falling-rising tone-level tone), level tone/falling tone (level tone-falling tone and falling tone-level tone), rising tone/ falling-rising tone (rising tone- falling-rising tone and   falling-rising tone-rising tone), rising tone/falling tone (rising tone-falling tone and falling tone-rising tone), falling tone/rising tone (rising tone-falling tone and falling tone-rising tone), each type of combination includes 4 groups of stimuli.

Identification of experimental materials. There are 4 tone categories, each tone category contains 8 characters and 32 characters totally (see appendix for details). The collocation of different difficulty of sound and vowel is taken into account in the character test.

Procedures. In the discrimination experiment, 32 groups of stimulus items appeared randomly. A Chinese speaker of Mandarin-B read and recorded them. The interval between two characters in each item was 2 seconds, and the interval between items was 4 seconds. The identification materials were also randomly arranged, and the recording interval between words was 4 seconds. The subjects wore headphones, listened to the recording materials in a quiet environment, and gave judgments or options on the perception test paper.

Results

Distinguish Experimental Results. The discrimination experiment counted the results from the bias rate (bias rate, total bias rate and total bias rate of each item) of each group's perception discrimination stimulus items.

Table 1   Statistical Table of Results of Chinese Single-character Tone Distinguishing Experiment for Bangladeshi Students

Projects	Total Error Rate of Each Item	Junior (15)		Medium-level (30)		Senior (13)	
		Number of errors	Error rate	Number of errors	Error rate	Number of errors	Error rate
Level tone /Rising tone	36.21%	32	47.06%	42	36.21%	10	20.83%
Level tone/Falling-rising tone	16.38%	11	16.18%	25	21.55%	2	4.17%
Level tone/Falling tone	18.10%	9	13.24%	27	23.28%	6	12.50%
Level tone/Falling-rising tone	30.60%	26	38.24%	35	30.17%	10	20.83%
Level tone/Falling tone	21.55%	18	26.47%	30	25.86%	2	4.17%
Go/go	12.93%	7	10.29%	23	19.83%	0	0.00%
Total number of errors		103		182		30	
Total error rate			28.61%		25.28%		9.62%

Identification Experiment Results. The identification experiment results are divided into two parts, including the identification error rate (error rate, type total error rate, total error rate) and the identification accuracy rate of the students of different level groups for mandarin single-character tone. The results are shown in tables 2 and 3 ("→" means "misreading is").

Table 2　Statistics on Error Rate of Mandarin Single-character Tone Recognition for Bangladeshi Students

Tone	Error type	Type total error rate	Junior (15) Number of errors	Error rate	Medium-level (30) Number of errors	Error rate	Senior (13) Number of errors	Error rate
Level tone	→ Rising tone	22.84%	42	35.00%	54	22.50%	10	9.62%
	→ Falling-rising tone	7.54%	10	8.33%	17	7.08%	8	7.69%
	→ Falling tone	6.47%	10	8.33%	15	6.25%	5	4.81%
Level Tone Error Rate		36.85%	62	51.66%	86	35.83%	23	22.12%
Rising tone	→ Level tone	20.91%	34	28.33%	42	17.50%	21	20.19%
	→ Falling-rising tone	17.46%	23	19.17%	47	19.58%	11	10.58%
	→ Falling tone	4.53%	7	5.83%	10	4.17%	4	3.85%
Rising Tone Error Rate		42.89%	64	53.33%	99	41.25%	36	34.62%
Falling-rising tone	→ Level tone	2.80%	4	3.33%	4	1.67%	5	4.81%
	→ Rising tone	7.33%	11	9.17%	20	8.33%	3	2.88%
	→ Falling tone	6.90%	10	8.33%	20	8.33%	2	1.92%
Error rate of falling-rising tone		17.03%	25	20.83%	44	18.33%	10	9.61%
Falling tone	→ Level tone	8.41%	17	14.17%	21	8.75%	1	0.96%
	→ Rising tone	7.54%	16	13.33%	15	6.25%	4	3.85%
	→ Falling-rising tone	5.82%	7	5.83%	13	5.42%	7	6.73%
Error rate of falling tone		21.77%	40	33.33%	49	20.42%	12	11.54%
Total Error Rate Times			191		278		81	
Total error rate				35.11%		29.96%		21.09%

Table 3　Statistical Table of Mandarin Single-character Tone Recognition Accuracy of Bangladeshi Students

Projects	Junior (15) Correct number	Correct rate	Medium-level (30) Correct number	Correct rate	Senior (13) Correct number	Correct rate
Level tone	65	54.17%	144	60.00%	80	76.92%
Rising tone	62	51.67%	131	54.58%	65	62.50%
Falling-rising tone	94	78.33%	188	78.33%	94	90.38%
Falling tone	95	79.17%	177	73.75%	94	90.38%

Analysis of Results

Bangladeshi Students Mandarin Single-Character Tone Perception Ability. According to the total error rate of the perception of the four tones of Mandarin, the subjects' mastery of the four tones can be known. In the discrimination experiment, the total error rates of tone perception of the junior, middle and senior level students were 28.61%, 25.28% and 9.62% respectively, which decreased overall, indicating that the discrimination ability was gradually increasing, especially to the senior level. Compared with the junior and medium level students, the discrimination ability was greatly increased, but the difference between the junior and medium level students was still not obvious.　In the identification experiment, the four-tone perception error rates of the junior, medium-level and senior groups are 35.11%, 29.96% and 21.09%, respectively, showing a decreasing trend, indicating that the ability to perceive tones gradually increases with the improvement of Chinese proficiency.

The Order of Difficulty in Perception of Single Syllable Tones in Mandarin by Bangladeshi students. According to the acquisition standards of Wei Li and Hua Zhu (2000), the correct rate of new phoneme occurrence reaches 90%, which can be considered that children in this age group have acquired the phoneme. In Table 3, the correct perception rate of falling-rising tone and falling tone exceeds 90%, basically reaching the acquisition standard, forming the perception awareness and category of falling-rising tone and falling tone. Therefore, for Bangladeshi students, the falling-rising tone and falling tone of Mandarin are easy to perceive. However, level tone and rising tone do not meet this standard. Even if they reach the advanced level, they still cannot fully perceive level tone and rising tone. From Table 2, it can be seen that among the four tone categories, rising tone is the tone category with the highest total error rate of Bangladesh students, reaching 42.89%, followed by level tone with a total error rate of 36.85%, followed by falling tone with an error rate of 21.77%, and the last one, falling-rising tone with an error rate of only 17.03%. Falling-rising tone is the tone category most easily recognized by Bangladeshi students. By sorting the error rates, we can see that the overall order of difficulty for Bangladeshi students in perceiving mandarin tones is rising tone > level tone > falling tone > falling-rising tone(">" means "more difficult"), and the order of difficulty for junior, medium-level and senior students in perceiving the four tones is the same.

The Types of Errors in Perception of Mandarin Single Syllable Tone of Bangladeshi Students. Table 2 shows that there are many types of errors in tone perception for junior, medium-level and senior Bangladeshi students. No matter what level of students, there are 12 types of errors, with a coverage rate of 100%. It can be seen that junior, medium-level and senior students confuse the four tones of Mandarin to varying degrees. Rising tone and level tone are the tones with the highest degree of confusion among Bangladeshi students. The results of discrimination and identification experiments can prove this point. In the identification experiments, the error rates of the two are 22.41% and 20.91% respectively, which are basically symmetrical. Secondly, Bangladeshi students are also easy to confuse the rising tone with the falling-rising tone. The error rate of rising tone mistaken for falling-rising tone is 17.46%, which is rank only second to the error rate of level tone and rising tone, but the error rate of falling-rising tone mistaken for rising tone is only 7.33%, which does not show symmetry. The existing research thinks that the confusion between the rising tone and the falling-rising tone is the most prominent problem for non-tonal native speakers, but this point does not appear on Bangladeshi students, which is the difference between Bangladeshi students' perception of Mandarin tones.

Discussion and Teaching Suggestions

After experiments, we found the above interesting results. Among them, the error types of level tone → rising tone, rising tone → level tone are the most prominent problems for Bangladeshi students. We know that level tone and rising tone are quite different from each other in terms of tone type and tone value. However, Bangladeshi students are difficult to distinguish between the two. It is possible that the two are classified into a perception category, which leads to difficulty in distinguishing. In addition, the error type of "Rising Tone → Falling-rising Tone" is also quite prominent, which is consistent with the research on Chinese tones of other non-tonal language native speakers. Luo research results pointed out that the junior students' pronunciation errors are mostly rising tone and falling-rising tone, and the medium-level students' pronunciation errors are mostly falling-rising tone [1]. for Bangladeshi students, it is the most difficult to perceive rising tone of mandarin and the easiest to perceive falling-rising tone, so the perception difficulty does not correspond to the pronunciation difficulty. In other words, falling-rising tone is the most easily perceived but the most difficult to pronounce for Bangladeshi students. Rising tone is difficult to perceive, but it is better than falling-rising tone. This is because the tone of rising tone does not rise in a straight line, but falls at the beginning of the tone segment and rises abruptly at one-third of the tone segment. therefore, it also has a groove like the upper tone shape, as shown in Fig. 1 Therefore, the two are often difficult to be distinguished and confused. Therefore, in the tone

teaching for Bangladeshi students, attention should be paid not only to the distinction between rising tone and falling-rising tone, but also to the distinction between level tone and rising tone.
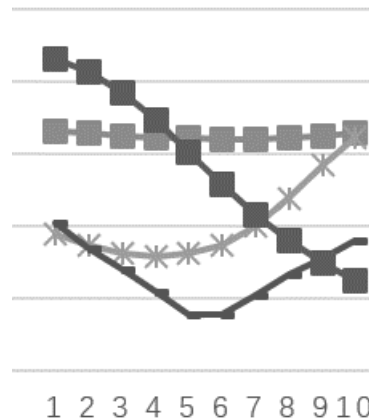

Figure 1. Chinese Mandarin Quadruple Tone Type

It is generally believed that vowel and consonant segment factors affect the perception of tones. Tone training attached to the same syllable is not very effective for those who do not have tonal language mother tongue. The strategy of "different syllables + different tones" can be adopted in training. The experiment conducted by Chen proves that this strategy is indeed effective [2]. Bangladeshi students can use the method of changing initial consonant and vowel to carry out perception training in tone teaching, especially focusing on level tone/rising tone, rising tone/falling-rising tone, and also adopting the method of combining perception and pronunciation, because the input and output of tones cannot be neglected. Due to the difficulty in tone perception of Bangladeshi students, a strategy from easy to difficult can be adopted. Adaptive perception training is adopted at the junior level, while adaptive perception training is mainly used at the medium level, supplemented by high variance perception training. High variance perception training with greater intensity and difficulty is mainly used at the advanced level. Of course, this also requires Chinese teachers to always emphasize and correct tone errors regardless of the level of Chinese students.

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Appendix
An Experimental Survey of Chinese Single-character Tones for Bangladeshi Students
1. Distinguish the experimental table (sequential version)

bā - bā	zōu - zōu
pīn -pín	gēn - gén
chān - chǎn	bīng - bǐng
huā - huà	yuē - yuè

mái – mái   xióng - xióng
cáng - cāng   yún - yūn
róng – rǒng   mián - miǎn
zháo- zhào   tuí - tuì
nǔ – nǔ   zhǐ - zhǐ
qiǎng – qiāng   děng - dēng
chuǎng - chuáng ěr - ér
jiǎo - jiào   kǔn - kùn
lì- lì   cì - cì
suàn - suān   yuàn -yuān
fèi - féi   liù - liú
shào - shǎo   yù - yǔ

2. Identify the experiment table (sequential version)

mā	má	mǎ	mà
xū	xú	xǔ	xù
jī	qí	qǐ	xì
dēng	duó	dǐng	diàn
nāng	náng	nǎng	nàng
chuō	cuó	cuǒ	chuò
shāi	qiá	zǎi	chài
niū	nún	niǎn	nüè