VOICE QUALITY PROCESSING STRATEGY OF KOREAN LEARNERS OF CHINESE

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ABSTRACT

This paper investigates whether the advanced Korean learners of standard Chinese produce Chinese with specific voice quality, and which voice quality parameters have significant difference. The study includes comparative analysis between the Korean and Chinese vowel /a/ for Korean speakers. It can be made certain by measuring voice quality parameters by means of EGG (electroglottalgraphy). The results showed that the Korean learners use specific voice quality features for improving Chinese nativeness, and especially the phonation quality changes were obvious. They produced Chinese phonation quality characteristics depending on higher F0 (fundamental frequency), lower OQ (open quotient), SQ (speed quotient) and H1-H2 (harmonic amplitude difference) compared with Korean. In addition, this study found that there are similarities between phonation quality features of Korean/ Chinese contrasts and Korean lax/ tense contrast features. It suggests, that in the target language processing, phonetic features of the L1 (mother tongue) contribute to "phonation quality" perception and production of a L2 (second language).

Keywords: second language, voice quality, Chinese, phonation, lax/tense

1. INTRODUCTION

When the L2 learners produce the target language, should one consider the phonation quality features of the target language?

As is known to all, the main purpose of learning L2 is common to "communication", while the goal of the L2 learners is often reaching to a native speaker-like level. So, when we practice L2 speaking, we often try to imitate its specific phonetic characteristics to close to native pronunciation. Stockmal, et al. [10] examined that bilinguals can produce two languages in significant different voice qualities respectively. Esling and Wong [3] and Stockmal, et al. [11] also emphasized that the voice quality is one of important cues for evaluating L2 learners fluency, and occupied very important position in the speak processing as well. However, much of the L2 research to date has focused on articulation properties.

This study, therefore, according to Kong's [8] classification of "Voice Quality", is divided into Phonation Quality and Articulation Quality, taking articulation quality data for reference data, mainly discusses whether the Chinese phonation quality of Korean speakers differ from Korean, and continue to make improvements on what kind of voice qualities are used to improve nativeness of Chinese.

2. METHOD

2.1. Subjects

The participants in this study included 20 native speakers of Korean (10 males, 10 females from ages 25-35 years old) with, whose language background was limited to Seoul dialect. In addition, they all had HSK (Chinese proficiency test) certificates of an advanced level.

2.2. Speech material

Recording materials consisted of two kinds of sentences with same meaning and different languages. To minimize the effect of F0 in Chinese tone, this study only selected the Chinese and Korean vowel "/a/", with no specific meaning. Each word was recorded in a frame sentence, which was as follows:

Chinese：这 是 汉 语 "啊" 的 发 音。
[tʂɤ ʂʅ hany "a" tə fain]
Korean：이것은 한국어 '아' 발음입니다.
[igʌsɯn haŋˀgu gʌ 'a' ɓɑr mimnidɑ]

The sentences above mean "This is the 'a' sound of Chinese/Korean."

2.3. Recording procedure and data analysis

The recording was taken in a sound-proof booth. It used Kay company production PENTAX Model 6103 EGG and microphone. Both of them can put

the EGG signal and the speech signal to audio processing software in computer at the same time with sampling rate of 22 kHz. Each material was read twice at normal speed, and 20 points were selected for each sample. The original signal file, after using cutting and noise reduction functions of Audition1.5, extracted the needed parameters by means of a Voicelab program (written on Matlab). Next it was saved in Excel form. Then both Chinese and Korean parameters were compared, including male and female parameters. Finally Excel's *t*-tests for statistical analysis and graph functions were used.

3. RESULTS

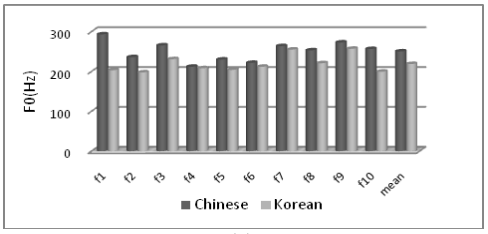
3.1. Phonation quality analysis

There are lots of acoustical parameters of phonation quality. Common parameters are: 1) F0; 2) OQ; 3) SQ and 4) H1-H2 [8].

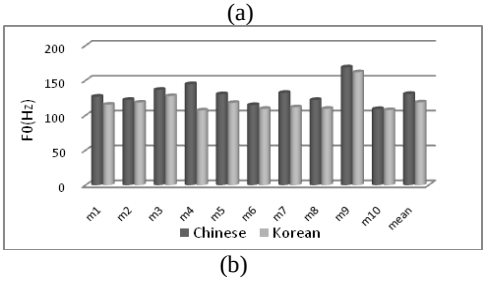
3.1.1. F0

Different types of phonation have different vocal cords vibration frequency, therefore, F0 is one of important aspects of reflecting voice quality features.

Figure 1: F0 data comparison of the Korean/Chinese vowel /a/, (a) for female, (b) for male.



(a)



(b)

Fig.1 shows the F0 change between two languages for male and female speakers respectively.

Generally the F0 values of modal voice ranges from 150 to 300 Hz for females and 100-200 Hz for males respectively. Clearly, all data is in range of modal voice, and results show that Chinese F0 values are higher than Korean F0 values without exception. The mean value of F0 for female is 251Hz in Chinese and 219Hz in Korean. As for males, the mean value is 131Hz in Chinese and 119Hz in Korean. These results were confirmed by statistical analysis (*t*-test). The change rate of F0 between Korean and Chinese, no matter what gender, are highly significant ($p<0.01$). Also the change rate of females are higher than males.

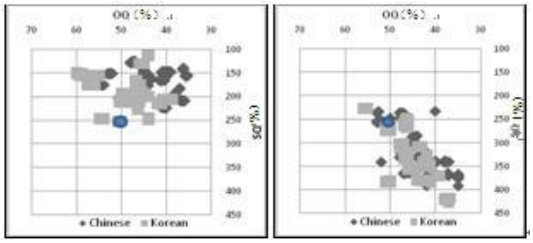
In brief, Korean learners of Chinese raise F0 to achieve specific voice quality of Chinese. In addition, based on Laver [9]'s study, it was reported that lax voices tend to have lower pitch, and from the result of F0 value, we can infer that Korean vowel is laxer than Chinese.

3.1.2. OQ and SQ

OQ is defined as the ratio of open phase and pitch period，and SQ is defined as the ratio of opening phase and closing phase [8]. With OQ and SQ parameters, Fig.2 visualizes directly the difference of the phonation types between females and males as well as Korean and Chinese. Because of space limitations, bar charts like Fig.1 were omitted.

Based on Laver [9] and Kong [8], the OQ value of modal voice is around 50%, and around 250% for the SQ value. As shown in Fig.2, phonation types of most female data for Korean vowel seems to belong to the modal voice and the breathy voice boundary, while most parameters of the Chinese vowel is close to between the modal voice and the creaky voice boundary. Compared to females, most male data belong to between the modal voice and the creaky voice boundary, and there is a large part that is overlapped.

Figure 2: The phonation type (OQ and SQ) chart of the Korean/Chinese vowel /a/, (a) for female, (b) for male.



(a) (b)

The specific results of this analysis showed that, OQ values of Korean are higher than Chinese especially for females, there is just one exception in males. The difference of OQ values between Korean and Chinese, no matter what gender, is shown to be highly significant (0.0002 for female, 0.0098 for male) statistically. Also the change was more obvious in female data, same as F0 result. The difference of the OQ value is one of a huge factor to distinguish different languages.

According to above results, from the view of native speakers, it is possible that the change of voice quality in female speakers would be more easily identified.

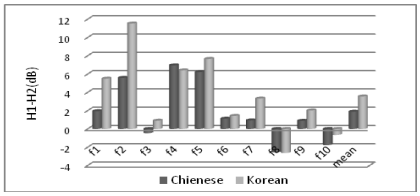
As for the SQ value, the result is overall the same as the OQ data. Most of the SQ values in Chinese are lower than Korean. The only difference is that the SQ data of the two languages are shown to have significant differences only in females ($p<0.01$). Because some inter-speaker variability was found, the statistical analyses demonstrated no significance for males.

It is notable that, OQ values of Chinese in both females and males are more close to a pressed voice feature, compared to the Korean. However, the results of Fig.2 shows that the SQ values of Chinese much lower than Korean, instead. There is a similar result concerning this. Wang [12] found that the SQ value of the tense voice is not always higher than the lax voice. It is not so clear whether the reason is specific phonation quality of Korean speakers or other factors, it is to be solved through further study.

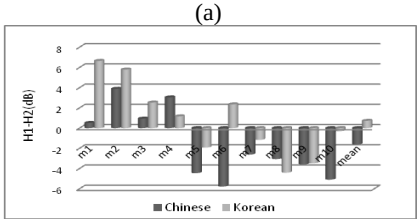
3.1.3. H1-H2

H1-H2 amplitude analysis has been widely used by linguists to infer the state of the glottis in distinguishing different phonation types [7, 8]. Physically, the lower value of H1-H2 has s pressed voice in general.

Figure 3: H1-H2 amplitude comparison of the Korean/ Chinese vowel /a/, (a) for female, (b) for male.



(a)



(b)

As it can be seen from Fig.3, no matter male or female, most subjects showed lower H1-H2 values in Chinese than in Korean. Although some exceptions were found in data (f4, f8, m4 and m8), the statistical analyses still demonstrated significances in male ($p<0.01$), so also in female data ($p<0.05$).

From the above results, it can be said that the Korean learners employed a relatively pressed laryngeal setting in Chinese compared to the one in Korean.

In a word, the results of phonation quality parameters revealed that there are substantial differences between both languages for Korean speakers.

3.2. Articulation quality analysis

Fant [10] pointed out that, because speech organs work in a systemic way, phonation is interacting with articulation unavoidably. Articulation quality is defined as the height of tongue and roundness of lips. In acoustic analysis, articulation is quantified by formants structure [8].

3.2.1. Formants structure

Formants structure can reflect resonant characteristics of both of two languages. As the position of your tongue relatively large change in different vowels, it can affect the height of larynx, and causes change of phonation quality. And raised larynx can raise all formants value as well as F0 value. On the contrary, lowered larynx can bring all formants and F0 values down [4].

Table 1: Comparison of mean values of formants for Korean(K)/Chinese(C) vowel /a/ for Korean speakers, (a) for female, (b) for male data.

		mean	Sig.	mean	Sig.
F1 (Hz)	C	977	0.3 ($p<.05$)	822	0.7 ($p<.05$)
	K	952		813	
F2 (Hz)	C	1497	0.7 ($p<.05$)	1437	0.4 ($p<.05$)
	K	1486		1482	
		(a)		(b)	

As can be seen above (Table1), the formants data between two languages are quite similar. The results show that there are no significant differences in each object statistically due to inter-speaker variability.

Based upon the above results of phonation and articulation quality analysis, it was found that generally Korean speakers didn't rely on articulation quality for producing Chinese specific voice quality in vowel, while mainly use the strategy of changing phonation quality.

4. DISCUSSION

Generally, phonation quality has not been emphasized in teaching and learning Chinese. However, the present study suggested that Korean students could notice differences of phonation quality in Chinese phonetics.

How could they observe differences between Korean and Chinese phonation quality? According to studies of Flege [5] and Best [1], the influence of L1 is essential to explaining this question.

The notable factor is, the Korean consonant system has a lax/tense contrast, and Cho, et al. [2] and Kim et al. [6] studies indicated that the F0 and H1-H2 values of Korean tense consonants are higher than lax sounds.

The table given below made comparisons between phonation quality parameters of Korean lax/tense sounds in CV syllables [2] and Korean/Chinese phonation quality parameters of the study above.

Table 2: Comparison of mean values of F0 and H1-H2 in Korean lax/tense contrast and Korean(K)/ Chinese(C) vowels for Korean speakers, (a) for lax/tense contrast, (b) for Korean/Chinese vowels. (D stands for difference)

	lax	Tense	D	K	C	D
F0 (Hz)	124	138	11%	119	131	10%
H1-H2 (dB)	4,2	-4.8	214%	0.7	-1.6	346%
		(a)			(b)	

Obviously, there were overall trends of changes in F0 and H1-H2 values between Korean lax/tense contrasts and Korean/Chinese parameters of the above study. In a word, Korean tense sounds correspond to Chinese vowel sounds for Korean speakers.

Combined with phonetic learning and perception models, the results suggest that due to Korean language having lax/tense contrast with different phonation qualities, it is possible that Korean speakers could be more sensitive to those features. Therefore, they process Chinese phonation quality by taking Korean lax/tense features as a reference.

The learners of different language backgrounds produce different L2 performances. It is worthwhile for further studies on how phonation qualities of L1 effects on L2 phonetic acquisition.

5. CONCLUSION

The results showed that advanced Korean learners produce Chinese with different voice quality features, compared to Korean. They who depend on higher F0, lower OQ, SQ and H1-H2 produce Chinese phonation quality characteristics, while articulation quality change is not quite remarkable. The general trends of the voice quality processing strategy of Chinese is the same in both males and females, while overall, female voice quality changes are more obvious than in males.

In addition, this study found that, the performance of Korean/Chinese phonation quality features for Korean students is quite similar with Korean lax/tense contrast features. It suggests that L1 transfer also plays a role in phonation quality perception and production of L2.

Finally, this study indicate that, due to phonetic features of L2 itself or in order to improve the nativeness of L2, the L2 learners at advanced levels should focus on the voice quality features of L2 naturally, and try to reflect the particular manners in L2 phonation.

6. ACKNOWLEDGEMENTS

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