World Academy of Science, Engineering and Technology
International Journal of Cognitive and Language Sciences
Vol:15, No:9, 2021

Comparative Study of Affricate Initial Consonants in Chinese and Slovak

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***Abstract*—**The purpose of the comparative study of the affricate consonants in Chinese and Slovak is to increase the awareness of the main distinguishing features between these two languages taking into consideration this particular group of consonants. We determine the main difficulties of the Slovak learners in the process of acquiring correct pronunciation of affricate initial consonants in Chinese based on the understanding of the distinguishing features of Chinese and Slovak affricates in combination with the experimental measuring of voice onset time (VOT) values. The software tool Praat is used for the analysis of the recorded language samples. The language samples contain recordings of a Chinese native speaker and Slovak students of Chinese with different language proficiency levels. Based on the results of the analysis in Praat, we identify erroneous pronunciation and provide clarification of its cause.

***Keywords*—**Chinese, comparative study, initial consonants, pronunciation, Slovak.

I. Introduction

THE comparative study of the affricate initial consonants in Chinese and Slovak facilitates the understanding of the distinguishing features of the consonants in Chinese and Slovak. We introduce the affricate consonants in both languages according to the manner and place of articulation and describe the differences between the varying place of articulation. We used software Praat for the linguistic analysis and processed recordings of a Chinese native speaker as well as Slovak native speakers in order to measure the length of VOT values. We also compiled recordings of Slovak native speakers to determine the mean VOT length for the Slovak affricates in the word-initial position. The distinguishing features of Chinese affricates that are foreign to Slovak learners are perceived as more difficult to acquire, therefore it is necessary to devote sufficient attention to the correct pronunciation of learners in the instruction practice as well as to select appropriate exercises aimed at the elimination of the learner's erroneous pronunciation of students.

II. Affricate Initial Consonants in Chinese

Affricate initial consonants in Chinese are composed of three pairs with their aspirated counterparts. Chinese affricates belong to the group of sibilants that are characterized by a hissing sound, and their acoustic energy occurs at a high frequency. Apart from the stricture, the friction sound of the Chinese affricates is produced by the airstream that is blocked by the teeth [1]. The Chinese affricates are considered homorganic consonants – the stricture and closure are formed at an identical place [2]. The closure in the oral cavity is formed by lifting the soft palate and its release is followed by the friction sound instead of the effect of an explosion, therefore the affricates are described as a combination of the closure and the friction sound. The affricates in Chinese are voiceless and the characteristic feature of this group of consonants is the presence of aspiration for the corresponding counterparts [3].

Based on the place of articulation, there are two alveodental initials: unaspirated *z* and its aspirated counterpart *c*, two retroflex affricates *zh* and *ch*, and two alveopalatal initials *j* and *q* (Fig. 1).

		alveodental	retroflex	alveopalatal
affricate	unaspirated	z [ts]	zh [tʂ]	j [tɕ]
affricate	aspirated	c [ts']	ch [tʂ']	q [tɕ']

Fig. 1 Affricate initials in Chinese in *Hanyu pinyin* and IPA transcription in brackets [3]

The articulation of Chinese retroflex initials *zh* and *ch* proceeds as follows: the tip of the tongue folds upwards and touches the palate and the tip of the tongue articulates against the posterior part of the alveolar ridge. Alveopalatal initials *j* and *q* are described as an intermediate articulation between the alveolar and palatal articulation [3].

III. Affricate Consonants in Slovak

Affricates in Slovak include two pairs of consonants differing in the place of articulation and both pairs are composed of a counterpart of a voiced and voiceless consonant. Comparably to Chinese, all four affricates in Slovak also represent hissing sounds. The prealveolar consonants *c* and *dz* are articulated by the tip of the tongue and the stop is formed with the tongue against the alveolar ridge. The closure of affricate prealveolar consonants *c* and *dz* is identical with the Slovak stop consonants *t* and *d.* The stricture is formed as by fricatives *s* and *z* – the tip of the tongue is brought directly against the lower teeth and airstream is pushed past the tongue to make a hissing sound. The postalveolar affricates *č* and *dž* are articulated with the active participation of lips. The blade of the tongue is behind the alveolar ridge and the tip of the tongue

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This study was created as a part of research project Contrastive Analysis of Chinese Consonants' Pronunciation by Using Praat supported by Research Grant for Young Researchers of the Comenius University in Bratislava, research grant nr. UK/306/2021.

elevates up to the palate. The soft palate closes the nasal cavity [4].

In comparison to Chinese, there are only two pairs of affricate consonants in Slovak (Fig. 2), therefore it is common that Slovak learners tend to replace the third pair of Chinese alveopalatal affricates *j* and *q* by alveopalatal stop consonants *ť* and *ď*. Despite the fact that Slovak students are familiar with the articulation of alveopalatal consonants, it is important to concentrate on their correct articulation of the alveopalatal affricates *j* and *q* in Chinese, because affricates *j* and *q* are not present in their mother tongue and belong to the group of consonants with a different manner of articulation.

		prealveolar	postalveolar
affricate	voiceless	c [ts]	č [tʃ]
affricate	voiced	dz [dz]	dž [dʒ]

Fig. 2 Affricate consonants in Slovak with IPA transcription in brackets

From the point of the place of articulation, the comparison of the affricates in both languages indicates that the distribution of the consonants in Chinese and Slovak do not have any place of articulation in common. Another distinguishing feature is the absence of aspiration in Slovak. Due to this fact, the learners might pronounce the voiceless Chinese initials as voiced consonants in their mother tongue. The successful acquisition of the retroflex initials is considered rather difficult to achieve, because the learners usually do not hold the tongue stable in the position long enough. In the case of Slovak learners, it is also common that Slovak students replace the Chinese unaspirated retroflex *zh* with the Slovak voiced postalveolar *dž* or unaspirated alveodental *z* in Chinese by voiced prealveolar *dz* in Slovak because of the audial resemblance of these consonants. Especially, inexperienced novice learners might be less sensible when distinguishing the manner and place of articulation of these initials in Chinese. As a result, the deviant pronunciation is reflected as the negative VOT value instead of the positive value applicable for Chinese affricates.

IV. Experimental Measuring of VOT

VOT refers to voice onset time (*sangyin qishi shijian* 嗓音起始时间) and represents the time duration between the release of the closure and the start of the voicing [2]. We employ Praat as a tool for analyzing the recordings of a Chinese native speaker representing the standard for VOT values, three Slovak learners of Chinese as well as ten Slovak native speakers to provide an overview of the mean VOT values of Slovak affricates. The language samples are composed of morphemes with affricate initials in Chinese and Slovak words with affricates in the word-initial position.

Table I displays the mean VOT values of Slovak affricates and based on our measuring, there is only a slight difference between the VOT values of female and male speakers. It might be caused by a lower number of male subjects in the group (six female and four male). The negative VOT values were measured for voiced affricates *dz* and *dž* whereas the voiceless affricates *c* and *č* have relatively high positive VOT values.

TABLE I
Mean VOT Values of Slovak Affricate Consonants in Initial Position (ms)

	Mean Value (M)	Mean Value (F)
dz	-105	-99
dž	-132	-111
c	82	82
č	105	105

The articulation of affricates is more complicated in comparison to the stop initials, therefore the VOT values are also comparably higher. The mean VOT value of unaspirated affricates *z, zh,* and *j* is 46 ms, and their aspirated counterparts *c, ch, q* have mean VOT value 123 ms [5]. Table II displays the results of our measuring of the VOT values of Chinese affricates. NS refers to the native speaker, student 1 is a beginner, student 2 is an intermediate learner and student 3 is an advanced learner of Chinese. Based on the results, the measured VOT values of the individual affricates in the recordings of the intermediate and advanced learners are within acceptable limits when compared to the values of the native speaker. The VOT values of the novice learner cannot be measured due to the incorrect pronunciation of *z* and *q*. The negative VOT value of the unaspirated affricate *j* refers to the interference of the learner's mother tongue.

TABLE II
Experimental Measure of VOT Values (ms)

	NS	S1 (beg.)	S2 (int.)	S3 (adv.)
z	75	xx	85	86
zh	32	57	30	43
j	70	-45	43	60
c	167	133	103	180
ch	142	102	172	172
q	143	xx	141	118

The negative VOT value – 45 ms corresponds to the value of voiced stop consonants in Slovak [6]. The learners in the initial stage of Chinese language acquisition tend to employ an incorrect manner of articulation transferred from their native language, because the Chinese affricate *j* might audibly resemble the pronunciation of Slovak stop consonants *ď* or *ť*.

Fig. 3 displays the comparison of the correct pronunciation of Chinese affricate *j* and deviant pronunciation of student 1. The negative VOT is displayed at the beginning of the waveform visible in the oscillogram whereas the oscillogram of the native speaker displays the positive VOT value. Fig. 4 displays the measured VOT value of voiced stop consonant *ď* marked in the red section. The negative VOT value of Fig. 4 is more zoomed in to demonstrate the waveform of a voiced consonant (compare Fig. 3 (b)).

Based on our findings, the interference of the learner's mother tongue is not present in the pronunciation of Chinese affricates *z* and *zh*, but as described in the case of Chinese

affricate *j,* there is another audial resemblance to the Slovak consonants *dz* and *dž* respectively. Similarly, the possible interference of the learner's mother tongue shifts the positive VOT value corresponding to voiceless affricates *z* and *zh* to the negative VOT of Slovak voiced consonants *dz* and *dž.*

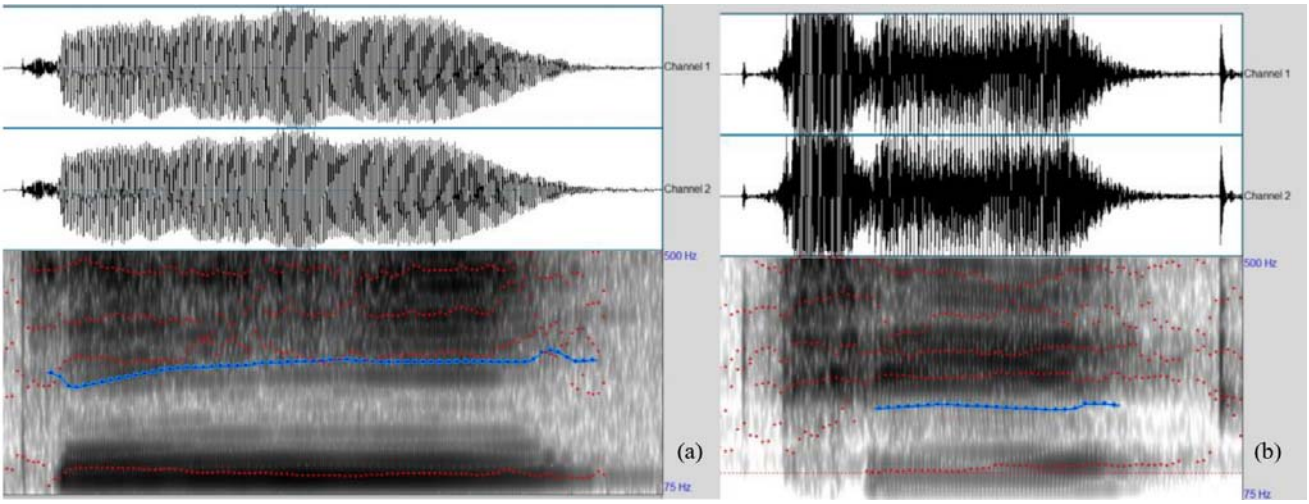

Fig. 3 Oscillogram and spectrogram of Chinese affricate *j* (a) and erroneous pronunciation of *j* by S1 (b)

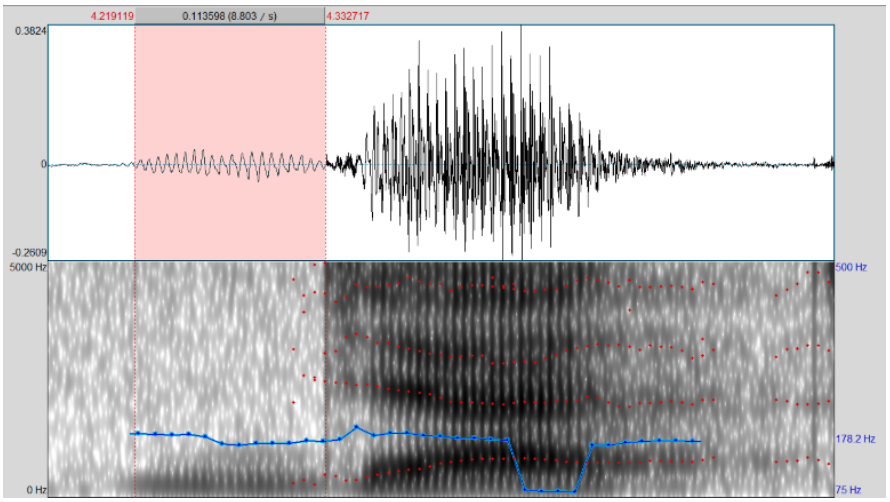

Fig. 4 Oscillogram and spectrogram of Slovak voiced stop consonant *d'*

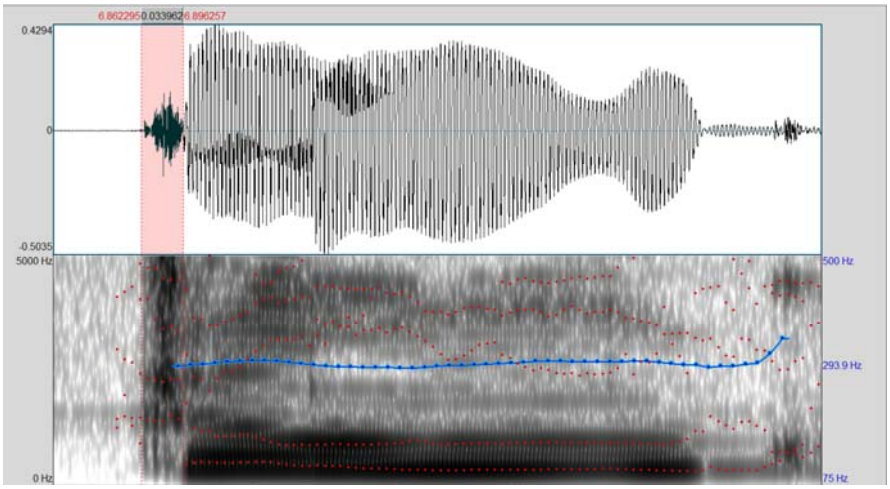

Fig. 5 Oscillogram and spectrogram of Chinese affricate *zh*

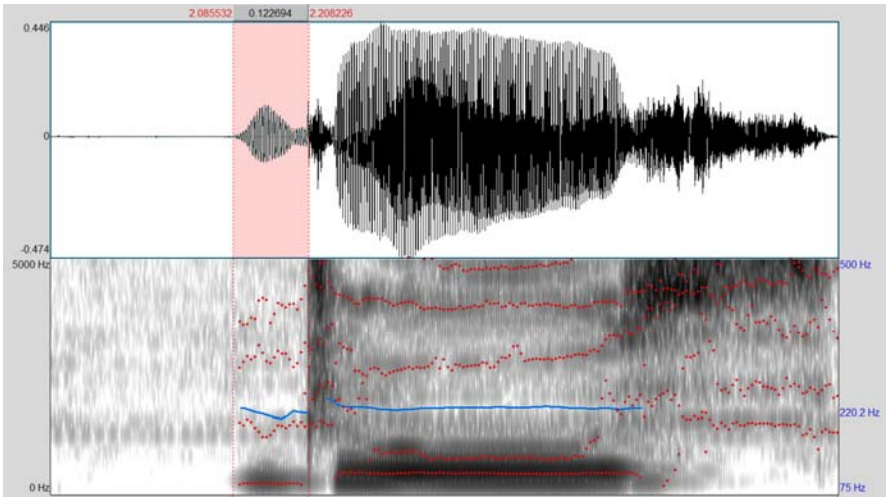

Fig. 6 Oscillogram and spectrogram of Slovak affricate *dž*

When comparing Figs. 5 and 6, we observe an evident difference between the waveform of the unaspirated voiceless affricate *zh* and voiced affricate *dž*. The VOT values are marked in the red frame.

V. Pronunciation Exercises

When acquiring the correct pronunciation of the Chinese affricates, the common learner's errors across different nationalities are divided into two main categories. The former is represented by the indistinct pronunciation of alveodental affricates *z* and *c* mixed with the pronunciation of the retroflex affricates *zh* and *ch*. The latter is the replacement of the retroflex affricates *zh* and *ch* by the pronunciation of the alveopalatal initials *j* and *q* [7].

Pronunciation exercises represent an important part of the instruction practice. The appropriate selection of the morphemes composed of the affricate initials with different place of articulation facilitate the learner's acquisition process and help them to master the varying points of articulation. Moreover, the pronunciation exercises strengthen the learner's ability to differentiate the individual Chinese affricates and enhance the elimination of incorrect pronunciation.

zh – zh	政治	ch – ch	长城
j – j	拒绝	q – q	全球
zh – j	直接	ch – q	出奇
j – zh	进展	q – ch	汽车

Fig. 7 Pronunciation exercise [7]

VI. Conclusion

Taking into consideration the prevailing research devoted to the acquisition of Chinese with the primary focus on English as a learner's native language, it is also necessary to concentrate on the study of the processes related to the acquisition of the pronunciation in Chinese in other language combinations than Chinese – English. From the point of instruction practice, the findings related to the learner's main difficulties represent an important source of information and facilitate the curriculum design. There are limited studies focused on the Slovak learners and we have to compile a sufficient amount of language material for conveying a complex analysis of the major difficulties and error of the Slovak learners. Further research enables the comparison of the generally established error categories introduced by Chinese scholars based on the heterogeneous group of learners originated from various countries with the typical errors of Slovak learners. As a result, we are able to adjust the employed teaching methodology aimed at the improvement of the erroneous pronunciation of Slovak learners.

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