Using a Somatically Enhanced Approach to correct 4th tone errors of Vietnamese Learners of Chinese

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Abstract

The continuing flow of new immigrants in Taiwan in the last ten years is placing significant pressure on the provision of transitional Mandarin Chinese services on the Taiwanese government. To ease the pressure, the Taiwanese government invests annually in various programs which aim at providing Mandarin Chinese classes to newly arrived migrants through its municipal libraries. This chapter reports on such a class in beginning Chinese in the Taipei City Library in 2020. The participants in this paper came from a family from Vietnam. In the course, an inclusive and unified approach in teaching beginning speaking pronunciation skills was used. This approach is known as the Somatically Enhanced Approach to language teaching (SEA) (Zhang, 2006) developed by the author of this paper. SEA aims at teaching the prosodic and phonetic systems of Mandarin Chinese by developing the proprioception of the body. Teaching techniques included the use of humming, clapping, and movements to highlight the nature of Mandarin tones and other characteristics of Mandarin Chinese. At the end of a 12 weeks 2 hour per week course, participants demonstrated the results of their learning through conversations. This paper would provide a close linguistic analysis of participants' oral performances.

Keywords: zero beginners of Mandarin Chinese of Vietnamese origin, Somatically Enhanced Approach, contrastive analysis, and error analysis of Vietnamese learners of Mandarin Chinese

Introduction

In July 2020, a private university in Taipei cooperated with the Multicultural Resource Centre of the Taipei Municipal Library to conduct a 'Basic Chinese Speaking Course' for newcomers and foreigners to develop Chinese basic ability to listen and speak to Taiwan. The course hoped to enable newcomers to integrate quickly and effectively into Taiwanese society and culture.

Literature Review

This chapter first conduct a contrastive analysis between the Mandarin Chinese tone system and the Vietnamese language. Then the differences between the Vietnamese language system and their influence on these Teaching Chinese Second Language (TCSL) students' acquisition of the Chinese pronunciation system will be discussed. In the last section of the chapter the Somatically Enhanced Approach (SEA) to language teaching will be detailed.
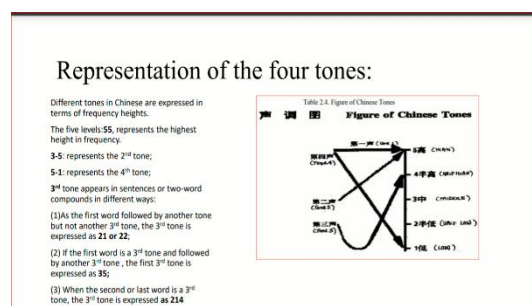
Mandarin Chinese Tone system

Figure 1 Chao (1930)'s the Figure of Mandarin Chinese Tones

Chao (1930) proposed to use 1, 2, 3, 4, and 5 to indicate height and shape of tones (see Figure 1). In this study, "1" expresses the lowest tonal value; "2" expresses the next lowest tonal value; "3" expresses the middle tonal value; "4" expresses the next highest tonal value and "5" expresses the highest tonal value. In most textbooks, the tones are graphically represented by the Figure of Chinese Tones as shown in Figure 1. Each number does not denote a particular absolute frequency value and the difference between the five different levels does not correspond to any *standardized absolute* frequency value measured in Hz. They only reflect the contrasts between highs and lows. An important feature of this notational system is that it relies upon the perceptive experience of NSs to judge the difference between the different tones. The determination of each tonal level depends on the height difference between the beginning of a tone and the end of a tone. For instance, in

Mandarin, 1st tone is usually pronounced as high compared to other tones (e.g., 媽: mā: mother, the value for this tone can be then assigned as 55. For the female Mandarin native speaker (NS) in Figure 2, 55 corresponds to at a frequency of 275.8 Hz in pitch for the syllable 'ma' (55) (Figure 2).
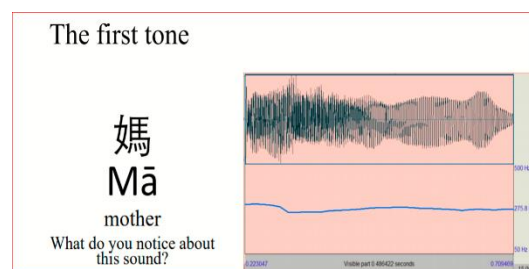

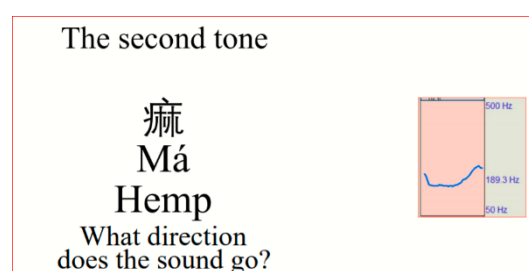**Figure 2** Pitch height depiction for 55 using Praat.

Figure 3 Pitch height depiction for 2nd tone using Praat.

2nd tone: The starting point of the 2nd tone is neither high nor low and its end point ends on nearly the same height as the 1st tone, so its tonal value can be assigned as 35 (e.g., 麻: má, hemp). Please see Figure 3. In running speech, 2nd tone is usually longer than 1st and 4th tone (葉德明, 2005). The vocal cord is gradually becoming tense (Sundberg, 1979).

One of the most interesting phenomena involving tones in the Chinese dialects is called tone sandhi. For instance, the 3rd tone, when it is in its citation form, i.e., alone, it falls first and then rises. It starts low. Therefore, this can be assigned a value of 2. It then falls to the same lowest level 1, then it rises to the medium high level, which is level 4. Therefore, the tonal shape of 3rd tone in citation form is 214 (e.g., 馬: mǎ: horse).

However, two important tone sandhi rules in Mandarin involve the 3rd tone in running speech when 3rd tones are surrounded by other words in running speech:

Tone sandhi rule 1: When a 3rd tone syllable is followed by a syllable with any tone other than another 3rd tone, the 3rd tone syllable changes to a low-tone syllable with the pitch contour 21. For example, when mǎ 'horse' is followed by another syllable such as chē 'vehicle' (see Figure 4), the

sequence is pronounced with following tone sequence: mǎ (21) with a frequency range of 224.56 to 152.43Hz, a drop of 72.13 Hz; chē (55) was produced with a frequency range of 282.06 to 254.88 Hz, a drop of 27.18 Hz. The drop in 馬 is 2.66 times larger than that of 車. The drop in frequency for ma (21) che (55) occurs in a similar manner when a 3rd tone is followed by 1st tone, 2nd tone, 4th tone and neutral tone. However, in textbooks it is still labelled with the 'v'(214) diacritic, thus making the perception of 3rd tone potentially confusing for students.
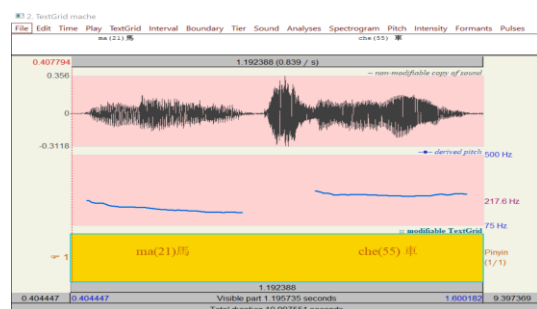

Figure 4 Realization of 'mǎ (21) chē (214) by Praat

Tone sandhi rule 2: When a 3rd tone syllable is followed by another 3rd tone syllable, the first one changes into a 2nd tone. For example, '你'(214, you) and '好' (214, good) both have 3rd tones. When they are in sequence, '你好' 'hello', the 3rd tone of '你' (in citation form 214) is changed to the 2nd tone (35) and tone on '好' remains 214. Again, there is a discrepancy between the labelling of these words in textbooks and their actual phonetic realization. In textbooks, both 3rd tones are labelled using the same 'v' diacritic.
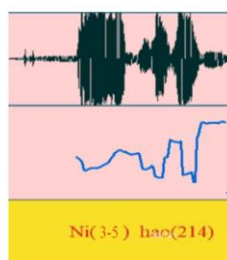

Figure 5 Realization of ni (35) hao (214)

4th tone: The starting point of the fourth tone has the same height as the 1st tone which is level 5. However, its end point is the lowest, therefore can be assigned as 1. So, for the fourth tone, from the highest to the lowest, the tonal value can be assigned as 51 (e.g., ma (51) 罵, to scold). Please see Figure 6. Notice the production of the tone is short, and because of its extremely lowness, a human voice might break a little when producing this tone.
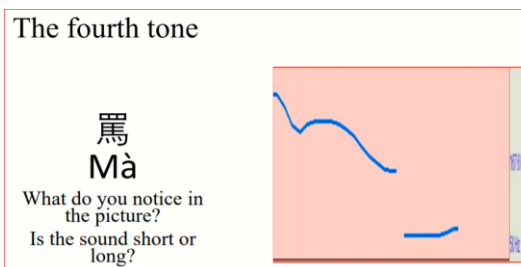

Figure 6 Realization of ma (51)

The segmental part of the Chinese words is represented by the widely known and accepted romanization system called Pinyin romanization system in this chapter.

In conclusion: The tonal range for Mandarin Chinese for this female native speaker from the highest tone (1st tone) to the lowest tone (4th tone) is from 276 Hz to 70 Hz. In the audition process, L2 students of Mandarin Chinese's first job is to segment the prosodic features of Mandarin. To achieve this goal, Professor Yeh De-ming (2005, p. 43) suggested that the cognitive procedure of pronunciation adjustment involves the following:

Input: '意識（知覺）(consciousness as awareness) 感受(perception), 注意(noticing), 理解(understanding) 意向，知識 (intention, knowledge) 記憶(memorization)'

Output: 對比(contrasting) 自我檢查 (self-monitoring) 自我修正(self-correcting) 自我評估(self-assessing)

To achieve the objectives listed above, learning strategies that can be use are: 重複(repetition) 推理 (reasoning) 分析(analysing) 綜合(synthesizing)

However, to understand how L2 students' learning of Mandarin might be influenced by their mother tongues, the pronunciation systems of the three mother tongues of L2 students involved in this study will be discussed next.

Comparison of L2 students' native Languages and the Chinese Tone System

The Vietnamese tone system

Below is a short summary on the Vietnamese language taken from (Hirst & Di Cristo, 1998). Vietnamese makes use of the Latin alphabet with diacritic signs, like those in Mandarin Chinese, to indicate the tone of the syllable. The standard orthography corresponds to the Northern variety of Vietnamese which has six lexical tones. Please see Figure 7.
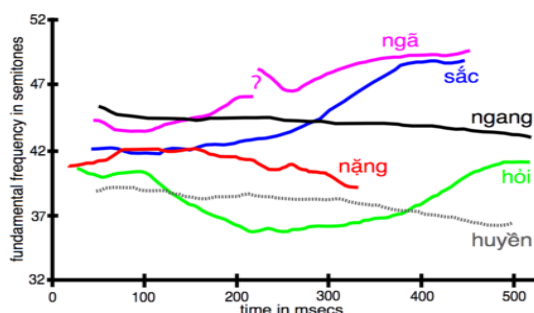
Figure 7 Northern Vietnamese (non-Hanoi) tones as uttered by a male speaker in isolation. Taken from NGUYỄN and EDMONDSON (1998)

According to NGUYỄN and EDMONDSON (1998) :

Sắc (á) is high and rising (perhaps nearly level at the high point in rapid speech) and tense. It is assigned a value of 35 according to the Chao's scale of five-point for transcribing tones.

Thanh ngã (ã) is also high and rising (in other words, the contour is roughly the same as that of sac), but it is accompanied by the rasping voice quality occasioned by tense glottal stricture. It is assigned a value of 44 according to the Chao's scale of five-point for transcribing tones.

Thanh ngang (a) is lax; in contour it is nearly level in non-final syllables not accompanied by heavy stress, although even in these cases it probably trails downward slightly. It is assigned a value of 33 according to the Chao's scale of five-point for transcribing tones.

Thanh huyền (à) is also lax, starts quite low and trails downward toward the bottom of the voice range. It is assigned a value of 21 according to the Chao's scale of fivepoint for transcribing tones.

Thanh hỏi (ả) is tense; it starts somewhat higher than HuS1 and drops rather abruptly. In final syllables, and especially in citation forms, this is followed by a sweeping rise at the end. It is assigned a value of 42-11-42 according to the Chao's scale of five-point for transcribing tones.

Thanh nặng (ạ) is also tense; it starts somewhat lower than hoi. With syllables ending in a stop [p, t, ch, k] it drops only a little more sharply than HuS1 tone. It is assigned a value of 32 according to the Chao's scale of five-point for transcribing tonesNga tone is also high and

rising (in other words, the contour is roughly the same as that of sac), but it is accompanied by the rasping voice quality occasioned by tense glottal stricture. It is assigned a value of 44 according to the Chao's scale of five-point for transcribing tones.

For female speakers, the mean value of high tones is around 250 Hz whereas that of low tones is around 190 Hz.) In continuous speech, tones are generally affected stressed vs. unstressed syllables; influence of neighbouring tones; tempo. All authors agree on the absence of tonal neutralization due to "sandhi" in Vietnamese, a phenomenon which occurs in other tone languages like Chinese and Thai. The overall movement of the fundamental frequency on a sentence is that in which the last syllable bears one of these three lexically rising tones, the final contour is rising.

In conclusion, the L2 student group of students for this study consisted of data from 3 students from a tonal language (Vietnamese). Due to their distinctively different pronunciation system of their mother tongues, the training of Mandarin tonal perception and production cannot simply by providing students with simple verbal explanations or tonal chart or diacritics to teach tones in Mandarin Chinese. A unified approach that taps directly into each student's cognitive system as outlined by Professor Yeh is the only way forward.

A Somatically Enhanced Approach

Zhang's (2006) Somatically Enhanced Approach was constructed on the understanding of the physical properties of speech according to acoustic phonetics [18] . According to acoustic phonetics, the sound of any language carries all frequencies (at various intensities) from about 50Hz to about 16,000Hz (Lian, 1980). In one's mother tongue, one's ear is trained to choose what to hear in practice. Second-language students tend to use what (Trubetzkoy, 1939) calls the 'mother tongue sieve' that is, learning the target language by using familiar sounds in the mother tongues. Students who have difficulty with the pronunciation of a particular foreign language are considered unable to recognize its optimal frequency band (through perception) and, as a result, they are no longer able to produce speech correctly (Lian, 1980). In addition to this, the 'meaning' of speech is through the speaker's rhythm, intonation, loudness, beat and linguistic elements. Most importantly, the auditory

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[18] Acoustic phonetics is a branch of phonetics, also known as acoustics. Acoustic phonetics is the study of the physical properties of speech that propagates between the mouth and

the ear (Crystal，1997).

information people produce reflects how they perceive language (Renard, 1975). If we correct his/her language (output), we also correct his perception of language (input). Therefore, one of the most important strategies for teaching is error correction in the audition phase. In fact, error correction of L2 students' output allows them to accurately attend to or focus on the element(s) of the language to be learned by identify what these elements are and what to absorb into the students' short-term memory.

Zhang (2006) conducted an experimental study using SEA by dividing the two groups of students, who were native speakers of English, into a control group and an experimental group. Students from the experimental group significantly widened their pitch range[19] when speaking Mandarin particularly for male students. Comparison of the male subjects' voice quality reveals that when speaking Mandarin, experimental group of male subjects' voice quality was more like that of the Mandarin Chinese NSs.' SEA also provided students with useful memory tools and strategies to learn both in the classroom and in self-directed learning.

Contrastive analysis between Mandarin and the three mother tongues of the students reveal that Vietnamese students whose mother tongue is also tonal might have an easier time learning Mandarin Chinese, but they would also encounter persistent problems such as the consistent problems of not being able to produce the 4th tone in Mandarin which is much lower than the Vietnamese low-level tones (Wu & Hu, 2004; 黃雅菁, 2017). Mandarin students from alphabetic languages such as Tagalog and Hindi, on the other hand, would need to 'rewire' their brains to accommodate the perception of tones and retrain their oral apparatus to produce tones in Mandarin.

The Sensitization Session

In a two hour per week course, this session takes place during the first hour of the two-hour contact. It should normally occur in a room, where tables, chairs, etc., can be rearranged to leave space in the middle of the room as possible.

Step1: Humming

"Now, get up and stand in a circle." The teacher joins the circle. The teacher says, "I will hum to the intonation of the sentence without vowels and consonants and please hum with me while walking slowly in a circle." This is done for 5 times. This is used to highlight the intonation and tones of Mandarin without the interference of

vowels and consonants. As the input and output of the language uttered mutually reinforce each other, such a structure should be easy to produce a maximum of 5 to 7 syllables. Second, humming allows them to develop a much better perception of the melodic patterns concerned. Third, this, like every other subsequent phase, would serve to reinforce the preceding one.

Step 2: Clapping to the rhythm of sentences.

"Now, I will clap to the rhythm of the sentence and then you can clap after me while walking in a circle." This is done for 5 times again. The intonation of the sentence is again hummed in this fashion while the clapping is taking place. The students, while listening to and "feel" the intonation patterns, begin to move in harmony with the rhythm and intonation of the sentences modelled by the teacher. The teacher demonstrated the beat of this sentence by providing beats for that group of words in the following manner:

[nǐ] [jiào] [shénme] [míngzi]?

1beat 1 beat 2 beats 2 beats

The clapping to the intonation patterns created a rhythm that students could follow while walking in a circle.

Step 3: Incorporation of movement and gesture

0ne of the major problems encountered by foreign language students is that they attempt to utter sentences in the foreign language while unconsciously preserving the set of movements that normally functions in their first language (Gassin, 1990). A synchrony of this nature leads to failure to reproduce the appropriate stress patterns of the foreign language in question. The humming and walking to the rhythm in steps 1 and 2 are also designed to develop synchrony of the body with the target language.

Research has shown that experience in learning a tone language is necessary for categorical perception of tone distinctions (Gandour, Wong, & Hutchins, 1998), Wong, & Hutchins, 1998; Van Lancker & Fromkin, 1973; Wang, Jongman, & Sereno, 2001 cited in (Werker & Tees, 2005). Moreover, direct experience in learning a tone language would result in left-hemisphere lateralization for perception of tone contrasts. Research on American bilingual speakers of Mandarin show that Chinese speakers have a much wider voice range when speaking Mandarin than English speakers speaking English

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[19] Pitch range: Highest point of the fundamental frequency of a person's voice through to the lowest point of the

fundamental frequency of a person's voice level.

(Chen, 1974). This indicates that the experience of learning a tone language such as Mandarin should manifest in physical changes in the lateralization of the brain and in the voice qualities of the speakers. One of the mechanisms, especially in terms of pitch, tension was proposed to describe how different muscular effort changes the production of sounds.

Tension is a term used in phonetic classification of speech sounds, referring to the overall muscular effort used in producing a sound. Tense sounds are sounds produced with a strong muscular effort, involving a greater movement of the (supraglottal) vocal tract away from the position of rest (cf. fortis) and a relatively strong spread of acoustic energy. The opposite term in Jakobson and Halle's system is lax (Crystal, 1997).

Zhao (1987) described the four tones of Mandarin in terms of varying degree of tenseness of the vocal cords. Corresponding gestures have been developed (Zhang, 2006) to produce the various tensions of the four tones in Mandarin and are described as follows:

Step 4: Gestures

1st tone requires the vocal cords to be tensed and to be kept tensed.

For students to experience the tensing of the body tension when pronouncing the 1st tone, underward movements and tensing of their stomach muscles are particularly important because the tension felt in their stomachs which allows students to perceive the different quality of the down tone in Chinese thus allowing them to generate the language through that *feeling* in their body. This can be achieved by having very tense hands, then push upward and then across keeping the gesture level with hands high above their own heads and keep to this posture, when pronouncing 1st tone.

2nd tone: the vocal cords are at first neither tense nor lax, then become tense gradually at 45oc towards the top of one's head. This tone is longer than 1st and 4th tone (葉德明，2005). Students are advised to start from the waist level, using very tense hands with the fingers spread out and the palms facing upwards, then tense up their arms and the whole of the upper body with the elbows held close to their body, then gradually push their hands up at 15 degree directly over their heads while pronouncing the 2nd tone.

3rd tone: the vocal cords become lax immediately after tense, and then tense up again. However, this description is only accurate in citation form, i.e., the 3rd tone as a single syllable.

In running speech, 3rd tone is either realized as (1) a lower-level tone before a 1st tone, 2nd tone, 4th tone or a neutral tone or (2) a 2nd tone before 3rd tone according to the tone sandhi rules. A low-level tone (22 or 21) can be made with a relaxed posture. The second tone sandhi change of 2nd tone to 35, the same 2nd tone gesture can be used.

4th tone: the vocal cords suddenly tense, and then lax gradually.

When it is necessary to go from tense muscle to lax muscle very quickly such as producing 4th tone, they were instructed to first raise their hands up high like what they were doing in 1st tone, thus tensing their bodies. Furthermore, since in general words with "4th tone" are louder than the rest, they stamp their foot last.

In Zhao's description, tenseness of muscles is involved in every tone. In addition, 1st, 2nd, and 4th tones all start at a very high frequency (55) level, a frequency usually higher than the highest point of these L2 students' own pitch range including the Vietnamese students thus necessitating the use of physical training to stretch their muscles to expand their pitch ranges. These gestures are artificial, but necessary to help set up the overall body tensions to produce the required speech.

By the time the sensitization session is finished, they would have had a considerable amount of intensive practice in the production of melodic patterns, accompanied by a development of their self-synchrony. When asked to reproduce them, they would be able to "remember" the pattern based on their acoustic impressions and a set of physical tensions which would complement the tones.

Step 4: Mouthing the words.

In this step, the teacher instructs students by saying "Continuing with the movements, now mouth the sentences while I say them out loud." For the first time in the learning sequence, so far, students were hearing an intelligible sentence with vowels and consonants included. They were asked not to say anything but merely to mouth the words. Mouthing the words gives students the opportunity to practice the articulation of the sounds of the words without producing them themselves.

Step 5-6: Adding words to the intonation patterns.

The teacher then says, "Now repeat after me, and then add words to the intonation." This again is done for five times. The teacher then instructs each student to repeat the sentence by themselves;

checking that each student is reproducing the sentence correctly (Step 6).

Step 7：Repetition exercises

Repetition first takes the forms of chorus work and then individual repetition which could reduce anxiety about speaking to a minimum. To improve interactivity, a ping pong game (Zhang, 2006) could be played with the newly acquired target language. By the time the students completed an "average" sensitization session, they would have repeated the same pattern or a set of closely related patterns in their situated context about 35-40 times. Repetition exercises such as

this obviously provided reinforcement at both the perceptual and articulatory levels.

Step 8 Checking for meaning.

The meaning of the utterances in English is usually established in seconds. Throughout the learning sequence, translation and writing down sentences are left to the last part of the session as a means of reinforcing internalized prosody of the sentences.

In the second hour, the whole class engaged in pair or group work in conversation activities using the materials covered in the lesson.

Research methodology

Participants

Research participants of this study were all zero-beginners.

Table 1 Basic Information of participants

Students	Gender	Nationality	Education levels	Occupation	Languages spoken	Length of stay in Taiwan
S1	Female	Vietnamese	University	Diplomatic spouse	Vietnamese, English	7-12 months
S2	Male	Vietnamese	Master's degree	Diplomat	Vietnamese, English	7-12 months
S3	Male	Vietnamese	High school	Son of the diplomat	Vietnamese, English	7-12years

Textbook

The textbook 'Practical Chinese 1', designed and published by Professor Felicia Zhang was used. The research subjects were taught for 12 weeks with two hours of teaching per week from July 05 to September 29, 2020, in Taipei, Taiwan.

Results

In Week 3, the teacher started the lesson which a review of tones using gestures. After reviewing previous week's work, content of the unit '你從哪裏來?' (Where are you from?) was covered. In Week 3, the Vietnamese family, consisting husband(S2), wife (S1) and the son (S3) joined the class. A parallel expression (often heard in Taiwanese society) 「你是哪國人?」 (nǐshìnǎguórén) was also taught.
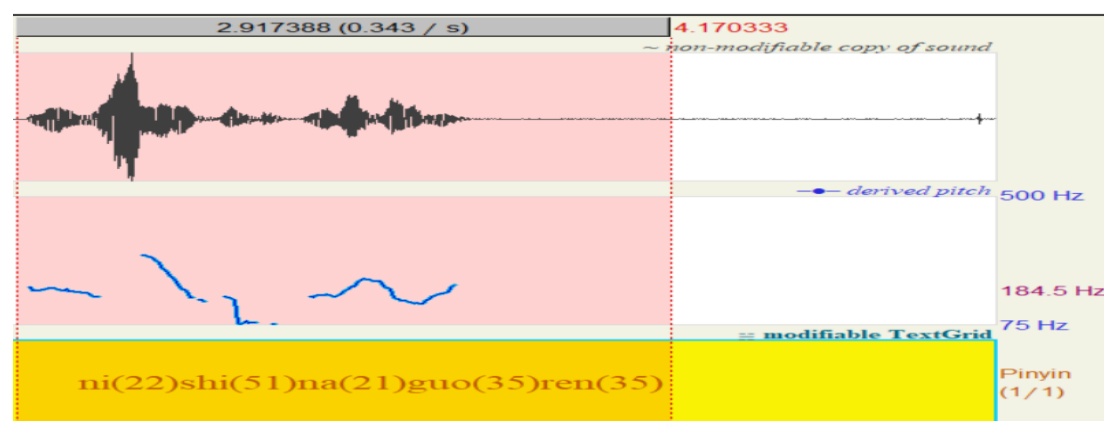
Figure 8 A native speaker's rendition of 「你是哪國人?」 (nǐshìnǎguórén) using Praat.

For this sentence, even though it is realized as ni (22) shi (51) na(21) guo (35)ren(35) in speech, in textbooks it is labelled as 「你是哪國人?」(nǐshìnǎguórén). Clearly this would create confusion in students especially for Vietnamese students. Focussing on diacritics of the tones in Mandarin would only cause Vietnamese speakers to compare tones in their language with that of Mandarin. Teaching tones through gestures and students were required to use gestures and movements to 'feel' the tenseness and laxness of the muscles in their body.

Table 2 Student-teacher interactions in the practice of 你是哪國人? in week 3

Sentence structure「你是哪國人?」(nǐshìnǎguórén)			
Lines	Speaker	Content	Errors and teaching strategies
1	S2	你 *是 ？ nǐ*shī	2 characters，1 error
2	T	你是 (Throw down your right hand and stomp your right foot)	Recast and gesturing for the 4th tone.
3	S2	你 是 *哪 *國 人? nǐ shì *ná *guǒ rén	5 characters，2 errors
4	T	哪國人?	Recast and gesturing for the 4th tone.
5	S2	你 *是 哪 國 人 ？ Nǐ*shī nǎ guó rén	5 characters，1 error
6	T	你是 (Right hand downward) stepping on the right foot ~ emphasis).	Explicit correction with gesture
7	S2	你 *是 哪 國 人 ？ nǐ *shī nǎ guó rén	5 characters，1 error
8	T	是(Throw down your right hand and stomp your right foot)	Recast and explicit correction using gesture
9	S2 T	你 *是　 哪 國 人 ？ nǐ *shī　 nǎ guó rén ([是] is prolonged, and stomping foot) ok! Wait do that…….	Still incorrect, prolonging it seemed to enable S2 to produce something like nang or ngang, but not the Chinese 4th tone.
10	T	是 人 is meaning what? S3： people T : people ,so there ask me 你是哪國人? 　So what country are you from?	Correcting S2's production of 'shi'(51) by emphasizing with palm down) Clarification strategy for 'ren'(35). 哪國人? Explanation in English
39	S1	我 是　 越 南 人。 wǒ shì yuè nán rén	5 characters，
40	T	Very good! Please ask S2.	
41	S1	你 *是 哪 國 人? nǐ *shí nǎ guó rén	5 characters，1 error

Note：T=teacher, errors are indicated in italics and with a *, S1 (female) and S2 (male): Vietnamese

Table 3 Distribution of tonal errors of the two Vietnamese students in Week 3

Tones	S2			S1			
	no. of tones	errors	Errors%	no. of tones	no. of tones	errors	Errors%
1st tone	1	0	0%	0	0	0	0%
2nd tone	10	2	20%	6	4	0	0%
3rd tone	11	1	9%	5	3	0	0%
4th tone	7	5	**71%**	4	3	1	**33%**
Neutral	0	0	0%	0	0	0	0%
Total	29	8	28%	15	0	1	10%

Note: S1(female) and S2 (male): Vietnamese

For the Vietnamese group, most of the tone errors were with the 4th tone. For instant '是' (51) were all produced as (55). In Table 3, S2 and S1 both made 71% and 33% errors in the 4th tone even after the teacher stamped her foot and explained explicitly how low the 4th tone should go but there was no effect. S2 could not produce the 4th tone confidently until he explicitly did the action of stamping his foot to produce the 4th tone. S1, S2's wife also produced '是' (51) as the 1st tone (55). Week 3 was S1 and S2's first week in the course. Their inability to produce the 4th tone through imitating and hearing only could be because they failed to contrast the tones in Vietnamese with the 4th tone in Mandarin. Therefore, without special action to enable the body to produce a very sharp drop to a very low-level tone, errors in 4th tone production in Mandarin have become a signature error of Vietnamese speakers of Mandarin as a second language.

Results of the final oral tests:

Did the learning during the 11 weeks (a total of 22 hours) result in better performance on the part of Vietnamese students?

Out of the 2 participants, student 3 acted in the oral role play with his father Student 2. Table 4-5 describes the distribution of errors of individual students in the final oral test.

Table 4: Error analysis of Student 1's final oral performance at the end of the semester.

Tone name	Student 1's total no. of tones (Vietnamese)	Student 1's tone errors
1st tone	53	1
2nd tone	38	2
3rd tone	24	0
4th tone	85	3
Neutral tones	63	6
Total no. of tones and errors	262	12
% of errors	100	4.6%

Student 1's data revealed that she only produced 262 syllables and only made 12 errors, this amounts to 4.6% of errors. Among the 12 errors made, 1/53 was 1st errors, 2/38 were 2nd tone errors, 3/85 were 4th tone errors, 6/63 were neutral tone errors. The characteristics of Student 1's oral production were frequent errors in neutral tones such as 'tai (51) tai' and 'di (51) di'. Before a 4th tone, Student 1 often pauses so that she could pronounce the 4th tone correctly. One of the 4th tone errors occurred in the question 'ni (21) jiao(51) shen (35)me ming (35)zi?' , therefore the error in 'jiao' (51) was likely to be caused by the

intonation of a question in Vietnamese. Other two 4th errors occurred in 'tai(51) tai' and 'di(51) di' with both the first syllables and the neutral syllables mispronounced. Overall, with the 4th tone, out of 85 4th tones, only 3 errors were made, a significant improvement from their output in week 3's lesson.

Table 5 Error analysis of Student 3 and Student 2 at the end of the semester.

Tone name	Student 2's total no. of tones (Vietnamese)	Student 2's tone errors	Student 3's total no. of tones (Indian)	Student's tone errors
1st tone	21	1	32	3
2nd tone	18	0	40	1
3rd tone	53	4	61	1
4th tone	28	1	41	3
Neutral tones	31	1	29	0
Total no. of tones and errors	151	7	203	8
% of errors	100	4.6%	100	3.9%

Table 4's data revealed that student 2 produced 151 syllables and only made 7 errors, this amounts to 4.6% of errors. Among the 7 errors made, 1/21 was 1st errors, 4/53 were 3rd tone errors, 1/28 were 4th tone errors and 1/31 were neutral tone errors. Overall Student 2's errors in tones including 4th tone errors were greatly reduced.

Student 3 is S1 and S2's son. Student 3's data revealed that she produced 203 syllables and only made 8 errors, this amounts to 3.9% of errors. Among the 8 errors made, 3/32 was 1st errors, 1/40 were 2nd tone errors, 1/61 were 3rd tone errors, 3/41 were 4th tone errors and no errors were neutral tone errors. Student 3 was a middle school student who spoke Chinese daily in school with his friends. His errors were mainly mistakes in initial errors rather than tonal errors.

Conclusions and suggestions for teaching

Results in this study demonstrated that L2 students from tonal languages tended to learn Mandarin quicker. All students improved significantly at the end of the semester. Errors in Vietnamese students' 4th tones were significantly reduced.

One significant strategy used by the teacher was that in her feedback to students' output, the teacher consistently used gestures for tones to accompany the feedback strategies, particularly the tensing of stomach muscles to enable the production of tones that start high (1st and 4th

tones) and tone that ends high (2nd tone). Given that in the first 22 hours, with their listening ability not highly developed, a multi-visual and action-based approach involving the tensing of one's stomach muscles to produce the 1st tone and the stomping of feet to produce the 4th tone has proven to be extremely effective. One long term resident of Taiwan (over 10 years) who was Vietnamese attended a subsequent course using the Somatically enhanced course in zero beginner Mandarin completed corrected any 4th tone errors in her Mandarin Chinese output after about the same amount of time.

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