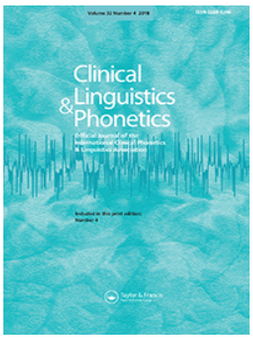

Clinical Linguistics & Phonetics

ISSN: 0269-9206 (Print) 1464-5076 (Online) Journal homepage: www.tandfonline.com/journals/iclp20

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To cite this article: Thomas Law, Ann Packman, Mark Onslow, Carol K.-S To, Michael C.-F. Tong & Kathy Y.-S. Lee (2018) Lexical tone and stuttering in Cantonese, Clinical Linguistics & Phonetics, 32:4, 285-297, DOI: 10.1080/02699206.2017.1359851

To link to this article: https://doi.org/10.1080/02699206.2017.1359851

CLINICAL LINGUISTICS & PHONETICS
2018, VOL. 32, NO. 4, 285–297
https://doi.org/10.1080/02699206.2017.1359851

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Lexical tone and stuttering in Cantonese

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ABSTRACT

Cantonese is a tone language, in which the variation of the fundamental frequency contour of a syllable can change meaning. There are six different lexical tones in Cantonese. While research with Western languages has shown an association between stuttering and syllabic stress, nothing is known about whether stuttering in Cantonese speakers is associated with one or more of the six lexical tones. Such an association has been reported in conversational speech in Mandarin, which is also a tone language, but which varies markedly from Cantonese. Twenty-four native Cantonese-speaking adults who stutter participated in this study, ranging in age from 18–33 years. There were 18 men and 6 women. Participants read aloud 13 Cantonese syllables, each of which was produced with six contrastive lexical tones. All 78 syllables were embedded in the same carrier sentence, to reduce the influence of suprasegmental or linguistic stress, and were presented in random order. No significant differences were found for stuttering moments across the six lexical tones. It is suggested that this is because lexical tones, at least in Cantonese, do not place the task demands on the speech motor system that typify varying syllabic stress in Western languages: variations not only in fundamental frequency, but also in duration and intensity. The findings of this study suggest that treatments for adults who stutter in Western languages, such as speech restructuring, can be used with Cantonese speakers without undue attention to lexical tone.

ARTICLE HISTORY
Received 9 May 2017
Revised 21 July 2017
Accepted 23 July 2017

KEYWORDS
Cantonese; lexical tone; stuttering

Introduction

Stuttering is known to be associated with a number of linguistic factors. These include syllabic stress, word position, grammatical class, utterance length, and linguistic complexity (Dayalu, Kalinowski, Stuart, & Rastatter, 2002; Logan & Conture, 1995; Natke, Grosser, Sandrieser, & Kalveram, 2002; Natke, Sandrieser, van Ark, Pietrowsky, & Kalveram, 2004; Packman, Code, & Onslow, 2007; Packman, Onslow, Richard, & van Doorn, 1996; Richels, Buhr, Conture, & Ntourou, 2010). Previous studies of these linguistic factors have mainly focused on Western languages, such as English and German (Dayalu et al., 2002; Dworzynski, Howell, & Natke, 2003; Logan & Conture, 1995; Natke et al., 2002; Packman et al., 2007, 1996; Richels et al., 2010). Very few studies have focused on Asian languages. Yet, a number of Asian languages possess unique features that are not commonly found in Western languages, with lexical tone being one.

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Lexical tone refers to the pitch contour on a syllable that marks a difference in meaning (Bauer & Benedict, 1997). In other words, changing the fundamental frequency (F0) pattern of a syllable can result in a different meaning. Languages that utilise lexical tones are called tone languages. The number of lexical tones and their respective patterns differ across different tone languages. For instance, Mandarin has four lexical tones, including one level tone and three contour tones; Thai has five lexical tones, consisting of three level tones and two contour tones; and Vietnamese is generally considered to have six lexical tones, including two level tones and four contour tones.

This study explores the relationship between stuttering and lexical tones in Cantonese and compares the findings with those of a similar study in Mandarin. The following section outlines the important features of Cantonese and reports on some similarities and differences between Cantonese and Mandarin.

Features of Cantonese and Mandarin

Cantonese and Mandarin are languages in the Sino-Tibetan language family. They both belong to one of the seven dialect groups of modern Chinese. The seven Modern Chinese dialect groups are Mandarin, Wu, Yue, Min, Xiang, Hakka and Gan. Mandarin represents a group of dialects. It is the largest of the seven Modern Chinese dialect groups. The Beijing dialect of Mandarin forms the basis of Standard Chinese and is the official language of China. Cantonese belongs to the Yue dialect group and is widely spoken in the southern provinces of China, including Hong Kong and Macau, as well as by many immigrants from these regions and all over the world.

Although Mandarin and Cantonese share some similarities, they differ in many linguistic aspects including phonology, syntax and semantics. Cantonese has 19 initial consonants, six final consonants, 11 vowels and 11 diphthongs. Its syllabic structure includes CV, VC, CVC, V or syllabic consonant, which is a word that does not contain a vowel. In contrast, Mandarin has 21 initial consonants, two final consonants, nine vowels, nine diphthongs and four triphthongs. It has four syllabic structures including CV, VC, CVC and V. These differences make speakers of the two languages mutually unintelligible to each other, rendering Cantonese and Mandarin two different languages. It has been suggested that the difference between Mandarin and Cantonese is as much as the difference between French and Spanish (Matthews & Yip, 2011).

Mandarin and Cantonese are both rhythmic sounding; however, Mandarin is less rhythmic than Cantonese (Mok, 2009). According to Mok (2009), "there is more variation of syllable durations in Mandarin than Cantonese, in line with expectation, because of the frequent occurrence of unstressed syllables in Beijing Mandarin." (p. 151).

In terms of lexical tones, not only do Mandarin and Cantonese have a different number of tones, but also different tonal contours. The pitch range of each speaker for tones is divided into five levels, namely high, mid-high, mid, mid-low and low. These pitch levels are relative, as F0 varies across speakers. Mandarin has four lexical tones including one level and three contour tones (for illustrations, see (Chou, Zebrowski, & Yang, 2015). Tone 1 is a high-level tone. It remains at the high-level throughout the production. Tone 2 is high-rising, it starts at mid-level and moves to a high level. Tone 3 is a dipping tone. It starts at mid-low level, dips to low-level and then rises to high-level. Tone 4 is a high-falling tone. It starts at high-level then falls to low-level. There is also a neutral tone, Tone 0.

Cantonese has six contrastive tones, three level tones and three contour tones. Tones 1, 3 and 6 are level tones and Tones 2, 4 and 5 are contour tones. Tone 1 is the high-level tone; that is, Tone 1 remains at the high level throughout the production. Tone 2 is the high-rising tone. It starts at the mid-low level and moves toward the high level. Tone 3 is the mid-level tone. It remains at the same mid-level throughout the production. Tone 4 is the mid-low falling tone. Tone 4 starts at the mid-low level and then falls to the low level. Tone 5 is the mid-low rising tone. In contrast to Tone 4, it starts at the mid-low level and then rises to the mid-level. Tone 6 is the low-level tone. Similar to the other level tones, it remains at the same level during production but at the low level. Figure 1 contains graphical representation of the Cantonese tone patterns adapted from Bauer and Benedict (1997). There are no significant differences in duration and intensity across the six Cantonese lexical tones (Fok-Chan, 1974).

In Cantonese, each character when spoken can be considered as one syllable. Although, theoretically, any syllable can be produced using all six tones, not all of them will necessarily have meaning. That is, for a particular syllable, two or more of its six possible

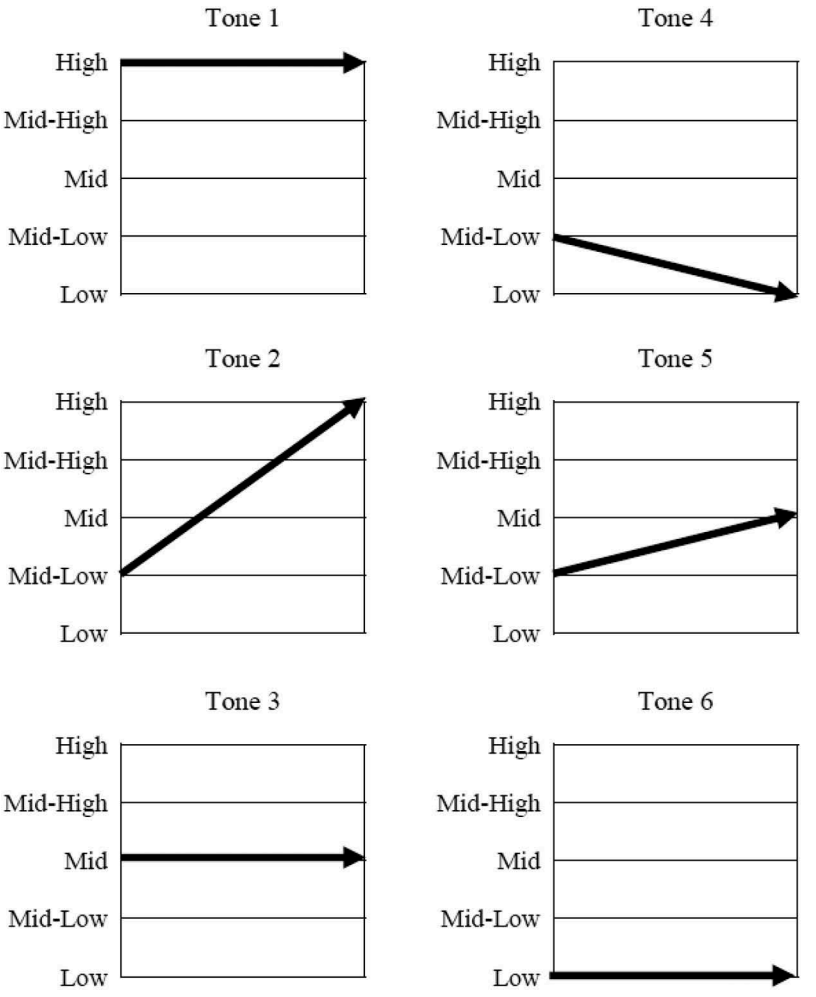

Figure 1. The graphical representation of the Cantonese lexical tone patterns.

tonal profiles may be non-words. An example for a syllable for which all six tones are real words is /ji/. The syllable /ji$_1$/ (衣) in high level tone 1 means *clothes*; /ji$_2$/ (椅) in high rising tone 2 means *chair*; /ji$_3$/ (意) in mid-level tone 3 means *opinions* or *thoughts*; /ji$_4$/ (兒) in mid-low level tone 4 means *child* or *son*; /ji$_5$/ (耳) in mid-low rising tone 5 means *ear*; and finally /ji$_6$/ (二) in low-level tone 6 means *two*. It is clear from this example that variation in lexical tone for a syllable is represented by different characters. An example of a syllable for which some of its six tones are non-words is /bau/. The syllable /bau$_1$/ (包) in high level tone 1 means *bread*; /bau$_2$/ (飽) in high rising tone 2 means *full*; /bau$_3$/ (爆) in mid-level tone 3 means *explode*; /bau$_4$/ in mid-low level tone 4 is a non-word; /bau$_5$/ in mid-low rising tone 5 is also a non-word; and finally /bau$_6$/ (鮑) in low-level tone 6 is one of the surnames in Cantonese.

Lexical tone and stuttering

The established relationship between syllabic stress and stuttering in Western languages leads to the speculation of a similar association between lexical tone and stuttering. Previous studies of syllabic stress have indicated that stuttering is more likely to be triggered on stressed syllables than unstressed syllables (Brown, 1938; Natke et al., 2002, 2004; Prins, Hubbard, & Krause, 1991). Syllabic stress is typically marked by an increase in vowel duration, F0 and greater vocal intensity (Lieberman, 1960; Sluijter & Van Heuven, 1996). Therefore, it is hypothesised that the increase in motoric demands to produce stressed syllables leads to stuttering (Brown, 1938; Natke et al., 2002). Packman and colleagues (1996) proposed a stuttering model to further elaborate on the association of syllabic stress and stuttering. According to their Variability Model (Vmodel), it is the varying of stress (effort) across syllables during spoken language, rather than stress itself, that is responsible for triggering stuttering (Packman et al., 1996). This model proposed that the underlying reason for such association is the increased motoric demands placed on an unstable speech motor system for varying the stress from syllable to syllable (Packman et al., 1996).

The possible association between lexical tone and stuttering investigated in the present study was prompted by consideration of the motoric demands associated with the production of lexical tone. In tone languages, different lexical tones are realised by changes in F0 (Bauer & Benedict, 1997). That is, they are produced by changes in the vibration of vocal folds on the vocalic portion of a syllable through the contraction and relaxation of the laryngeal muscles (Sagart, Halle, Boysson-Bardies, & Arabia-Guidet, 1986; Xu, 1994). During speech production, in order to realise the lexical tones carried by different syllables, a constant variation of F0 is required. According to the Vmodel, a crucial factor that triggers stuttering is the motoric demands induced by the continuous variation of stress across syllables. However, in the studies supporting this model, stress was measured by vowel duration only. Hence, it is of theoretical interest to know whether varying the F0 of syllables in a tone language during speech production is sufficient to trigger stuttering.

It is well documented that stuttering is associated with unusual brain structure and function, although the causal relationship between these brain anomalies and stuttering is not yet well understood (for a review see Etchell, Civier, Ballard, & Sowman, In press). While the majority of brain research with stuttering has been with Western languages, there is evidence that the neural processing of rising and falling tones in Mandarin is different in adults who stutter compared to those who do not stutter (Howell, Jiang, Peng, & Lu, 2012).

To date, however, only one study has investigated the relationship between lexical tone and stuttering. This study investigated the effects of Mandarin lexical tones in 20 children in Taiwan (Chou et al., 2015). Stuttering moments were elicited through conversational speech samples. The lexical tones on the syllables with stuttering were identified. The results indicated that there was significantly more stuttering on syllables carrying Tone 3 and Tone 4 when compared to Tone 1, Tone 2 and Tone 0. In addition, stuttering was found to be more frequent under conflicting tonal contexts. The authors reasoned that syllables carrying Tones 3 and 4 were associated with more stuttering because they are more demanding motorically.

Despite the discovery of the relationship between stuttering and both lexical tone and the transition between tones in the Mandarin study by Chou and colleagues (2015), its results may not be generalised to other tone languages. First, and most importantly, different tone languages have different numbers of tones and different tonal contours. Nonetheless, the study showed that contour tones are more likely to be associated with stuttering when compared to level tones, possibly due to their higher motoric demands. However, the use of conversational speech samples may not be the optimal way to determine the true relationship between lexical tone and stuttering. Conversational speech production places a higher demand on the speech motor system due to its need to realise both lexical tone and linguistic stress (Ma, 2007). In order to realise lexical tones, a continuous variation of F0 is required at the syllable level. In contrast, linguistic stress is produced at the utterance level, and comprises continuous variation of F0, speech intensity and syllable duration. Hence, in conversational speech it is possible that the effects of lexical tones on stuttering are masked by the production of linguistic, or sentence level, stress. In other words, in conversational speech there will be an interaction between lexical tone and linguistic stress and the effects of each of these on stuttering may be difficult to determine.

The present study

In the present study, the possible effects of lexical tone on stuttering in Cantonese is investigated, using a speaking task that controls as far as possible for the influence of other linguistic features, such as linguistic stress. Cantonese possesses more lexical tones and more complex tonal structure than Mandarin, hence raising the question of whether tone alone is sufficient to trigger stuttering in Cantonese. Hence, the two present research questions are: (1) is there an association between lexical tones and stuttering in Cantonese, and (2) is there an association between stuttering and the type of lexical tones—level and contour—in Cantonese?

Method

Participants

The number of participants required for this study was determined based on significance at 0.05, power of 0.8 and assumption of no correlation among the 13 Chinese syllables chosen for this study. To detect a medium effect size of 0.25 for a difference across the six lexical tones in Cantonese, a minimum of 23 participants was required.

Twenty-four adults who stuttered participated in this study, comprising 18 men and 6 women. Details of the participants are reported in Table 1. Participant ages ranged from18–33 years with a mean age of 22 years. The study was conducted at the Chinese University of Hong Kong and participants were recruited through the university mass mailing list in Hong

Table 1. The characteristics of the participants, including age in years, sex, and per cent of syllable stuttered (%SS).

Participant	Ages	Sex	%SS
1	27	Male	6.6
2	21	Male	3.2
3	22	Male	30.4
4	20	Male	4.4
5	33	Male	1.6
6	30	Male	6.5
7	21	Male	2.6
8	19	Male	4.1
9	18	Male	2.9
10	20	Male	8.6
11	20	Male	3.5
12	28	Male	11.6
13	23	Male	4.1
14	23	Male	1.8
15	22	Male	3.5
16	18	Male	4.2
17	23	Male	8.5
18	23	Male	4.7
19	23	Female	2.0
20	18	Female	12.9
21	26	Female	22.6
22	20	Female	2.6
23	22	Female	12.7
24	30	Female	1.5
Mean	22		7.0

Kong, the University speech clinic, and four local Hong Kong district councils. Cantonese is the dominant language in Hong Kong and all participants were native speakers of Cantonese. The participants reported no history of neurological disorders. Stuttering diagnosis was confirmed by a Cantonese-speaking speech therapist with 10 years of experience with stuttering assessment and treatment. The participants' percentage of syllable stuttered (%SS) was calculated from 600-syllable conversational speech samples that were audio-visually recorded in the laboratory. An experienced speech therapist measured the samples from the recordings using a button-press machine. To determine interrater agreement, seven (29%) randomly selected samples were measured by a blinded, independent experienced speech therapist. Pearson correlation between the two sets of scores was 0.8, $p = 0.03$. The %SS scores for the 24 participants ranged from 1.5% SS–30.4%SS, with a mean of 7.0%SS, and were positively skewed. This mean and distribution of %SS scores in Cantonese is consistent with studies reporting large numbers of English-speaking adults who stutter (Jones, Onslow, Packman, & Gebski, 2006).

Materials

Thirteen Cantonese syllables that were commonly used in everyday speech were chosen as stimuli for this study. These were chosen because they all had six different meanings according to six different tones and are commonly used in Cantonese. For 13 Cantonese syllables, each with six contrastive lexical tones, this provided a total of 78 Cantonese syllables. Each of the syllables was embedded in a carrier sentence "*This word is* ____". The literal translation of the carrier sentence into English is "*This* ___ *word is*"). The target syllables were embedded the in the middle of the carrier sentence in order to prevent sentence initial or final effects on stuttering (Buhr & Zebrowski, 2009; Wingate, 1979).

Procedure

The study was conducted in a quiet room and participants completed the procedure individually. A high-definition video camera (Panasonic HDC-DS9) was placed on a tripod 2 meters directly in front of each participant. The images in the videos showed the face and upper torso. The participants were video recorded for stuttering analysis. The stimuli (carrier sentence and target syllable) were presented one at a time in random order, projected onto a screen approximately 4 metres in front of the participants. Participants were instructed to read each stimulus as soon as it appeared on the screen in their usual manner. There was a 2–3 second interval between the stimuli.

Stuttering identification

The perceptual definition of stuttering was used to identify moments of stuttering (Bloodstein & Ratner, 2008). Two speech therapists that are native Cantonese speakers and experienced in working with stuttering were recruited to identify the moments of stuttering. They were instructed to identify stuttering on the target words. Hence, stuttering moments that occurred before or after the target word were not counted. The first judge viewed all the videos and identified all the stuttering moments. One week later, the first judge viewed 20% of the videos again, randomly selected, to determine intrajudge agreement. The second judge independently identified stuttering moments in 20% of the videos, selected randomly, to determine interjudge agreement. Intrajudge agreement for stuttering moment identification was 96% and interjudge agreement was 90%.

Statistical analyses

Statistical analyses were conducted using IBM SPSS version 22©. A Friedman test was used to examine the median rates of stuttering across all six Cantonese lexical tones. Post hoc analysis with Bonferroni adjustment was planned in the event of a significant main effect for tone. For the association between stuttering and the types of tones a Wilcoxon signed-rank test was used to examine whether both tone types had the same median rates of stuttering. Non-parametric tests were used because of the non-normal distribution of stuttering moments.

Ethics approval was obtained from the Human Ethics Committee of The University of Sydney (2014/835) and the Joint Chinese University of Hong Kong–New Territories East Cluster Clinical Research Committee (CRE-2012.164).

Results

The first analysis explored stuttering moments across all six Cantonese lexical tones. For the six Cantonese lexical tones the total number of stuttering moments on each tone were as follows from Tones 1–6 respectively: 19, 8, 8, 10, 16, 7. The following are the mean number and standard deviation of stuttering moments of each tone: Tone 1, 0.79 *SD* 1.47; Tone 2, 0.33 *SD* 0.70, Tone 3, 0.38 *SD* 1.01, Tone 4, 0.42 *SD* 0.88, Tone 5, 0.67 *SD* 1.13, Tone 6, 0.71 *SD* 1.50 (see Figure 2). The number of stuttering moments was not significantly associated with the Cantonese lexical tones, χ^2 (5) = 7.66, p = 0.18.

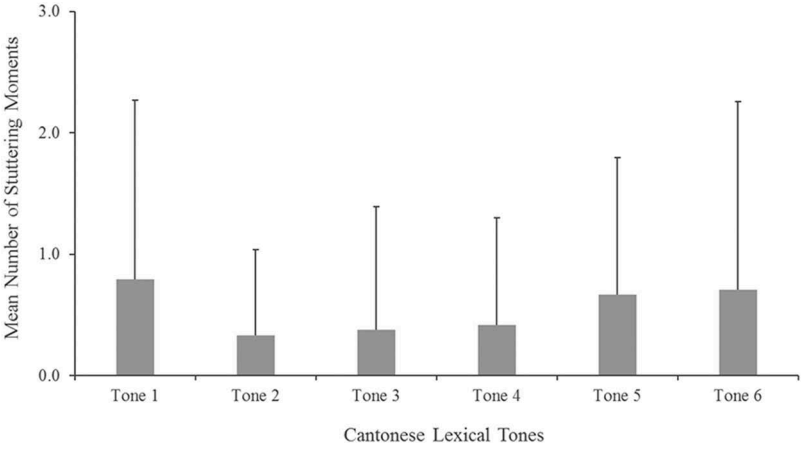

Figure 2. Mean number of stuttering moments on each of the six Cantonese tones.

The second analysis explored the association between stuttering moments and the types of tones. Figure 3 presents the mean number of stuttering moments between the two types of lexical tones: level tones and contour tones. The mean number of stuttering moments on level tones was 3.60 *SD* 3.78 and on contour tones was 2.72 *SD* 2.41. There was no statistically significant difference in the median number of stuttering moments between the two types of tones, $Z = -0.36$, $p = 0.72$.

Discussion

This study investigated the association of stuttering and Cantonese lexical tone under controlled conditions, without the influence of variations in sentence-level suprasegmental features. The results indicated that there were no significant differences for stuttering

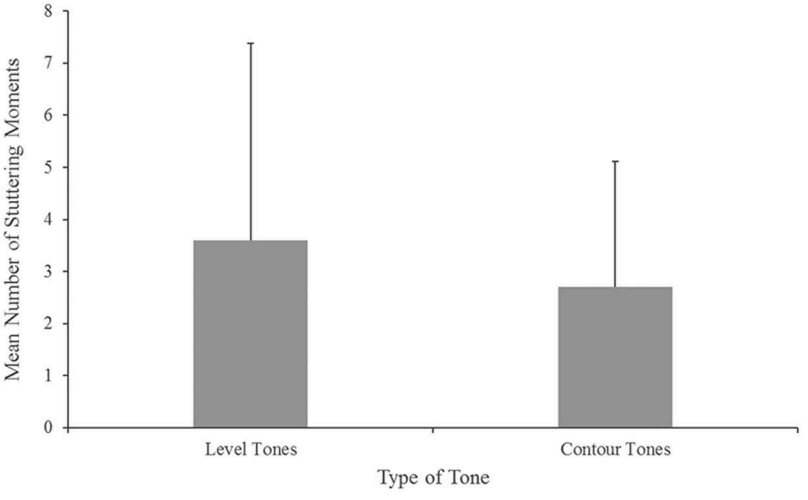

Figure 3. Mean number of stuttering moments on the level Cantonese tones and on the contour Cantonese tones.

frequency either across the six lexical tones or between the level and the contour tones. In other words, no one lexical tone in Cantonese was associated with increased stuttering. The study was powered to detect a medium effect so it is possible that greater participant numbers might have detected a small effect. However, it was considered that a small effect would have little theoretical or clinical relevance.

Syllabic stress, lexical tones and stuttering

The findings of this present study did not support the hypothesis that varying the F0 to realise lexical tones could trigger stuttering in Cantonese. The hypothesis originated from the established relationship in Western languages between stuttering and linguistic stress, where linguistic stress, and/or the variation of linguistic stress during spoken language, is associated with stuttering (Brown, 1938; Natke et al., 2002, 2004; Packman et al., 2007, 1996; Prins et al., 1991). However, by comparing the acoustic and physiological properties between syllabic stress and lexical tone, it is not surprising to expect a less significant role for lexical tone as a trigger of stuttering. Acoustic studies have shown that linguistic stress involves a combination of variations in one or more of F0, vowel duration and vocal intensity (Lieberman, 1960; Sluijter & Van Heuven, 1996). Physiologically, it is produced by varying effort in articulation and phonation (de Jong, 1995; Fry, 1955; Öhman, 1967). Increased effort for high stress involves hyper-articulation to produce a distinctive perceptual contrast and to realise the target phoneme, increase subglottic pressure to produce a higher vocal intensity and increase laryngeal tension and airflow rate to enhance the F0 pattern (de Jong, 1995; Fry, 1955; Öhman, 1967). In contrast, the production of lexical tones only involves variation of F0. In physiological terms, only changes in the laryngeal muscle tension and airflow rate through the glottis are required to vary F0 (Bauer & Benedict, 1997). Hence, in English for example, the motoric demands for the production of linguistic stress, and the variation in stress across syllables, is much greater than that of lexical tones. Therefore, it can be concluded from the present findings that lexical tone alone is not sufficient to trigger stuttering in Cantonese.

Differences between present findings and those in mandarin

The findings of this present study are not consistent with the previous study of stuttering and lexical tones in Mandarin (Chou et al., 2015). In the Mandarin study, lexical tones that have a complex tonal contour, especially when placed under conflicting tonal contexts, were found to be associated with stuttering. We suggest that these differences simply reflect important differences between Cantonese and Mandarin, as outlined previously. Importantly, the rhythm of the two languages is different. Furthermore, Mandarin has only four lexical tones, including one level tone and three contour tones, with an additional neutral tone, while Cantonese has six lexical tones. As the carrier sentence was constant across tones in the present study, any influence of conflicting tones, as was the case in Mandarin in the Chou et al. (2015) study, would have been apparent.

However, it needs to be noted that the two studies differed methodologically. The present study was with adults while the Chou et al. (2015) study was with children. Furthermore, measures of stuttering differed, with the present study identifying stuttering moments while the Chou et al. study identified stutter-like disfluencies, which are not

necessarily stuttering moments. Also, the present study used the reading of carrier sentences to control for context and sentence level stress, while the Mandarin study was conducted using conversational speech. Stuttering is typically less severe in oral reading than in conversational speech. In conversational speech, features of sentence level stress and intonation are imposed on the syllables carrying different lexical tones. In conversational speech, then, there is more than a mere change of F0 on each syllable, as was the case in the present study.

The relationship between lexical tones and intonation at the sentence level is interesting and studies indicate an intricate relationship between the two. The classical analogy proposed by Chao (1968), using ripples to represent lexical tones and waves to represent intonation, provided a perfect depiction of the relationship between lexical tones and intonation. Chao (1968) described the relationship between the two as "small ripples riding on a large wave (though occasionally the ripples may be "larger" than the waves)" (p.39). In other words, intonation is the larger perturbation, which takes its effects at the sentence level and lexical tones are the smaller perturbations at the syllable level. Although it appears inevitable that the ripples will follow the form of the wave, the relationship is not as straightforward in intonation and lexical tones.

Studies in Cantonese have shown that both intonation and lexical tones appear to exert a bidirectional effect on each other (Gu, Hirose, & Fujisaki, 2005, 2006; Lee, 2004; Ma, Ciocca, & Whitehill, 2006). In Cantonese, intonation can modify the F0 pattern of lexical tones. For example at sentence final position of some question forms, the tone contours of falling or level tones would rise. Conversely, lexical tones can also limit the degree of intonation, for example in other question forms the tone contours are maintained and another linguistic device is added to convey the question form (Gu et al., 2005, 2006; Lee, 2004; Ma et al., 2006). We used standard carrier sentences in our study in order to control for the effects of variation in intonation that occurs in conversational speech, as would have been the case in the Chou et al. (2015) study in Mandarin.

Study limitations

The use in the present study of a standard carrier sentence that contained the target syllables could be seen as a limitation. Repeatedly reading the same material tends to reduce the frequency of stuttering, which is known as the adaptation effect (Kroll & Hood, 1974; Max & Caruso, 1998; Max, Caruso, & Vandevenne, 1997). However, while a standard carrier sentence was used, the stimulus word in each sentence differed, and the participants were asked to read the stimuli as naturally as possible, the mean number of stuttering moments for each lexical tone was low. Nonetheless, the use of the carrier sentences in the present study was designed to examine the sole effect of lexical tones on stuttering, without the influence of sentence level suprasegmental features. Therefore, even though repeatedly reading a standard carrier sentence may facilitate motor learning leading to a reduction in stuttering frequency, any stuttering identified during the task could be attributed to the independent variable, namely lexical tone. Future studies can consider exploring the interaction effect of lexical tones and linguistic stress on stuttering. However, a carefully designed experiment is required to ensure the target lexical tones are well controlled but the naturalness of speech output is ensured.

Clinical implications

This study provided some clinical implications for the management of people who stutter in Cantonese. A caveat here, however, that the present study was conducted with adults and so findings may not be generalisable to children who stutter. Although the use of carrier sentences in the present study may have resulted in lower stuttering rates than might occur in conversational speech, lexical tone alone does not appear to influence stuttering in Cantonese. Hence, the behavioural treatment programs developed for non-tone languages, such as English, are likely to be transferrable to Cantonese speakers. We can assume that the active ingredients in these treatment programs will not be influenced by lexical tones and little attention needs be paid to the tonal aspect of the person's speech. Treatment, especially speech-restructuring type treatment, can focus on other speech motor components to achieve fluent speech output.

Conclusion

The present study examined the association between Cantonese lexical tones and stuttering in native Cantonese-speaking adults. The results showed that lexical tones alone are insufficient to trigger stuttering in Cantonese, at least for adults. This is likely due to the lesser speech motor demands involved in the production of lexical tones, compared to the greater task demands of linguistic stress, which typically include varying not only F0 but also syllable duration and intensity. Future research could investigate if the findings of the present study hold true for conversational Cantonese and for Cantonese-speaking children who stutter.

Acknowledgements

The authors would like to express their appreciation to Annie Fu for her participation in rating of the stuttering video samples. The authors would also like to thank Stephen Lam, Rina To for assisting with data collection.

Declarations of interest

Non-Financial Disclosures: Thomas Law, Ann Packman, Mark Onslow, Carol To, Kathy Lee and Michael Tong did not disclose any relevant non-financial relationships used in support of the research reported in this article.

Funding

This research was funded by the Australian Research Council. Financial Disclosures: Ann Packman, Mark Onslow, Kathy Lee and Carol To received funding from the Australian Research Council (Grant Code DP140100982) in support of the research described in this paper

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