



## Singing Tones in Cantonese Operas and Pop Songs

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### Abstract

This study investigated the (mis)matching between tones and tunes in Cantonese songs in traditional operas and popular music, with a focus on composition processes. We calculated the degree of matching by tracking directions of pitch changes in consecutive syllables in the melody and lyrics, and also measured the musical range in absolute pitches. We then compared patterns discovered across genres and classes of songs. It is hoped that our examination will provide evidence to the study on music and speech in tonal languages, and also implications for using songs to facilitate the learning of a tonal language like Cantonese.

**Index Terms:** Cantonese songs, music and speech, lexical tone, pitch

### 1. Introduction

Singing a song involves melodic articulation including rhythm and tonality, and as well as semantic perception of words and symbols, which are all required in daily verbal communication. The relationship between songs and speech has attracted increasing research interest from various perspectives [1], [2], [3], and [4]. Particular interest has been put on songs of tonal languages such as Chinese including Cantonese and Mandarin [5], [6], [7], [8], [9], [10]. It has been reported that Mandarin songs, especially the more contemporary ones, no longer pay close attention to the mapping between tones and tunes, whereas modern Cantonese songs may still retain such tradition. The difference in song writing has been attributed partly to the tonal systems: rich level tones in Cantonese and more contour tones in Mandarin [5], [8], [10]. No consensus is reached, however, on how and why prosodic patterns (mis)match between music and speech. It is also intriguing to explore the motivation to strategies in music writing.

This paper aimed at an examination on the relationship between melody and lexical tones in Cantonese pop songs in Hong Kong, and extends the examination to a comparison with traditional Cantonese opera. Cantonese is a tonal language that contains nine tones that appear in two syllable types: six tones in open syllables ending in a vowel or a nasal and three short tones in checked syllables ending with an unreleased plosive [11]. With 5-point reference to pitch levels, the six tones in open syllables are high-level tone 55, high-rising tone 25, mid-level tone 33, low-falling tone 21, low-rising tone 23 and low-level tone 22; and the three short tones are high-level tone 5, mid-level tone 3 and low-level tone 2 [12]. Table 1 lists examples of Cantonese characters for all nine tones.

Table 1. *Digits 0-9 in Cantonese. Upper panel: tones in open syllables. Lower panel: tones in closed syllables.*

Tone name	Pitch level	Example	Gloss
High-level	55	三 saam	3 – ‘three’
High-rising	25	九 gau	9 – ‘nine’
Mid-level	33	四 sei	4 – ‘four’
Low-falling	21	零 ling	0 – ‘zero’
Low-rising	23	五 ng	5 – ‘five’
Low-level	22	二 ji	2 – ‘two’
Tone name	Pitch level	Example	Gloss
High-level	5	七 cat1; 一 jat	7 – ‘seven’; 1 – ‘one’
Mid-level	3	八 baat	8 – ‘eight’
Low-level	2	六 luk	6 – ‘six’

Cantonese songs are known to use colloquial vocabulary in their lyrics, but a growing trend has been observed in more contemporary pop songs that start using standard Chinese vocabulary instead of colloquial Cantonese [13], [14]. On the other hand, the traditional Cantonese opera has also always been written using standard Chinese for much more poetic effects without sacrificing the strict conformity to the concordance between tones and tunes. The harmony in melody guarantees that a word may still be heard correctly in limited and sometimes uncommon contexts in the operas [5], [8].

As shown in Table 1, digits 0-9 in Cantonese each bear a different tone. This interesting coincidence has been long explored by musicians to instruct and facilitate beginners with Cantonese lyrics writing [13]. A method nicknamed “0243” (tones of these four digits roughly correspond to extra-low, low, mid, and high pitch ranges) was proposed and widely used based on converting between the tonal system and the numerical notation system. In 1986, a Cantonese song entitled ‘Numbers and Life’ (數字人生 sou3 zi6 jan4 sang1) was released by George Lam who rewrote it based on an English song ‘A Lover’s Concerto’ originally performed by The Toys in 1965. This song is a representative of the method “0243”, as a large part of the lyrics was written in numbers whose tones corresponded neatly to the tunes in the melody. As numbers from zero to nine carry different tones, the song eventually turned into widely-used teaching material for Cantonese tones.

## 2. This study

### 2.1. Selection of songs

We analyzed and compared the relationship between tones and tunes in excerpts from two Cantonese Operas and three Cantonese pop songs.

#### a) Cantonese Opera songs

- Young and Fit (1962. 鳳閣恩仇未了情 *fung6 gok3 jan1 sau4 mei6 liu5 cing4*): This opera is performed in ‘bǎn qiāng singing’ (板腔體), one of two major genres in Cantonese opera singing. There is no melodic template, i.e., the melody is composed according to lyrics. A singer can prolong the tune according to his/her pitch range, sound quality and emotion.
- Emperor Flower – Fragrant Death (1957. 帝女花 – 香天 *dai3 nei5 faa1 – hoeng1 jiu1*): This opera is performed in ‘qǔ pái singing’ (曲牌體), the other genre in Cantonese opera singing in which the melody is fixed and composed before the lyrics are written. The melody for Emperor Flower is called *Zhuāng Tái Qiū Sī* (妝台秋思 “Autumn Thoughts at the Dresser”), originally played by Chinese lutes.

#### b) Cantonese Pop Songs

- The Eiffel Tower (1974) (鐵塔凌雲 *tít3 taap3 ling4 wan4*): The lyrics were translated from an English poem, and then the melody was composed.
- Can’t Let Go (1996) (放不低 *fong3 bat1 dai1*): the melody was written before lyrics.
- Seven Hundred Years Later (2009) (七百年後 *cat1 baak3 nin4 hau6*): the melody was written before lyrics.

### 2.2. Method of analysis

First, we used the 5-point reference scale to transcribe lexical tones of each character in the lyrics. The pitch levels at offsets of consecutive syllables were tracked so as to compare with those obtained from musical notes in the melody. As suggested by Wee (2008), lengthening of characters bearing a contour tone such as *si2* [25] should be sung as [2555555] but not \*[2222225]. So, our transcription and analysis for contour tones used the pitch level at each syllable offset as the point of comparison with the immediate context.

Second, melodies in pop songs were converted into a numerical notation system, and then to a normalized scale according to absolute pitches of music notes. For instance, ‘A’ note is lower than ‘B’ note. If ‘A’ note is the lowest note in a unit of line, then ‘A’ would be marked as 1 while ‘B’ as 2 and so on. Sharp and flat notes were transcribed by adding or reducing by 0.5. For example, if ‘A’ is the lowest note in a score, then C flat will be 2.5. For Cantonese operas, we referred to the Gongche notation used in traditional Chinese music [15] to convert the musical notes into numerical notations for analysis, as shown in Figure 1. The notations were then normalized in the same method used for pop songs.

Low Range					Medium Range					High Range										
5	6	7	1	2	3	4	5	6	7	1	2	3	4	5	6	7	1	2	3	4
佻	仕	亿	仕	伋	仁	佞	合	士	乙	上	尺	工	反	六	五	亿	生	猗	征	佞

Figure 1: The converting table between the numerical notation (top) and the Gongche notation (bottom).

Third, we compared the tracks of pitch changes for lexical tones with those of the musical notes. If directions of changes were congruent with each other, then tone and tune were considered as ‘being matched’. Otherwise, they were mismatched. We also calculated the music range by counting the distances between the highest and lowest notes in terms of absolute pitches. Table 3 and Figure 2 show an example of analysis from the traditional opera of “Emperor Flower”. There are 9 Chinese characters in this line, as shown in Table 2, resulting in 8 mapping cases. Their tones at pitch offset range from 1 to 5. Their tunes in Gongche converted into numeral notation spans from 1 to 8. Tracking the direction of pitch changes in the 8 consecutive offset positions, as shown in Figure 2, reveals 3 mis-matching points: between 1-2, words 2-3, and words 7-8.

Table 2. Transcription of tones and tunes of a line from the traditional opera named “Emperor Flower”.

#	Character (Gloss)	Tone		Tune	
		Pitch	Offset	Gongche	Numeral
1	不 (not)	5	5	尺	7
2	甘 (willing)	55	5	工	8
3	殉 (to die for)	55	5	上	6
4	愛 (love)	33	3	乙	5
5	伴 (accompany)	22	2	士	4
6	我 (me)	23	3	上	6
7	臨 (to)	21	1	合	3
8	泉 (spring)	21	1	仁	1
9	壤 (soil)	22	2	士	4

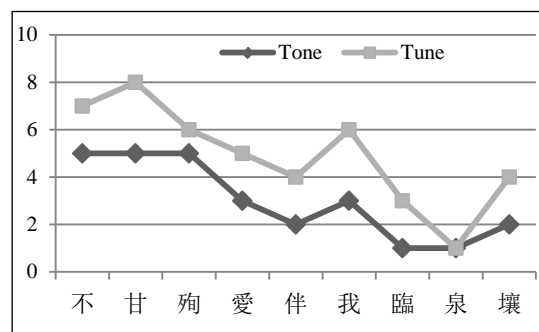


Figure 2: Schematic illustration of pitch changes by tracking directions of tone and tune in the example shown in Table 2.

### 2.3. Results and discussion

A high degree of matching was obtained from all five songs, including both the traditional operas and pop songs. Generally, more than 80% of the musical tunes match their lexical tones in all five samples. In particular, two songs from the traditional operas both contain more than 95% matching, which is much higher than those of the three pop songs.

Another finding is that the musical ranges of the songs vary in correlation with the tone-tune correspondence. The summary of the correlation results is listed in Table 3.

The degree of matching between tone and tune in Cantonese music is in general very high, but it varies across individual songs. In the five songs we analyzed, one traditional opera as well as one pop song contain a percentage of matching as high as over 95%, which is significantly higher than the other three songs. These two songs ranked high on tone-tune matching share similar features in music composing, as lines of their lyrics were both written before the melodies. The other three songs with relatively lower matching percentages also share a common feature: lines of their lyrics were written after the melodies.

The result suggests that Cantonese music exhibits a strong tendency in matching tones with tunes, in both traditional and contemporary songs. More specifically, directions of lexical pitches in consecutive syllables in lyrics are to a large extent preserved in Cantonese songs. The difference in the degree of such tone-tune matching is however, significantly affected by the way in which a song is created, i.e. the harmony between tone and tune is further promoted or hedged depending on how whether a song is written in a melody-first way or a lyrics-first one.

Melody-first songs may show a mild deviation from the matching regulation, while lyrics-first songs an enhanced adhesion to such tradition. The distinct degrees of faithfulness confirms that writers of Cantonese songs with a strong sensitivity to rich tonal contrasts still abide by the principle that musical melody should be faithful to linguistic prosody. As reviewed earlier, Cantonese tonal system is rich with level tones, which poses difficulties in perception in isolation to even native speakers of Cantonese [8]. Moreover, conflicts between tune and tone easily result in misunderstanding in limited contexts such as in poetic and short lines in lyrics [5], [8]. It is then paramount in orthodox song writing that the harmony between tones and tunes be maintained.

The conventional method such as “0243” locates the “3” in a line of lyrics first and then uses it as the anchor for the high-range tune of its melody. In this sense, melody is composed based on pre-written lyrics, which facilitates the mapping between tone and tune. A pre-written melody, however, leaves less freedom in word choices in lyrics writing. This is even more so when more contemporary Cantonese songs adopt a melody from songs in other languages such as English [14]. Therefore, we found a relatively lower matching percentage in the three songs composed in this fashion.

Another finding from our analysis is the melodic characteristics of the melody-first songs and lyrics-first songs. It seems that the matching percentage of a song correlates counter-proportionately with its musical range, as shown in Table 3. With lyrics ready, it is easier for composers to manipulate melodies to accommodate the changes in lexical tones. However, when the melody is fixed, the selection of the “pitch-perfect” words is rather limited and challenging, which naturally results in a lower matching percentage in the latter three songs.

Table 3. *Tone-tune correspondence and musical range of all five songs (Song 1 and Song 4 are the traditional operas, and the other three are pop songs).*

#	Name of Songs	Musical Range	Musical Notes	Mis-match	Tone-tune matching %
1	Young and Fit	10	208	10	95.19%
2	The Eiffel Tower	10	164	8	95.12%
3	Can't Let Go	11	331	42	87.31%
4	Emperor Flower	12	317	58	81.70%
5	Seven Hundred Years Later	18	405	75	81.48%

### 3. Conclusions

We examined the degree of concordance between melody and lyrics of five Cantonese songs, by analyzing and comparing percentages of mapping between the musical tunes and lexical tones at pitch-offsets in consecutive characters. Unlike some claims that modern Cantonese songs disfavor the faithfulness principle that binds tunes to tones, we found a high degree of correspondence in direction of pitch changes of musical notes and that of lexical tones in all three pop songs. The harmony purported by conventional song writing in Cantonese is not only found in traditional operas but also in pop songs.

Furthermore, in not only the pop songs but also the traditional operas, the matching can be influenced by the composing order of melody and lyrics. A melody composed preceding lyrics may cause difficulties in maintaining the harmony between tones and tunes, which results in decrease of percentages of mapping. On the other hand, a melody composed after lyrics safeguards and promotes strong faithfulness of musical tunes to lexical tones. This concordance in Cantonese songs and its variations across song types provide insights to research of prosody in tonal languages. It offers as well good evidence to the searching of the mechanism underlying or shared by human speech and music. Moreover, Cantonese songs may be adapted as fun pedagogical materials for teaching Cantonese tones which are known as difficult and confusing to even native speakers of other tonal language. Such pedagogical implication can be further extended to second language acquisition of Chinese vocabulary and writing, e.g., to sing out words in sentences, or to write a line of words for a known melody.

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