

## CHAPTER 3

### Traditional Taiwanese Folk Songs

This section discusses traditional Taiwanese folk songs and presents an Optimality Theoretical analysis of the relationship between lyrics and musical notes among those songs. The first section presents the data and the second examines some common features of traditional Taiwanese folk songs, focusing on the mapping between linguistic and musical forms from the aspect of prosody, structure and tonal shapes. The third section takes a constraint-based approach to the surface musical representation and the fourth gives a brief summary.

#### 3.1 The Data

The analysis in this section is based on four Taiwanese folk songs—*chhiu hong ia u* ‘autumn night sorrowfulness’, *bang tshun hong* ‘embrace spring breeze’, *su kui ang* ‘all seasons red’ and *ho pin tshun bang* ‘the spring dream by the riverside.’ These

songs are created in early stages of Taiwan, mainly from 1930 to 1950. Most of them reflect people's everyday lives and are sung by the public since then. Like many traditional Taiwanese songs, these four songs are consistently composed from lyrics to melodies. It is thus interesting to look at the relationship between the lyrics and the music. The scores of these four songs are given in (1) to (4).

(1) The score of *chhiu hong ia u* 'autumn night sorrowfulness'

## 秋 風 夜 雨 chhiu hong ia u

周添旺作詞  
楊三郎作曲

風 雨 聲 音 擾 亂 秋——夜——靜——時 常  
hong u sian im jiau loan chhiu ia jeng si siong

聽 見 蚪 蚪 啼——悲——情——引 阮 思 鄉——  
thian kin to un hau bi jeng in un su hong

嗚 知 雨 水 冷——自 恨 自 嘆——幸 福 未 完 成——啊——啊  
m chai ho chui ling chu hun chu tham heng hok bi oan seng a a

前 途 茫 茫——宛 然 失——光——明——  
chian to bang bang oan jian sit kong beng

*Chhiu hong ia u* ‘autumn night sorrowfulness’ is created in 1950’s, when Taiwan is under the depression after the war against Japanese. Zhou Tian-wang initially writes the lyrics and Yang San-lang composes the melody for it later. Similar as a poem, the words are neatly done. Each stanza consists of five metrical lines, in which the fifth one is preceded by an expletive word *a*. Every metrical line is equally composed by a four-character hemistich plus a five-character one; in addition, the last word of each line rhymes with each other.

(2) The score of *bang tshun hong* ‘embrace spring breeze’

## 望春風

李臨秋作詞  
鄧雨賢作曲

獨 夜 無 伴 守 燈 一 下 清 風 對 一 面 吹  
tok ia bo phuann siu ting\_ c tshing hong dui\_ bin tshuc

5  
十 七 八 歲 一 未 出 嫁 登 著 少 年 家 果 然 標 緻 一  
tsap tshit pue hue\_ bué tshut ke tng tio hsiu lian ke koo lian piau tsih\_

10  
面 肉 一 白 誰 家 人 一 子 弟 想 袂 問 伊 一 驚 歹 一 勢  
bin bah\_ beh siang ka lang\_ tsu te siunn be mng i\_ giang phainn\_ se

15  
心 內 彈 琵 琶  
sim lai tuann pe pe

*Bang tshun hong* ‘embrace spring breeze’ is created in 1930’s when Taiwan is under the control of Japanese. Since it was first presented to the public, it has been the representative of Taiwan Sothern Min songs. Inspired by the classic novel *Xi Xiang Ji*, Li wrote the lyrics with poetic mechanism. Similar as a poem, the words are neatly done. The whole song consists of four long metrical lines, each of which is composed of a seven-syllable line followed by a five-syllable one. In addition, the last word of every line, or every hemistich, rhymes with each other.

(3) The score of *ho pin tshun bang* ‘the spring dream by the riverside’

## 河邊春夢

黎明作詞  
周添旺作曲

河 邊 春 風 寒—— 怎 樣 阮 孤 單——  
ho pinn tshun hong kuann—— tsuann iunn un ko tuann——

9  
夯 頭 一 下 看—— 幸 福 人 作 伴——  
iah thou tsit leh khuann hing hok lang tsue phuann

17  
想 啓 伊 對 我—— 實 在 是 相 瞞—— 到——  
siunn khi i tui uah sit tsai si siong mua tau

26  
底—— 是 按 怎—— 嘸 知 阮 心 肝——  
tue si an tsuann m tsai un sim kuann

*Ho pin tshun bang* ‘the spring dream by the riverside’ is created in 1930’s when Taiwan is under the control of Japanese. It is a 3/4-meter Taiwanese folk song. Progressing in a slow tempo, the song shows the sadness of a young person that is forsaken by his or her lover. As other traditional Taiwanese folk songs, it is neatly composed like a poem. The whole song is formed by three stanzas and we focus on the first one. One stanza consists of eight five-character metrical lines. The last word of every metrical line rhymes with each other except for the fifth and sixth ones.

(4) The score of *su kui ang* ‘all seasons red’

## 四季紅

李臨秋作詞  
鄧雨賢作曲

春 天 花 吐 清 香 雙 人 心 頭 齊 振 動  
tshun thinn hue tho tshing phang siang lang sim thau tse ting tang

5  
有 話 想 欲 對 你 講 嚙 知 通 抑 嚙 通 叮 一 項  
u ue siunn be tui li gang m tsainn thang ia m thang to tsit hann

10  
甘 也 有 別 項 肉 紋 笑 目 周 降 你 我 戀 花 朱 朱  
kam ia u pak hann bah bun tshio bak tsiu gang li ua luan hue tsu tsu

15  
紅  
ang

*Su kui ang* ‘all seasons red’ is made in 1938 when Taiwan is at the later period of Japanese governance. To express the joyfulness of lovers’ dating, the song moves easily and smoothly. Unlike previous three songs, where the lyrics are composed poetically, the song is displayed as a musical dialogue. The number of syllables in every metrical line is not necessarily the same, while the last syllable still rhymes with each other.

### 3.2 The Characteristics of Taiwanese Folk Songs

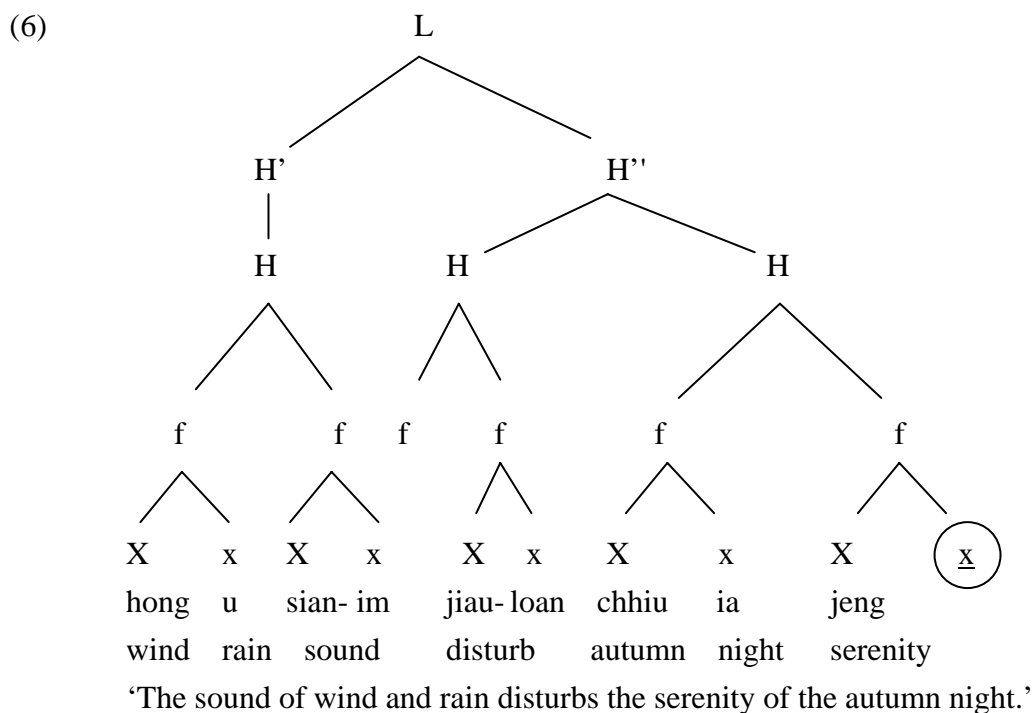
#### 3.2.1 Language and Musical Mapping in Prosody

First of all, I observe that the last syllable of every metrical line has the longest duration in terms of music beats. Consider the first line of *chhiu hong ia u* ‘autumn night sorrowfulness’ in (5) and the metrical structure of this line is given in (6).

(5)

風 雨 聲 音 擾 亂 秋 夜 靜

hong u sian im jiau loan chhiu ia jeng



Metrically, there is a final silent beat in the metrical template. When the lyrics are composed into melodies, the final syllable has the longest duration, as *jeng* in (5).

In addition, no pause appears in the initial position. Therefore, the first syllable of a hemistich must be aligned with the left edge of a musical domain, as marked by the dotted line in (7).

(7) *chhiu hong ia* ‘autumn night sorrowfulness’ Line 1

風      雨      聲      音      擾      亂      秋      夜      靜

hong      u      sian      im      jiau      loan      chhiu      ia      jeng

These phenomena prevail among the four songs, such as those lines shown in (8) to (10).

(8) *bang tshun hong* 'embrace spring breeze' Line 1

獨 夜 無 伴 守 燈 一 下 清 風 對 一 面 吹  
tok ia bo phuann siu ting— e tshing hong dui— bin tshue

(9) *ho pin tshun bang* 'the spring dream by the riverside' Line 1,2

河 邊 春 風 寒 一 樣 阮 一 孤 單 一  
ho pinn tshun hong kuann— tsuann iunn un— ko tuann—

(10) *su kui ang* 'all seasons red' Line 1,2

春 天 花 一 吐 一 清 一 香 雙 人 心 頭 齊 振 一 動  
tshun thinn hue— tho— tshing— phang siang lang sim thau tse ting— tang


In these examples, the final syllable of every metrical line has the longest duration, as *tshue* in (8), *kuann* and *tuann* in (9), and *phang* and *tang* in (10). In addition, the first syllable of every hemistich is consistently aligned with the left edge of a musical measure, as *tok* and *tshing* in (8), *ho* and *tsuann* in (9), and *tshun* and *siang* in (10).

Second, traditional Taiwanese folk songs tend to progress smoothly without medial pauses, so there is few rest marks in the scores. If there is any, it is not linked




to any syllables. Consider the two hemistiches in (11), or more lines in (12).

(11) *ho pin tshun bang* ‘the spring dream by the riverside’ Line 1,2



河 邊 春 風 寒 \_\_\_\_\_ 怎 樣 阮 孤 單 \_\_\_\_\_  
 ho pinn tshun hong kuann \_\_\_\_\_ tsuann iunn un ko tuann \_\_\_\_\_

(12) *ho pin tshun bang* ‘the spring dream by the riverside’ Line 3,4



夯 頭 一 下 看 \_\_\_\_\_ 幸 福 人 作 伴 \_\_\_\_\_  
 iah thou tsit leh khuann \_\_\_\_\_ hing hok lang tsue phuann \_\_\_\_\_

In (11) and (12), the rest marks only fall on the final position of a hemistich and are not linked to any syllables. Here the function of the rest is like the function of pause during speech. It allows the players or singers to breathe or to prepare for the following sound.

### 3.2.2 Mapping between Syllables and Musical notes

The correspondence between language and music can also be observed from the basic components in the two sound forms, i.e. syllables and musical notes. From the data, syllables and musical notes are mostly in a one-to-one mapping, but sometimes

in one-to-two mapping. Consider the example in (13).

(13) *bang tshun hong* ‘embrace spring breeze’ Line 3,4

The musical notation consists of a single staff with ten notes. Vertical lines connect the notes to the syllables below. The syllables are: tsap, tshit, pue, hue, buc, tshut, ke, tng, tio, hsiau, lian, ke. The syllable 'hue' is connected to two notes, while all other syllables are connected to one note.

十	七	八	歲	—	未	出	嫁	登	著	少	年	家
tsap	tshit	pue	hue	—	buc	tshut	ke	tng	tio	hsiau	lian	ke

In (13), each syllable of the lyrics is linked to one musical note, except for *hue*, which is represented by two notes. In the data, there are totally 180 syllables. Among them, 140 syllables are assigned one musical notes, but 39 syllables are linked to two notes. Only one syllable is linked to more than two musical notes, as the second *tsu* in (14).

(14) *su kui ang* ‘all seasons red’ Line 8

The musical notation consists of a single staff with ten notes. Vertical lines connect the notes to the syllables below. The syllables are: li, ua, luan, hue, tsu, tsu, ang. The second 'tsu' is circled, indicating it is linked to two notes. The first 'tsu' is linked to one note, and 'ang' is linked to one note.

你	我	戀	花	朱	—	朱	—	紅
li	ua	luan	hue	tsu	—	tsu	—	ang

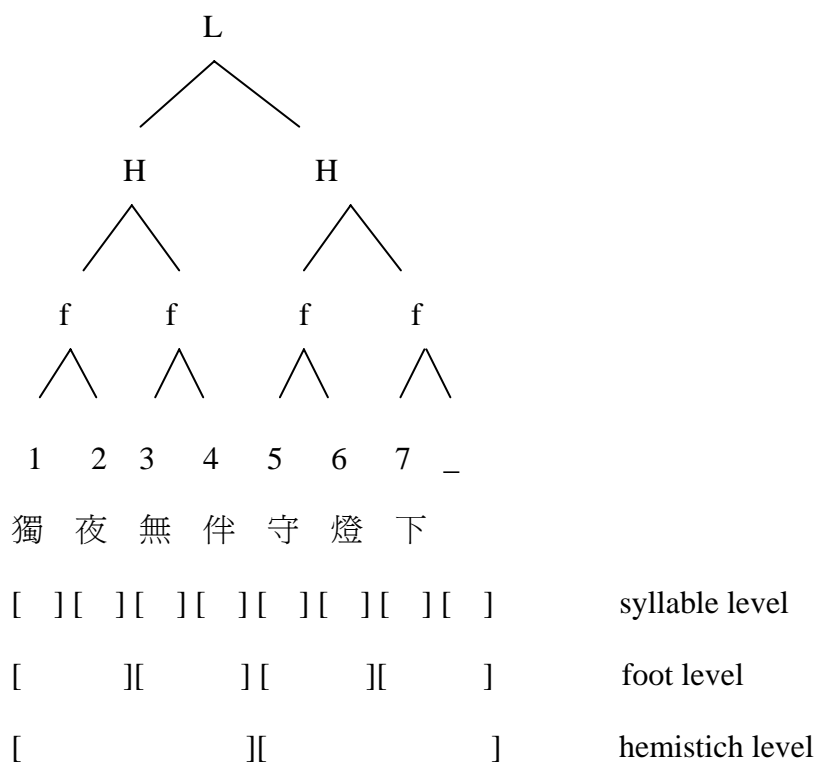
Consequently, in traditional Taiwanese folk songs, there is a great tendency for one syllable of lyrics to be linked to one or two musical notes. In other words, it is less preferred for a syllable to be linked to more than two notes.

### 3.2.3 Structural Mapping between Language and Music

The correspondence between language and music not only exists in small linguistic and musical units, but in bigger structures. In this section, the metrical structure and the musical structure will be investigated.

First, consider the metrical structure in (15).

(15) *bang tshun hong* ‘embrace spring breeze’ Line 1



As in (15), two syllables form a foot and two feet in turn form a hemistich. The structures are marked by brackets.

On the other hand, the musical structure is defined on the basis of time-spans. Time-spans are the intervals between beats. Below is an example of the time-span

structure.

(16) *bang tshun hong* ‘embrace spring breeze’ Line 1

獨 夜 無 伴 守 燈 一 下

$\left. \begin{array}{c} | \quad | \quad | \quad | \quad | \quad | \\ \cdot \quad \cdot \quad \cdot \quad \cdot \quad \cdot \quad \cdot \quad \cdot \quad \cdot \quad \cdot \quad \cdot \quad \cdot \quad \cdot \quad \cdot \quad \cdot \end{array} \right\} \text{Musical Note}$

$\left[ \right] \left[ \right] \left[ \right] \left[ \right] \left[ \right] \left[ \right] \left[ \right] \left[ \right] \left[ \right] \left[ \right] \left[ \right] \left[ \right] \left[ \right] \left[ \right] \left[ \right] \left[ \right] \left[ \right]$

$\cdot \quad \cdot \quad \cdot \quad \cdot \quad \cdot \quad \cdot \quad \cdot \quad \cdot$  Musical Note

$\left[ \quad \right] \left[ \right] \left[ \right] \left[ \right] \left[ \right] \left[ \right] \left[ \right] \left[ \right]$

$\cdot \quad \cdot \quad \cdot \quad \cdot$  Musical Note

$\left[ \quad \right] \left[ \right] \left[ \right] \left[ \right]$

$\cdot \quad \cdot$  Musical Note

$\left[ \quad \right] \left[ \right] \left[ \right]$

From the comparison of (15) and (16), we can see that the feet correspond to the half-notes (♩) and the hemistiches correspond to the whole-notes (♩). In other words, a foot has 2 beats and a hemistich has 4 beats. However, syllables do not correspond to the quarter-notes (♩), as *to* “獨” in (16) occupies 1.5 quarter-note, while *ia* “夜” only seizes 0.5 quarter-note.

### 3.2.4 Tonal Correspondence in Language and Music

As a tonal language, Taiwanese has seven tones and has high tendency of tone sandhi. Most Taiwanese folk songs are composed from lyrics to tune, so the fluctuation of melodic shape is influenced by the tone value<sup>4</sup> of the linguistic syllables. Consider (17).

(17) Tonal correspondence between syllables and musical notes

a. *chhiu hong ia u* Line 2

蚪 蚓 哮 悲 情  
to un hau bi jeng  
LM

b. *ho pin tshun bang* Line 3

夯 頭 一 下 看  
iah thou tsit leh khuann  
LM

c. *chhiu hong ia u* Line 5

嘸 知 雨 水 冷  
m chai ho chui ling  
HL

d. *bang tshun hong* Line 2

清 風 對 面 吹  
tshing hong dui bin tshue  
HM

If the syllable is a rising tone, such as *jeng* ‘emotion’ in (17a), and *thou* ‘head’ in (17b), it is assigned a rising pitch in music; if the word is a falling syllable, like *ling* ‘cold’ in (17c), and *dui* ‘toward’ in (17d), it is represented in a falling pitch.

<sup>4</sup> The tone value here refers to the surface tone.

The mapping of tonal shapes can also be found in the foot domain. Here, a foot is defined on the basis of the metrical tree, as shown in (15)<sup>5</sup>. The tonal correspondence is given in (18).

(18) Tonal correspondence in the foot domain

a. *chhiu hong ia u* Line 1



擾 亂  
jiau loan  
HH MM

b. *bang tshun hong* Line 1



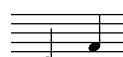
無 伴  
bo phuann  
LL MM\_

c. *ho pin tshun bang* Line 1



河 邊  
ho pinn  
MM HH.

d. *su kui ang* Line 1



春 天  
tshun thinn  
MM HH\_

In (18), the tonal shape of one foot corresponds to the tone value of the syllables. For example, in (18a) *jiau* has a high level tone and *loan* has a mid level tone. As the syllables are composed into melodies, they are assigned a falling pitch. Such tonal correspondence of a foot can be found in (18b-c).

The tonal correspondence can also be discovered in a larger domain, such as a

<sup>5</sup> Throughout this study, whenever we talk about “foot”, it is defined by the metrical tree of the linguistic form.

hemistich. In (19), the melodic fluctuation corresponds to the tone values of the lyrics.

(19) *su kui ang* 'all seasons red' Line 1



吐 — 清 — 香  
 tho — tshing — phang  
 HM — MM — HH —

Such delicate tonal mapping can be further illustrated by (20) and (21).

(20) *bang tshun hong* 'embrace spring breeze' Line 3



十 七 八 歲 — 未 出 嫁 登 著 少 年 家  
 tsap tshit pue hue bue tshut ke tng tiohsiau lian ke

(21) the tonal contour of the line

H	— ● — ● —	H	— ● — ● ● —
M	— — — —	M	— ● — ● ● ● —
L	— ● — ● — ● ● —	L	— ● ● — — — —
	十 七 八 歲		登 著 少 年 家
	tsap tshit pue hue		tng tioh siau lian ke

From the comparison of (20) and (21), we can see that the fluctuations of melody and linguistic tone are very similar.

### 3.3 An Optimality Theory Analysis

We have seen above that music and language are similar in many ways, so the musical outputs of the folk songs can be evaluated under the framework of Optimality Theory (Gilbers and Schreuder 2002). This section applies OT to analyze the relationship between lyrics and melodies in Taiwanese folk songs. The input is the linguistic form and the output candidates are the musical forms.

#### 3.3.1 Prosodic Mapping

From the observations of the songs above, we find that some constraints are relevant to the prosodic mapping of the Taiwanese folk songs. First of all, a silent beat falls on the end of a metrical line: In the initial position of a hemistich, the first syllable must be aligned to the left edge of the measure. An alignment constraint is needed, as in (22).

(22) **Align-Left (H, M)**: The left edge of a hemistich is aligned to the left edge of a measure.

Second, there is no rest that can be associated with a syllable, as stated in (25).

(23)  $*\sigma = \text{r}$  : No syllable can be linked to a rest mark.

Third, traditional Taiwanese songs demand a simplistic tune, so the one-to-one mapping between syllables and music notes prevails among the metrical lines. A



constraint about this is given in (24).

**(24) Uniformity-SN<sup>6</sup>:** Every syllable is assigned one single musical note.

One-to-three or one-to-many mapping is prohibited, because no syllable is designed more than two notes. Another markedness constraint against one-to-three mapping is shown in (25).

**(25) \* $\sigma = \text{J} \text{J} \text{J}$ :** A syllable is not allowed to link to three or more notes.

Fourthly, the edges of the foot corresponds to the edges of the half-notes, and thus one foot is assigned 2 beats, as the constraint in (26) states.

**(26)  $\mathbf{F} = \text{J} \text{J}$ :** A foot must be as long as two musical beats.

With the above constraints, a line is evaluated in (27). The foot domain is marked by brackets and the domain of a half-note is signaled by  $\frown$  above the measures.

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<sup>6</sup> This constraint is adapted from Song (2008).

(27) *chhiu hong ia u* 'autumn night sorrowfulness' Line 1

Input: 風雨聲音擾亂秋夜靜

Candidates:

A.

(風 雨) (聲 音) (擾 亂) (秋 夜) 靜

hong u sian im jiau loanchhiu ia jeng

B.

風 雨 聲 音 (擾 亂) (秋 夜) 靜

hong u sian im jiau loan chhiu ia jeng

C.

風 雨 聲 音 (擾 亂) (秋 夜) 靜

hong u sian im jiau loan chhiu ia jeng

D.

風 雨 聲 音 (擾 亂) (秋 夜) 靜

hong u sian im jiau loan chhiu ia jeng

E.

風 雨 聲 音 (擾 亂) (秋 夜) 靜

hong u sian im jiau loan chhiu ia jeng

In (27), the examined output candidates are the musical forms. The focus is on the third measures that differ in each candidate. In candidate A, syllables are linked to musical notes one by one from left to right, leaving the final syllable in this measure *ia* to be linked to three musical notes. In candidate B, *chhiu* and *ia* are equally linked to two musical notes. In candidate C, *jiau* is linked to the initial two notes, which constitutes one domain of half-notes, and *loan* is compressed to the next domain of half-notes. As a result, the foot *jiau* and *loan* crosses different domains of half-notes. In candidate D, there is a measure-initial rest and the rest mark is not linked to the any syllable. There is also a measure-initial rest in E, while the rest mark is linked to the first syllable of this measure *jiau*. These candidates are evaluated in tableau (28).

(28)

	*σ=ζ	Align-L (H,M)	F=♩	*σ=♩♩	Uniformity-SN
A				* !	* *
↻ B					* * *
C			* !		* * *
D		* !	*		* * *
E	* !				* * * *

As in the tableau above, candidate E is eliminated because *jiau* in the third measure is linked to a rest. Candidate D fails because the first syllable *jiau* in the third measure is not aligned to the left edge of the measure. Candidate C and D are rejected

because the foot containing *jiau* and *loan* has 2.5 beats in C and 1.5 beats in D. As for candidate A, it is ruled out because *ia* in the third measure is linked to three musical notes. The optimal candidate B wins out because the constraint it violates is the lowest one. The one-to-two mapping can be tolerated due to the need for musical fluctuation.

### 3.3.2 Tonal Mapping

The correspondence between language and music not only presents harmony in prosodic structure, but also in the pitch value. In Taiwanese folk songs, melodic shapes are mapped with tonal shapes in the foot domain of the lyrics. As mentioned previously, one syllable tends to be linked to one musical note in Taiwanese folk songs. It is hard to investigate the contour tonal mapping since there is no melodic fluctuation. For syllables that are linked to two musical notes, the tonal contours do not always match the music melody, as shown below.

(29) a. *chhiu hong ia u*, Line 4

幸 福 未 完 成

heng hok bi oan seng

LM

b. *bang tshun hong*, Line 3

誰 家 人 子 弟

siang ka lang tsu te

LM

In (29), *seng* and *lang* have rising tones, but they correspond a falling pitch in the score. The tonal mapping is not harmonic. Among the four songs, there are 39 syllables that are linked to two musical notes, only 9 of them are harmonic in terms of the tonal mapping. Therefore, we turn to a larger domain, i.e. the foot.

According to the observations in 3.2.4, when two syllables belonging to the same foot change from a high tone to a relatively lower tone, they are assigned a falling pitch in music. On the contrary, when they change from a lower tone to a higher tone, the music form of them is a rising pitch. Retaining the tone value of the language in music form can produce harmony to a better degree. From the perspective of OT, the requirement of pitch association can be defined by the association constraint in (29) (Song 2008).

(29) **Association-Pitch:** Given a pair of syllables A and B and a pair of notes X and Y; X is associated to A and Y is associated to B. When the tone value of A is higher than that of B, then  $X > Y$ . When the tone value of A is lower than that of B, then  $X < Y$ .

With this constraint, a foot containing a falling pitch is evaluated in (30).

(30) Tonal input:        HH   MM  
                               *jiau* *loan* 'disturb'  
                                   |       |  
 Music output:         H       L  
                               L       H

	Association-Pitch
☞ A. <i>jiau loan</i> -HL	
B <i>jiau loan</i> -LH	* !

In (30), the tonal input of *jiau loan* is a high level tone followed by a mid level tone. It may have two music outputs: HL or LH. H refers to notes with higher pitch and L refers to notes with lower pitch. So, *jiau loan* is preferably associated with a falling melodic contour, represented by HL, than with a rising contour, represented by LH. As a result, candidate A is the best output.

As for a foot containing a rising pitch, the similarity of tonal shapes in music and language is expected as well. Consider (31).

(31) Tonal input:	MM	HH	
	<i>ho</i>	<i>pin</i>	‘riverside’
Music output:	H	L	
	L	H	

	Association-Pitch
A. <i>ho pin</i> -HL	* !
☞ B. <i>ho pin</i> -LH	

The evaluation in tableau (31) shows that associating a mid level tone to a higher pitch but a high level tone to a lower pitch, such as candidate A, violates the association constraint and is therefore excluded. Candidate B, on the contrary, wins out because of the contour matching of tonal and melodic shapes.

The table in (32) lists the number of tonal alternation in the four songs, showing the rate of accordance among these songs.

## (32) Number of tonal accordance and disaccord

Song	Number of foot	Accordance	Disaccord
<i>chhiu hong ia u</i>	20	12	8
<i>bang tshun hong</i>	20	16	4
<i>ho pin tshun bang</i>	16	10	6
<i>su kui ang</i>	18	14	4
<b>Total</b>	<b>74</b>	<b>52</b>	<b>22</b>

From the table, the mapping of melodic and tonal shapes is not always perfectly consistent. Out of 74 feet, 22 feet do not correspond to the predicted outputs. However, there are 52 feet that show accordance between linguistic and musical tones, with the accuracy rate at 70.3 %. In brief, the mapping between tone and music melody is mostly achieved through the domain of a foot.



### 3.4 Summary

This chapter analyzes the interaction of music and language in four traditional Taiwanese folk songs. These songs reflect the prosodic structure of the linguistic form. They have the following features. First of all, of every metrical line, the last syllable has the longest duration in terms of musical beats. Second, the first syllable of a hemistich must be aligned with the left edge of a musical domain. Third, no linguistic syllable is allowed to be aligned to a rest mark. In addition, traditional Taiwanese folk songs demand a simplistic tune; thus, each syllable of the lyrics tends to be linked to one musical notes. One-to-three or one-to-more mapping between syllables and musical notes is less preferred. The correspondence between language and music also exists in structures. The feet of lyrics corresponds to a half-note ( $\downarrow$ ) and the hemistiches correspond to the whole-notes ( $\circ$ ). Thus, a foot has 2 beats and a hemistich has 4 beats. From a theoretical perspective, the above phenomena are determined by the following constraint ranking:  $*\sigma=\downarrow \gg \text{Align-L (H, M), F} = \downarrow \gg * \sigma=\downarrow \downarrow \downarrow \downarrow \gg \text{Uniformity-SN}$ .

On the other hand, the language-music correspondence also occurs in sound pitches. The rising or falling pattern of a musical foot is approximately determined by the linguistic syllables and can be predicted by the constraint Association-Pitch.