

DO NOTE VALUES AFFECT PARALLELISM BETWEEN LEXICAL TONES AND MUSICAL NOTES IN THAI POP SONGS?

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ABSTRACT

This paper aims to investigate parallelism between tonal transitions and musical note transitions in Thai pop songs, focusing on the effect of note duration on parallelism. In agreement with previous studies, there is a statistically significant parallelism between tonal transitions and musical note transitions, though note duration has no significant effect on the degree of parallelism.

Keywords: Thai, Tones, Music, Prosody, Tones-Music Parallelism, Note values

1. INTRODUCTION

One interest aspect of tone languages is the relationship between lexical tones and musical notes in songs. Previous research on the mapping between tones and musical notes (Schellenberg [15]; Wee [16]; Wong and Diehl [17]) has revealed that transitions between tones on adjacent syllables typically agree in direction with musical note transitions, despite reports of cases that lack such parallelism (Agawu [2], Bodomo and Mora [5], Baart [3], Ho [8]). Ketkaew and Pittayaporn [9] find a similar effect in Thai, showing a statistically significant parallelism between the transitions of tones and musical notes.

The goal of this study is to extend examination to the relationship between prominence in music and prominence in language. In languages, prominence refers to the relative strength among units within the same phonological domain. Stressed syllables, that is, head syllables with relatively high prominence within the word, are associated with an increase in volume and duration (Hayes [7], Pater [12]). The longer duration in these such syllables are known to allow full phonological contrasts, which are often neutralized in unstressed syllables. For example, Thai tones contrast is preserved on stressed syllables but are claimed to be neutralized in unstressed ones (Abramson [1], Gandour et al [6], Luksaneeyawin [11]).

Like in language, prominence also plays an important role in music. In music, the stress or accent is the emphasis placed on a particular note within a musical phrase. Accent or stress in music is

often realized with greater intensity, duration and relative pitch excursion, in ways parallel to the effects of stress on language

Given the importance of prominence in both language and music, it is conceivable that prominence should have a favorable effect on the parallelism between tones and note transitions. Investigating the parallelism between tones and musical notes in Mandarin, Wee [16] suggests that the most prominent beat in the musical phrase can create more parallelism or agreement between tonal transition and note transition in terms of the direction. However, it is still unclear how exactly musical prominence is related to linguistic prominence. Given that some accent or stressed notes can be either longer or louder than the other notes within the bar or musical phrase, it is possible that just the duration favors parallelism.

In this study, we investigate Thai pop songs to determine whether relative note duration influences the degree of parallelism between tonal transitions and musical note transitions. Our hypothesis is that relative note duration influences parallelism between lexical tone transitions and musical note transitions. More specifically, longer note durations are correlated with higher percentage of parallel transitions, while shorter notes are matched with opposing transitions more frequently.

2. BACKGROUND

The phonology, acoustics and perception of Thai tones have been studied extensively, though relatively little has been done on the mapping between lexical tones and music in Thai. In addition, the Thai language is a good case study for tone-music interface because of its five tones, illustrated in Table 1.

Table1: Thai lexical tones

Tone	Example	Tone value
MID	khā: ‘to be stuck’	[33]
LOW	khà: ‘galangal’	[21]
FALLING	khâ: ‘value’	[42]
HIGH	khá: ‘to trade’	[45]
RISING	khǎ: ‘leg’	[24]

Previous studies on the relationship between tones and music in Thai show parallelism between the transitions of lexical tones and the transitions between two successive musical notes. List [10] shows that the degree of parallelism between tones and sung pitch in recital reaches approximately 90 percent. In contrast, the correspondence between tones and musical notes is only approximately 60 percent in contemporary songs. Similarly, Saurman [14] demonstrates that the degree of parallelism between tones and tunes in classical and traditional songs is approximately 90 percent, in contrast to contemporary songs, which shows parallelism at only 60 to 70 percent. Not only do these studies reveal parallelism between tonal transitions and musical pitch in Thai, but they also show that musical genres have a substantial effect on the degree of parallelism.

For Thai pop songs, Ho [8] shows that the degree of parallelism is approximately 80 percent. In her observations, the mismatches generally involve the Falling tone. More recently, Ketkaew and Pittayaporn [9] confirm parallelism between tones and melody in popular music, using a larger corpus. Moreover, in the study, they find that both Falling and Rising tones in Thai behave as if they were High for the purposes of tone-music alignment.

In summary, all previous work on Thai demonstrates clearly that tonal transitions and note transitions typically agree in direction. However, there have been no studies which have examined the role of prominence in the mapping. It is therefore still unclear if the rhythmic value of notes has an effect on parallelism.

3. METHODS

In order to investigate this question, a corpus of 40 Thai pop songs was examined. The study consisted of two parts. The first part investigated parallelism between the direction of tonal transitions and musical notes transition, following the methodology of Ketkaew and Pittayaporn [9]. In particular, tonal transitions were grouped into 3 categories according to their directions, as summarized in Table 2. Note that the RISING and FALLING are treated as if they were HIGH, based on Ketkaew and Pittayaporn's [9] previous findings. One exception is FALLING→FALLING, which was classified as a descending rather than a level transition.






Table 2: Tonal transition categories (following Ketkaew and Pittayapon [9])


Ascending tonal transition	Descending tonal transition	Level tonal transition
MID→HIGH MID→RISING MID→FALLING LOW→MID LOW→FALLING LOW→HIGH LOW→RISING	MID→LOW FALLING→LOW FALLING→MID FALLING→FALLING HIGH→MID HIGH→LOW RISING→LOW RISING→MID	MID→MID LOW→LOW FALLING→HIGH FALLING→RISING HIGH→FALLING HIGH→HIGH HIGH→RISING RISING→FALLING RISING→RISING RISING→HIGH

Subsequently, we coded the mapping between the tonal transitions and musical note transitions as parallel, opposing and non-opposing. Tonal target transitions that agreed with musical transitions in the direction of pitch change were coded as parallel. We coded transitions as opposing if the tone transition and note transition went in opposite direction. Those that were neither parallel nor opposing were coded as non-opposing.

In the second part, we investigated whether the rhythmic values of notes affected parallelism. To examine this, each note was converted in to a numeric value. A quarter note, which represents a single beat, was coded as '1', and other notes were coded with the appropriate corresponding values (as summarized in table 3).

Table 3: Coding of musical notes

Musical note notations	Name of musical notes	Number coded for the notation
	Half note	2
	Quarter note	1
	Eighth note	0.5
	Sixteenth note	0.25
	Thirty-second note	0.125

Note that dotted notes, which increase the duration for particular note by 50 percent of its duration, were also coded accordingly. For example, a dotted quarter note () , which represents one and a half beats was coded as 1.5.

4. RESULTS

Before testing the effect of notes' rhythmic value on parallelism, the parallelism between tonal transitions and musical note transitions were investigated. Friedman and Wilcoxon test were applied to the 5,891 transitions found in the corpus. Table 4 summarizes the percentages of parallelism in Thai pop songs.

Table 4: Parallelism between tonal transitions and musical note transitions

Tonal transition	Melodic transition		
	Ascending	Descending	Level
Ascending	1310 (22.24%) (parallel)	286 (4.85%) (opposing)	260 (4.41%) (non-opposing)
Descending	388 (6.58%) (opposing)	1241 (21.07%) (parallel)	301 (5.1%) (non-opposing)
Level	656 (11.13%) (non-opposing)	609 (10.33%) (non-opposing)	840 (13.70%) (parallel)

Sum of diagonal cells: 57.6%

From the analysis, parallel transitions (3391/5891, 57.7%) occurred more frequently than opposing (674/5891, 11.5%) and non-opposing (1826/5891, 30.1%) transitions at a statistically significant level ($p < 0.001$). Non-opposing transitions were also more frequently than opposing transitions at a statistically significant level ($p < 0.001$). In agreement with Ketkaew and Pittayaporn's [9] previous study, there was a relatively high degree of parallelism between tonal transitions and musical note transitions in Thai pop songs.






To investigate the effect of note values, a linear mixed effects model was applied to determine whether the duration of first note, the second note or both notes affected the percentage of parallelism. Again, our hypothesis was that longer notes would yield a greater percentage of parallel transitions than shorter notes.

R (R Core Team [13]) and glmer from the function lmer4 (Bates, Maechler & Bolker [4]) were used to run a linear mixed effects analysis of the relationship between parallel and note values. The fixed effects were the first note value, the second note value (with an interaction term). Random effects included random intercepts for subjects and items and random slopes for subjects and items. The results revealed that none of the fixed effects had a main effect on parallelism between transitions

($p = 0.134$ for first note and $p = 0.386$ for second note). Furthermore, there was no interaction between two fixed factors.




Notes commonly found in Thai pop songs were whole notes, half notes, quarter notes, eighth notes, sixteenth notes and thirty-second notes. Eight notes were found most frequently in Thai pop songs. However, these notes did not differ substantially from one another in terms of parallelism, as shown in table 5.

Table 5: Percentage of occurrence of parallel transitions

Note value	Percentages of parallel transitions (%)	
	As the first note	As the second note
	72.22%	48%
	51.9%	54.43%
	59.14%	55.55%
	63.36%	53%
	55%	57.89%

As seen in the table above, longer notes did not have higher percentages of parallel transitions. In addition, the dotted notes, which are 50 percent longer than the corresponding non-dotted notes, did not have any substantial effect on tone parallelism, as shown in the table 6.

Table 6: Percentage of dotted note occurring with parallel transitions

Note value	Percentage of parallel transition (%)	
	First note	Second note
	61.43%	55.37%
	55.26%	58.49%
	-	55.37%

It can be seen that the longer duration of dotted notes did not also create more parallel transitions than the shorter notes.

5. DISCUSSION AND CONCLUSION

As for the results of parallelism, with more data than the previous work, tonal transitions and musical notes transitions were shown to parallel one another in their direction at a statistically significant level. However, the hypothesis that the rhythmic values of notes affect the degree of parallelism was not supported. The results from the mixed-effects model showed that neither effects from the first note nor the second note reached significance, suggesting that note value has no effect on parallelism.

These results for the effect of note value differ from Wee [16], who suggests that prominent positions in the musical melody create more parallel transition. However, the discrepancy may be due to the different methods used. While Wee [16] examines impressionistically prominent beats in the songs, our current study focuses on one basic element of musical stress which is the rhythmic value of individual notes.

One promising direction for future studies is the effect of prominent beats on parallelism. From a linguistic perspective, whether the syllable is part of a content word or a function word is another prominence-related factor that may affect parallelism. To better understand the role of prominence in the mapping between tones and melody, more research is needed on the interaction between duration and perceptual prominence in both language and music.

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