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以優選理論分析梅縣與曼谷客語變調

Meixian and Bangkok Hakka Tone Sandhi: An Optimality Theory Analysis

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MEIXIAN AND BANGKOK HAKKA TONE SANDHI:
AN OPTIMALITY THEORY ANALYSIS

By

Johnny

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研究所別: 語言學研究所

論文名稱: 以優選理論分析梅縣與曼谷客語變調

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在前人的研究中，已透過音韻規則的角度分析梅縣客語 (Meixian Hakka) 和曼谷客語 (Bangkok Hakka)， 但仍有部分疑問未獲得合理解釋。諸如：部分聲調不會受變調規則(Tone sandhi)的影響、變調的觸發條件以及本調 (Citation tone) 和變調間結構上的關係等。 有鑒於此，本研究透過優選理論 (Optimality theory, OT) 重新分析梅縣客語和曼谷客語。

上述兩個方言有兩種變調的方式 : 同化(assimilation)和異化(dissimilation)。在此基礎上，為了更準確的描述變調現象，本研究在分析上主要採用必要性起伏原則 (obligatory contour principle) 和避免起伏原則 (no-jumping principle)，並應用聯合制約 (Constraint Conjunction approach) 的概念。採取此分析方式的理由在於分析對象的變調具有相當有標(marked)且受限於中心詞(head)右端音節的聲調。此外，本研究也採用一部分比聲調結構性制約(tonal markedness constraint)更高排序的信實性制約(faithfulness constraint)。這些制約會導致部分聲調或變調結構不受變調規則影響，例如：調域 (register) 和聲調的起點 (initial target) 將保留原始樣貌。

研究結果指出，聲調結構性制約和數個排序最高的聲調信實性制約能更準確地呈現梅縣客語和曼谷客語在變調時，輸入值與輸出值之間的對應關係 (input-output correspondence)。在論文結尾，筆者將綜覽本研究並提出未來可繼續延伸的相關議題。

ABSTRACT

The grammar of Meixian and Bangkok Hakka tone sandhi has been analyzed from a rule based approach. Nevertheless, there are some questions and details that could not be solved by the analysis, such as the status of tones that do not undergo sandhi, triggers of the tone sandhi, and the structural relation between citation tones and their sandhi counterparts. Thus, the purpose of this study is to re-analyze the tone sandhi in Meixian and Bangkok Hakka under the constraint based framework, Optimality Theory (OT).

There are two mechanisms of tonal alternations in the two dialects' tone sandhi: assimilation, and dissimilation. So in order to capture the tonal alternations, the current analysis applies the concepts of the Obligatory Contour Principle, and the No-Jumping Principle. The constraints generated according to these principles work well with the application of the Constraint Conjunction approach. The conjoined constraints are needed since the tone alternations are highly marked, and depend a lot on the head/right syllable tone. Furthermore, this thesis also posits several faithfulness constraints that rank higher than the tone sandhi markedness constraint. The high ranked faithfulness constraints govern the preservation of several tones from any alternation, and preservation of some structures of the citation tones when they become sandhi tones (i.e. register and initial target).

In conclusion, the positing of tone sandhi markedness constraints and undominated identity constraints presents a better input-output correspondence relation of the tone sandhi phenomena in Meixian and Bangkok Hakka. To conclude the thesis, a brief summary of the study and possible further issues are presented.

CHAPTER 1

INTRODUCTION

This thesis provides an analysis of disyllabic tone sandhi phenomena in Hakka dialect of Meixian and Bangkok from the framework of Optimality Theory/OT. Meixian Hakka is a dialect spoken in Meixian County, China. It is considered one of the most standard Hakka dialects to be researched by scholars such as, Hashimoto (1973), Norman (1988), Huang (1992, 1995), Xie (1994), Yuan et al. (2001), and Cheung (2011). The data used in this research was mainly taken from Cheung (2011) with some reconsideration of its tone values. There are three tones that undergo alternations described in that research. First, mid level tone (MM) changes to mid rising tone (MH) when it is followed by low level tone (LL), low falling tone (ML), and short low falling tone (ML). Second, low falling tone (ML) changes to mid level tone (MM) when it is followed by low level tone (LL), low falling tone (ML), and short low falling tone (ML). Last, high falling tone (HM) changes to high falling tone (HH) when it is followed by low falling tone (LL), low falling tone (ML), high falling tone (HM), and short low falling tone (ML). There are two interesting aspects in the tone sandhi of Meixian dialect: First, It is recognized two mid level tones in its tonal inventory that possess different register, and tone melody values as the results of different sources. Second, the tone sandhi system is affected by both assimilatory and dissimilatory mechanisms in tone melody level that interacts with each other.

Bangkok Hakka refers to Hakka spoken in Bangkok City, Thailand. This dialect is found in Bangkok due to the immigration of some Hakka people to Southeast Asia countries such as Indonesia, Malaysia and Thailand more than 100 years ago. The first generation of Hakka speakers in Thailand came from several districts of Guangdong (mainly Meixian and Shantou). Thus, it is highly possible that Bangkok Hakka is a variation of Meixian Hakka as Shantou is an area where Teochiu dialect is spoken. In Siripen (2008), it is described that Bangkok Hakka has two tones that undergo tone sandhi. First, mid level tone (MM) changes to high rising tone (MH) when it is followed by LL, ML and <u>ML</u>. The other was HH (*Qusheng*) changes to HM when it is followed by MM and <u>H.</u> The tone sandhi in Bangkok Hakka shares similar characteristics with Meixian Hakka where there is interaction between assimilatory and dissimilatory effect in its tone melody tier.

In previous research of these two dialects, the tone sandhi in the dialects was analyzed by using a ruled-based approach. It is an approach that uses a single rule for a single transformation. The traditional approach shows a grammar of the tone sandhi and it also provides the mechanism on how tones are alternated. However, there are several problems that can not be explained by the ruled-based approach like: why certain tones undergo sandhi and the others do not despite being provided the same environment, and why a tone transforms to a certain tone not the other. In the following details, there are key issues that accounted for later in the thesis from the constraint based approach, OT.

1. How OT analysis differs from the rule-based approach?

2. Can a single traditional constraint analyze the tone sandhi in these dialects? If not, are there any other mechanisms to solve the problem?

3. Regarding the interaction between assimilation and dissimilation which is triggered by low register head/right tone, which one is prioritized and how are they ranked in the hierarchy?

4. What happens to tone sandhi with non-low register head tone? What kind of constraint is adequate to describe this tone sandhi?

5. What happens to non tone sandhi tones such as tone in head position and certain tones that remain their faithful form? How are they preserved?

6. Is there specific characteristic of the output tone which is similar to its input tone? How are they defined in the ranking argument of OT?

This thesis is organized as follows: Chapter one provides brief introduction of the objective of the research and introduction of both of the dialects. Chapter two presents the theoretical base of this research, OT and several importance aspects related to tone and tone sandhi. Chapter three and four present the OT analysis towards tone sandhi of the two dialects. And, chapter five gives conclusions to this thesis.

CHAPTER 2

LITERATURE REVIEW

This chapter consists of three sections. The first section (2.1) discusses the theoretical framework which is related to the constraint based approach of Optimality Theory. This section also presents some approaches within the theory such as Correspondence Theory and Constraints Conjunction. The concept of tonal markedness, development of tonal structure, and duration of tones are introduced in section 2.2. In the last section (2.3), different kinds of Chinese tone sandhi and the application of relevant constraint conjunction are explained.

2.1 Theoretical Background

2.1.1 Optimality Theory

Optimality Theory (OT) is proposed by Prince and Smolensky (1993, 2004). This theory uses different approaches as compared to the rule-based model of Chomsky and Halle (1968). The rule-based model use transformation rules to set the grammar of a language. While in OT, the grammars of languages are set in the parameter of the set of universal constraints with a language specific ranking. This means all languages possess similar constraints, and the differences among languages are in the rankings of the constraints. This ranking system is fulfilled by means of several core elements of the framework: CONSTRAINT, GENERATOR, and EVALUATOR. The framework of the model can be seen from flowchart (1).

(1) OT Flowchart

	GEN (Generator)		EVAL (Evaluator)		
Input	→	Candidate (a)	CONSTRAINTS	→	Output
	→	Candidate (b)	CON 1 >> CON 2 >> CON 3		
	→	Candidate (c)			
		…			

The flowchart (1) starts from the given input where it is generated in GEN to become a set of possible candidates. Then, these candidates are sent to EVAL which consists of the ranking of constraints. This ranking evaluates the generated candidates and selects the one optimal candidate. The optimal candidate is the one which violate less highly prioritized (top-ranked) constraints.

2.1.2 Correspondence Theory

Correspondence theory (McCarthy and Prince 1995) defines the relation between representations of a language, and explains whether they show an input-output relation or output-output relation. The input-output correspondence relation associates some or all of the elements in the input with some or all of the linguistics elements in the output. To get a better theoretical understanding, the following schema (2) elaborates the schema of Correspondence.

(2) The schema of Correspondence (McCarthy and Prince 1995:262)

Given two strings S1 and S2, correspondence is a relation Ʀ from the elements of S1 to those of S2. Element α ϵ S1 and β ϵ S2 are referred to as correspondence of one another when α Ʀ β.

The association between these input-output linguistics elements is governed by faithfulness constraints while its markedness constraint "militate against structural configurations" (McCarthy 2003)

(3) a. MAX (maximality): Every segment in S1 has a correspondent in S2.

b. DEP (dependence): Every segment in S2 has a correspondent in S1.

c. IDENT [F] (identity): Correspondent segments are identical with respect to feature F.

Since every tone has its own citation tone and sandhi which directly shows the input-output form, the input-output correspondence relation is the most relevant in this two dialects' disyllabic tone sandhi.

2.1.3 Constraint Conjunction

Constraint conjunction (CCT) is considered as a mechanism in OT which combines two simple constraints. This kind of constraint is proposed by Smolensky (1993, 1995). These kinds of constraints are meant to eliminate unwanted candidates which cannot be eliminated by a single constraint (Green 1993, Smolensky 1993). Lubowicz (2005) developed the idea of CCT for constraints in order to exclude the worst of the worst candidate. Theoretically, Ito and Mester (1998:10) define the CCT as shown in schema (4).

(4) Local Conjunction of Constraints is:

a. Definition

Local Conjunction is an operation based on the constraint set forming composite constraints:

Let C1 and C2 be members of the constraint set Con. Then their Local Conjunction C1 & C2 are also members of Con.

b. Interpretation

The Local Conjunction C1 & C2 is violated if and only if both *C1 and *C2 are violated in some domain δ.

The ranking of these combined constraints are always higher than single constraint ones.

c. Ranking (universal)

C1 & C2 >> C1

C1 & C2 >> C2

From the interpretation in (4b), it is clear that all components of the combined constraints need to be violated to get one violation mark. And in (4c) the CCT must rank higher than its single counterpart since they are a more specific constraint.

2.2 Tone

2.2.1 Tonal Markedness

Contour tones are considered as a more marked tone when it is compared to level tones. There are two arguments which directly support this view. First, we can find more languages with level tones instead of contour tones (Zhang 2001: Yip 2001,2002; Bao 2003). Second, we need more effort and duration in articulating contour tones as compared to level tones. In addition to this second arguments Yip (2001,2002) proposes a markedness hierarchy (5):

(5) Minimize Articulatory effort (Yip 2001;315)

a. Contour tones are more marked than level tones: *CONTOUR >> *LEVEL

b. Rising tones are more marked than falling tones: *RISE >> *FALL

c. High tones are more marked than low tones: *H >> *L

In the hierarchy (5), the preference of certain types of tone in term of articulation effort is obvious. However, even contour tones is more marked, they are still available in human language, especially in Chinese. Moreover, the constraints could compose a part of CCT utilized in this thesis.

In addition, de Lacy (1999, 2002) brings up the positional tendency of tonal markedness as shown in (6) and (7) to deal with the stress grammar of Ayutla Mixtec.

(6) Tonal preference in the head position

*HD/L >> *HD/M

(7) Tonal preference in the non-head position

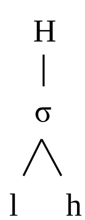
*NonHD/H >> *NonHD/M

The hierarchies (6 & 7) show that low level tone is the least preferred in the prosodic head position while high level tone is the least preferred in the prosodic non-head position. It is important to note that these hierarchies based on stress language. Their existence in Chinese languages is still debatable but these kinds of positional markedness constraint are taken into account into the tone sandhi of the dialects later in this thesis.

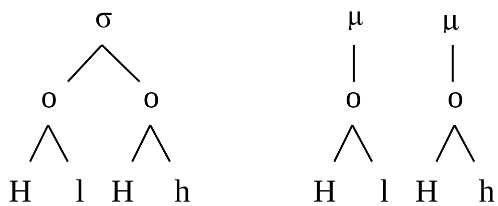
2.2.2 Internal Structure of Tone

There are 4 kinds of internal structure of tone and its theoretical significance which we discuss in the following diagrams.

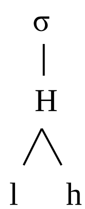
(6) Tonal representation 1 (Yip 1980, Hyman 1993): Tonal node does not dominate tone melodies. In addition, the tonal melody is also independent. As they are independent of each other, the whole tone cannot spread as a unit and the contour cannot spread without the register.



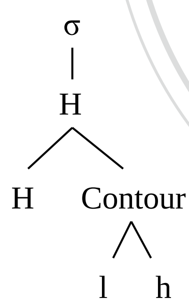
(7) Tonal representation 2 (Clements 1981, Duanmu 1990, 1994, Snider 1990) : Tonal features dominate two independent tone melody



(8) Tonal representation 3 (Yip 1989, Hyman 1993): The register node is the tonal node meaning the tone melodies are dominated by the tonal node. The whole tone may spread as a unit. However, the register and contour could not spread without each other.



(9) Tonal representation 4 (Bao 1990, Snider 1999): tone melody is dominated by contour node which is a sister to register feature, and where both are dominated by a Tonal Node.



This thesis adopts the tonal geometry 4. The model is chosen as unlike the geometry 1,2 ,and 3 that remain intact, the tone melody in this diagram may change independently without involving register tier.

2.2.3 Syllable types and Tone duration (Zhang 1998)

Concerning the type of syllable, tone in traditional Chinese phonology is divided into two kinds. *Shu* tones which end in sonorants and *Ru* tones which end in obstruents or checked syllables. *Shu* tones have longer tonal and *ru* tones have shorter duration. *Ru* tones are usually underlined to differentiate it from other tones. Thus, Zhang (1998) posits two constraints related to the duration of tone in Chinese which prevents long tone on checked syllables and short tones on open syllables. The concept of the two tones and the duration related constraints are to be identified as identity constraint in the analysis.

2. 3 Chinese Tone Sandhi Typology (Bao 2011)

By referring to previous works of Chen (1987, 2000), Bao (2011) categorizes Chinese tone sandhi into four types: Contextual tone sandhi, positional tone sandhi, templatic tone sandhi and tone spread. When a tone sandhi is sensitive to certain adjacent tone features, it is considered as a contextual type. This type of tone sandhi may target an element of the tonal structure such as either register or contour or both elements. Some examples of languages which fall into this category are Luoyang (He 1996) which target the register tier of the language, Pingyao (Hou 1980) which target the contour tier, Gaomi which target both register and contour. When tone sandhi is conditioned by its position such as Southern Min dialect of Xiamen (Chen 2000) they are considered as positional tone sandhi. The third kind, templatic tone sandhi is the one which occurs in the polysyllabic compounds or phrases. The sandhi tones are usually prespecified meaning they have no relation to tones in the input. The last type is spread tone sandhi which means a sandhi tone spreads to neighboring syllables as we may see from Wu Dialects (Chen 2000). Both dialects discussed in this thesis are of the contextual types. The tone sandhi is sensitive to adjacent elements and targets the melody tier of the adjacent elements.

2.4 Tone Sandhi and CCT (Lin 2011, Chen 2013)

Lin (2011) analyzes Hakka tone sandhi of Dongshi dialect by means of CCT. Since Dongshi Hakka's assimilation and dissimilation tone sandhi occurs when the head tone are low in register value, they cannot be captured by simple assimilation constraint (NOJUMP-t) and dissimilation constraint (OCP-C(l)). Thus, several CCTs on tone sandhi in adjacent domain are posited by Lin (2011) such as $[\text{NOJUMP-t\&*HD/Lr}]_{ADJ}$ and $[\text{OCP-C(l)\&*HD/Lr}]_{ADJ}$ to account for these kinds of tone sandhi phenomena. These combined constraints rank among the highest constraints while their single counterpart is inactive.

Chen (2013) also addresses the tone sandhi of Liujia Raoping Hakka and Ningdu Tiantou Hakka by positing several CCTs. Some of the tone sandhi in these two dialects are captured by a combination of agreement and sequential of markedness constraint with certain marked tones such as [OCP-h & *M] and Agree-t & *LL] which proves to be a good strategy to solve certain problematic tone sandhi in the dialects. Since similar cases are found in Meixian and Bangkok Hakka, where there are some characteristics of tonal feature in the head position of Meixian and Bangkok Hakka, this strategy in Lin (2011) and Chen (2013) are adopted in the analysis in Chapter 3 and 4.

CHAPTER 3

OT ANALYSIS OF MEIXIAN HAKKA

This chapter presents a constraint based analysis of disyllabic tone sandhi of Meixian Hakka spoken in Meijiang District and Meixian County, China. The data of this thesis is mainly taken from Cheung (2011). The chapter is arranged into following sections: Section 3.1 provides the value of the citation tones and sandhi tones of Meixian Hakka. Section 3.2 shows patterns, process and generalization of the tonal alternations. Section 3.3 presents the Optimality Theory analysis of the disyllabic tone sandhi patterns. In this section, the alternations of tone structure are analyzed in detail. And the mechanism on how the conjunction constraints (CCT) are ranked against faithfulness constraints and other markedness constraints to produce the optimal sandhi tone is shown. The preservation of certain tones, and tone features are also presented in this section. Section 3.4 provides a Hasse diagram showing Meixian Hakka tone sandhi grammar, and a summary table of possible outputs. Section 3.5 is the conclusion for the analysis of tonal alternation grammar of Meixian Hakka.

3.1 Tone Inventory

According to the phonetic based research presented by Cheung (2011), there are six citation tones in Meixian Hakka: *Yinping* 33 (mid level/MM), *Yangping* 11 (low level/LL), *Shangsheng* 41 (high falling/HL), *Qusheng* 51 (high falling/HL), *Yinru* 41 (short high falling/HL), and *Yangru* 5 (short high level/H)[1]. Meixian Hakka tonal

[1] In this thesis, Chao's (1930) is converted to Yip's transcription (2001) where tone value 4& 5 are marked as H, 3 as M, and 1&2 as L.

inventory is also composed of three sandhi tones: sandhi tones 35 (high rising/MH), 33 (mid level/MM), and 55 (high level/HH) of which derived from *Yinping* (MM), *Shangsheng* (HL) and *Qusheng* (HL) respectively. There are several overlapping tone values in this thesis, but this thesis recognizes that the tones with similar tone value to have phonetic differences not a phonemic difference. For example, there are three high falling tones and two mid level tones. In order to solve this phonemic similarity, this thesis reconsider both tone value 41 of *Shangsheng*,and 41 of *Yinru* to be low falling/ML and short low falling/ML phonologically. This means, 41 and 41 are considered as phonetic variants of 31 and 31 respectively. This claim is also supported by the Cheung's own research where the F_0 value is slightly below the 4th point on the 5 point scale. Therefore, it is highly possible the differences are only gradient (phonetic) differences rather than the categorical (phonemic) differences. Moreover, *Qusheng* is also considered as a high falling tone/HM rather than 51/HL. The reason for this consideration is that the fact that most of tone systems avoid contour tone pairs which have the same start or end points but different pitch differentials such as the overlap of HL and ML as found in this data (Bao 1999). So like *Shangsheng* and *Yinru*, 51 found in the data are considered as a phonetic variant rather than a phonemic category. This claim is also supported by Huang's (1992) transcription where the tone value was given 53.

Another point to make is that there are two mid level tones here, *Yinping* citation tone and *Shangsheng* sandhi tone. In this thesis, it is assumed that the register value of Meixian and Bangkok Hakka sandhi tones are always identical and they are enforced by an undominated faithfulness constraint, IDENT-reg (see 3.3.4). Thus, these two tones are identified to have two different values: register value and tone melody value as we can see later in (1). This argument can be proven by the alternation of tone from MM to MH and from ML to MM. The hypothesis is that register value of MH sandhi tone (Hr,lh) is preserved from its citation tone. The same condition applies to the sandhi tone MM where the register value is derived from its citation tone ML which has low register value.

Furthermore, the tonal alternations in Meixian Hakka are approached from its internal structure. Since the tone alternations in this dialects affects its register, contour and the tone melody value of the tone, Bao's (1999) tone structure system with Lin's (2011) labeling is adopted. The following table presents the internal structure of tones in Meixian Hakka grammar.

(1) Meixian Hakka Tone Inventory

Citation Tones	Sandhi Tones
MM, (Hr,l)	MH (Hr,lh)
LL (Lr, l)	
ML (Lr, hl)	MM (Lr,h)
HM (Hr,hl)	HH (Hr, h)
ML (Lr, hl)	
H (Hr,h)	

3.2 Tone Sandhi Patterns

There are three citation tones that undergo sandhi process in Meixian Hakka. First, the mid level tone (MM) alternates to high rising tone (MH) when it is preceded by low level tone (LL), low falling tone (ML) and short low falling tone (ML). Second, low falling tone (ML) alternates to mid level tone (MM) when it is preceded by low level tone (LL), low falling tone (ML) and short low falling tone (ML). Third, high falling tone (HM) alternates to high level tone (HH) when it is preceded by low level tone (LL), low falling tone (ML), short low falling tone (ML)and high falling tone (HM).

To allow us see a better picture of the tones that undergo alternations, and those that do not, a full chart (6x6) of the tonal combination is shown in the following table.

(2) Tonal combinations table

S2 S1	*Yinping* MM Hr, l	*Yangping* LL Lr, l	*Shangsheng* ML Lr, hl	*Qusheng* HM Hr, hl	*Yinru* ML Lr, hl	*Yangru* H Hr, h
Yinping MM Hr, l	MM-MM Hr-Hr l-l	MH-LL Hr-Lr lh-l	MH-ML Hr-Lr lh-hl	MM-HM Hr-Hr l-hl	MH-ML Hr-Lr lh-hl	MM-H Hr-Hr l-h
Yangping LL Lr, l	LL-MM Lr-Hr l-l	LL-LL Lr-Lr l-l	LL-ML Lr-Lr l-hl	LL-HM Lr-Hr l-hl	LL-ML Lr-Lr l-hl	LL-H Lr-Hr l-h
Shangsheng ML Lr, hl	ML-MM Lr-Hr hl-l	MM-LL Lr-Lr h-l	MM-ML Lr-Lr h-hl	ML-HM Lr-Hr hl-hl	MM-ML Lr-Lr h-hl	ML-H Lr-Hr hl-h
Qusheng HM Hr, hl	HM-MM Hr-Hr hl-l	HH-LL Hr-Lr h-l	HH-ML Hr-Lr h-hl	HH-HM Hr-Hr h-hl	HH-ML Hr-Lr h-hl	HM-H Hr-Hr hl-h
Yinru ML Lr, hl	ML-MM Lr-Hr hl-l	ML-LL Lr-Lr hl-l	ML-ML Lr-Lr hl-hl	ML-HM Lr-Hr hl-hl	ML-ML Lr-Lr hl-hl	ML-H Lr-H hl-hl
Yangru H Hr, h	H-MM Hr-Hr h-l	H-LL Hr-Lr h-l	H-ML Hr-Lr h-hl	H-HM Hr-Hr h-hl	H-ML Hr-Lr h-hl	H-H Hr-Hr h-h

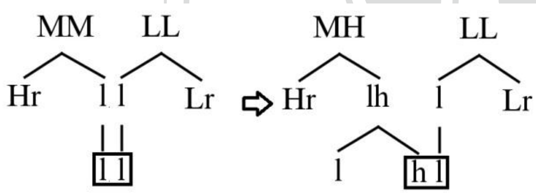
From the table above, it is evident that the mid level tone undergoes changes when it is followed by low level tone, low falling tone and short low falling tone. There are rules for each tonal alternation with its structural details in the following table.

(3) Mid level tone sandhi

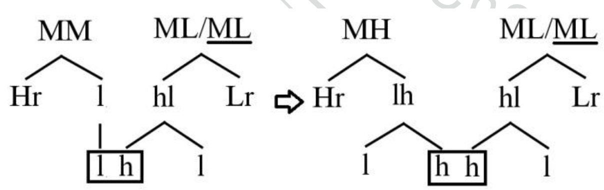
1.	MM-LL [(Hr,l)-(l,Lr)] *tsu* p^h*i* 'pork skin'	→	MH-LL [(Hr,lh)-(l,Lr)] *tsu* p^h*i* 'pork skin'
2.	MM-ML [(Hr,l)-(hl,Lr)] *tsu tu* 'pork belly'	→	MH-ML [(Hr,lh)-(hl,Lr)] *tsu tu* 'pork belly'
3.	MM-ML [(Hr,l)-(hl,Lr)] *su tsok* 'desk'	→	MH-ML [(Hr,lh)-(hl,Lr)] *su tsok* 'desk'

In the alternations of mid level tone, it is obvious that there are two different mechanisms of the tonal alternation: tone melody dissimilation (MM-LL) and tone melody assimilation (MM-ML & MM-ML). The tree diagrams showing the details on both phenomena are presented below.

(4) MM-LL tone sandhi (low tone melody dissimilation)



(5) MM-ML/ML tone sandhi (high tone melody assimilation)



Tree (4) shows the dissimilated intersyllabic low tone melody. The dissimilation process of (4) contradicts with tree (5) where the different intersyllabic features are assimilating from the head/right syllable of the tonal pair. In addition, ML and ML are treated in one analysis.

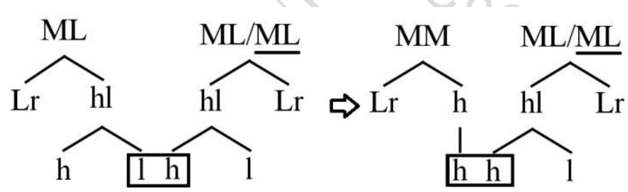
The low falling tone of the Meixian dialect alternates to mid level sandhi tone when it precedes the same sets as found in mid level tone alternations, they are low level tone, low falling tone, and short low falling tone. The alternations are shown in the following table:.

(6) Low falling tone sandhi

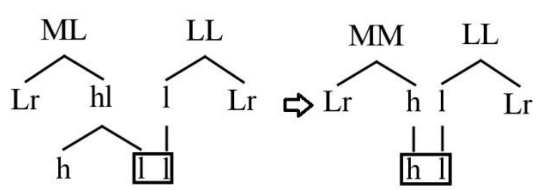
1.	ML-LL [(Lr,hl)-(l,Lr)] *pu* t^h*eu* ‘axe’	→	MM-LL [(Lr,h)-(l,Lr)] *pu* t^t*eu* ‘axe’
2.	ML-ML [(Lr,hl)-(hl,Lr)] *pu* k^h*au* ‘make up examination’	→	MM-ML [(Lr,h)-(hl,Lr)] *pu* k^h*au* ‘make up examination’
3.	ML-<u>ML</u> [(Lr,hl)-(hl,Lr)] *tu pok* ‘gambling’	→	MM-<u>ML</u> [(Lr,h)-(hl,Lr)] *tu pok* ‘gambling’

Regarding low falling tone alternations, the similar forces that trigger the sandhi in Meixian Hakka are also found. They are tone melody dissimilation with LL and tone melody assimilation with ML and <u>ML</u>. Following are trees which showing a detail rule analysis on both phenomena.

(7) ML-ML/<u>ML</u> tone sandhi (high tone melody assimilation)



(8) ML-LL tone sandhi (low tone melody dissimilation)



Tree (7) provides the analysis of assimilation process where ML and ML high tone melody feature spreads to the left one. While Tree (8) shows how the adjacent low tones melody is prevented by the dissimilatory force as in (5).

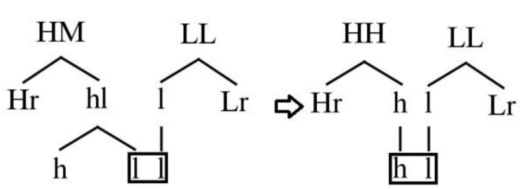
There are four tonal alternations of high falling tone where it alternates to high level tone only when it precedes low level tone, low falling tone, high falling tone, and short low falling tone as shown in the following table.

(9) High falling tone sandhi

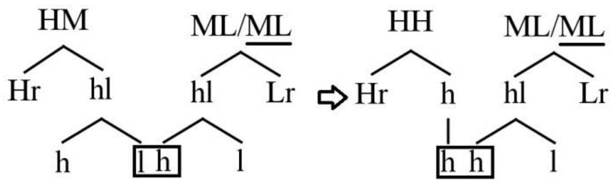
1.	HM-LL [(Hr,hl)-(l,Lr)] *tsa t^heu* 'sugarcane'	→	HH-LL [(Hr,h)-(l,Lr)] *tsa t^heu* 'sugarcane'
2.	HM-ML [(Hr,hl)-(hl,Lr)] *ki tsa* 'reporter'	→	HH-ML [(Hr,h)-(hl,Lr)] *ki tsa* 'reporter
3	HM-HM [(Hr,hl)-(hl,Hr)] *fu kui* 'wealth'	→	HH-HM [(Hr,h)-(hl,Lr)] *fu kui* 'wealth'
4.	HM-ML [(Hr,hl)-(hl,Lr)] *fu tsuk* 'rotten bamboo'	→	HH-ML/ML [(Hr,h)-(hl,Lr)] *fu tsuk* 'rotten bamboo'

In term of the change of high falling tone, the tone melody dissimilation (HM-MM) will be first discussed, followed by tone melody assimilation (HM-MLML), and tonal dissimilation (HM-HM) of Meixian Hakka**.**

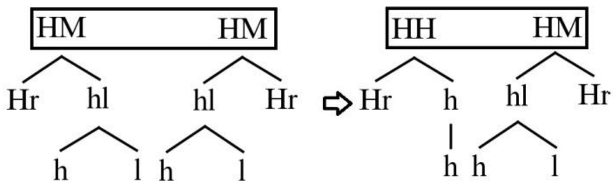
(10) HM-LL tone sandhi (low tone melody dissimilation)



(11) HM-ML/ML tone sandhi (high tone melody assimilation)



(12) HM-HM tone sandhi (tonal tier dissimilation)



Tree (10) and (12) present dissimilatory type tone alternations, but they involve different structures in the process. In (10), the trigger is the low level tone at the head position while in (12), it is triggered by similar tone at the right position. In tree (11), the same assimilatory mechanism as in ML-ML/ML alternations is found.

In conclusion**,** there are two forces that trigger Meixian Hakka tone alternations: dissimilation and assimilation forces at tone melody level and tone level. The dissimilation of the low tone melody is more preferred than assimilation of the tone melody when the register value of the head is low. Meixian Hakka tonal alternations bring the effect to the left syllable meaning only the left position tone changes its value, not the right ones. There are 3 tones (LL, ML, and H) that do not undergo changes despite being provided the same environment. Lastly, the citation tones and their sandhi counterpart always retain the same register value, initial target, and tonal type/duration.

3.3 OT Analysis

The OT analysis of Meixian Hakka tone sandhi bases on the generalization made from the previous section. Several points are discussed here where it starts from the pattern of the tonal alternations, followed by certain preservations of tonal features and completed with a summary tables of all possible pairs. It is important to note that Meixian Hakka tone system is right dominant[2] where the tone system in this dialect only allows the change of its left tone. The right (head) syllable tone does not undergo tonal change and this preservation of tone is expressed in the form of identity constraint IDENT-HD (following Lin 2011). This constraint is undominated so that the right tone/head position tone should not be alternated.

3.3.1 Obligatory Contour Principle Effect

The Obligatory Contour Principle effect is found in Meixian Hakka disyllabic tone sandhi**.** The OCP governs the prohibition of certain similar elements to be adjacent which is normally associated with dissimilation. And there are four tonal pairs that undergo the process of dissimilation from the rule based analysis: MM-LL→MH-LL, ML-LL→MM-LL, HM-LL→HH-LL and HM-HM→HH-HM. The first three alternations where the triggers have low register value in the right position are taken into account initially because it is evident that they have similarity in term of sequence of low tone melody, and the tone in the non head position changes its value. This kind of intersyllabic low melody similarity can be captured by an OCP based constraint. The OCP based constraint should ranks higher than faithfulness constraint IDENT in the following tableau.

[2] This right dominancy is due to several tone languages (Mandarin, Southern Min, Dongshi Hakka) whose second syllable always preserves its tone. There are also left-dominant languages such as Northern Wu dialects (Yue-Hashimoto 1987, Chen 2000, Zhang 2007).

(13) OCP-t(l) - Assign one violation mark for every pair of tones which have a similar low tone melody value intersyllabically

(14) IDENT-T - Assign one violation mark for every tone in the output which have different value to its input

(15) MM-LL → MH-LL

MM-LL Hr-Lr l-l	OCP-t(l)	IDENT-T
☺ 1. MH-LL Hr-Lr l[h-l]		*
2. MM-LL Hr-Lr [l-l]	*!W	L

(16) ML-LL → MM-LL

ML-LL Lr-Lr hl-l	OCP-t(l)	IDENT-T
☺ 1. MM-LL Lr-Lr h-l		*
2. ML-LL Hr-Lr hl-l	*W	L

(17) HM-LL → HM-LL

HM-LL Hr-Lr hl-l	OCP-t(l)	IDENT-T
☺ 1. HH-LL Hr-Lr h-l		*
2. HM-LL Hr-Lr h[l-l]	*!W	L

Tableaus (15), (16), and (17) shows how OCP-t(l) provides a possible argument that by ranking it higher than IDENT-T, the expected candidate of the input of the pair which has sequence of low tone melody would not surface. However, an analytical problem occurs since there are other candidates which have similar low tone melody value such as MM-MM (Hr,l-l,Hr), ML-MM (Lr,hl-l,Hr) and HM-MM (Hr,hl-l,Hr) which do not undergo alternations. These remaining faithful candidates suggest that the higher ranking of OCP-t(l) over IDENT-T predicts the wrong candidate as shown by an example (18). It is a candidate pair that has adjacent low tone melody (MM-MM).

(18) Example of wrong candidate predicted by OCP-t(l)>> IDENT-T

MM-MM→MM-MM

MM-MM Hr-Hr l-l	OCP-t(l)	IDENT-T
☠ 1. MH-MM Hr-Hr lh-l		*
☹ 2. MM-MM Hr-Hr l-l	*!W	L

Since it predicts wrong output, OCP-t constraint is inadequate to deal with the whole tonal pairings as shown in tableau (18). To solve this problem, the head (right syllable) structure is included into the analyses. It is found that the low register features of the right tone play role in the tonal alternation. This characteristic is also found in the literature of some Chinese languages where the high register tone such as high level tone does not trigger an alternation (Dongshi Hakka and Mandarin). To solve this problem, Lin's (2011) idea of using a modified OCP-t constraint is applied in this thesis. This OCP based constraint is conjoined with the register value in the head/right syllable position.

(19) *HD/Lr - Assign one violation mark for tone in head position which has low register value

(20) OCP-t(l)&*HD/Lr : Assign one violation mark for every tonal pair which violate both OCP-t(l) and *HD/Lr

By using the conjoined constraint (CCT), we get a better identification of the whole dissimilated and non dissimilated tonal pairs. Following tableaus show how the CCT constraint plays its part in the ranking argument.

(21) *tsu*MM-*p*^{h}*i*LL → *tsu*MH- *p*^{h}*i*LL 'pork skin'

MM-LL Hr-Lr l-l	OCP-t(l)& *HD/Lr	IDENT-T	OCP-t(l)	*HD/Lr
☺ 1. MH-LL Hr-Lr lh-l		*		*
2. MM-LL Hr-Lr l-l	*!W	L	*	*

(22) *pu*ML- t^h*eu* LL/ → *pu*MM- t^h*eu* LL 'axe'

ML-LL Lr-Lr hl-l	OCP-t(l) & *HD/Lr	IDENT-T	OCP-t(l)	*HD/Lr
☺ 1. MM-LL Lr-Lr h-l		*		*
2. MM-LL Hr-Lr l-l	*!W	L	*	*

(23) *tsa*HM- t^h*eu*LL/ → *tsa*HH- t^h*eu*LL 'sugarcane'

HM-LL Hr-Lr hl-l	OCP-t(l)& *HD/Lr	IDENT-T	OCP-t(l)	*HD/Lr
☺ 1. HH-LL Hr-Lr h-l		*		*
2. HM-LL Hr-Lr hl-l	*!W	L	*	*

(24) *si*MM-*kua*MM→*si*MM-*kua*MM

MM-MM Hr-Hr l-l	OCP-t(l)& *HD/Lr	IDENT-T	OCP-t(l)	*HD/Lr
☺1. MM-MM Hr-Hr l-l			*	
2. MH-MM Hr-Hr lh-l		*!W		

Tableaus (21), (22) and (23) show the tonal alternation which prevents sequence of low tone melody where the head is low register tone. The tonal alternation is triggered by the higher ranked of OCP-t(l)&*HD/Lr over IDENT-T. Moreover, the tonal pair in tableau (24) does not need to undergo changes since it has different register feature (high). So, the faithful pair, MM-MM, is protected from dissimilation effect.

OCP-t(l)&*HD/Lr, however, affects LL and ML when they are paired with low level tone in the head position. However, they do not undergo changes, and their forms are preserved. The violation of the CCT is tolerated by following undominated tonal identity constraints.

(25) IDENT-LL: Input-output of low level tone is identical.

(26) IDENT-ML: Input-output of short low falling tone is identical.

(27)LL-LL→LL-LL

LL-LL Lr-Lr l-l	IDENT-LL	OCP-t(l)& *HD/Lr	IDENT-T
☺ 1. LL-LL Lr-Lr l-l		*	
2. MM-LL Lr-Lr h-l	*!W	L	*

(28)ML-LL→ML-LL

ML-LL Lr-Lr hl-l	IDENT-ML	OCP-t(l)& *HD/Lr	IDENT-T
☺ 1. ML-LL Lr-Lr hl-l		*	
2. MM-LL Lr-Lr h-l	*!W	L	*

Tableau (27) and (28) show how the highest ranked IDENT-LL and IDENT-ML preserve the identity of LL and ML from changing enforced by OCP-t(l)& *HD/Lr. So despite being provided the same environment (low register head and similar low level melody), LL and ML cannot change or they will make serious violation. This king of ranking provides an argument that explains why LL and ML tones in Meixian Hakka do not undergo dissimilation. This kind of an argument that cannot be provided by the rule based model.

Next, the pair of HM-HM does not surface in Meixian. The high falling tone in the left syllable alternates to high level tone. It is found that the trigger of the alternation is HM. To solve this tone sandhi case, a constraint that can prevent two consecutive high falling tones to be adjacent another is needed. Here, another OCP based constraint that triggers the tone sandhi, namely OCP-T (HM) is posited.

(29) OCP-T(HM): assign one violation mark for every high falling tonal pair.

(30) *fu*HM-*kui*HM → *fu*HH-*kui*HM 'wealth'

HM-HM Hr-Hr hl-hl	OCP-T (HM)	IDENT-T
☺ 1. HH-HM Hr-Hr h-hl		*
2. **HM-HM** Hr-Hr hl-hl	*!W	L

Tableau (30) shows how HM alternates to HH. It is due to the tonal tier constraints, OCP-T (HM), ranks higher than IDENT-T. Other constraints are considered irrelevant and they are omitted from the tableau.

3.3.2 No-Jumping Principle Effect

As shown in the previous analysis, Meixian Hakka disyllabic tonal alternations also include the assimilation of the tone structures. The tone alternations of several pairs as: MM-ML/ML→MH-ML/ML, ML-ML/ML→MM-ML/ML and HM-ML/ML→HH-ML/ML are enforced by the assimilation process. The assimilation of high tone melody can be captured by NO-JUMPING Principle (Hyman & Van Bik 2004). This principle was firstly introduced in Hakka Lai to capture its tone alternation where the alternations occur intersyllabically. This concept is later adopted by Lin (2011) in a form of constraint to analyze the tonal assimilation of Dongshi Hakka. The same concept is then adopted in the thesis to deal with the agreement type of alternations.

(31) NOJUMP-t: Assign one violation mark for every tone melody value which does not agree intersyllabically.

This assimilatory constraint, when ranked above faithful constraint IDENT-T like shown in the tableau (32), (33) and (34), seems to provide a ranking argument which enforce the outputs that have sequence of similar tone melody to surface, not the faithful ones.

(32)MM-ML/ML→MH-ML/ML

MM-ML/ML Hr-Lr l-hl	NOJUMP-t	IDENT-T
☺ 1. MH-ML Hr-Lr l[h-h]		*L
2. MM-ML Hr-Lr [l-h]l	*!W	

(33) ML-ML/ML → MM-ML/ML

ML-ML/ML Lr-Lr hl-hl	NOJUMP-t	IDENT-T
☺ 1. MM- ML/ML Lr-Lr [h-h]l		*
2. ML-ML/ML Lr-Lr [h**l-h**]l	*!W	L

(34) HM-ML/ML→HH-ML/ML

HM-ML/ML Hr-Lr hl-hl	NOJUMP-t	IDENT-T
☺ 1. HH- ML/ML Hr-Lr [h-h]l		*
2. HM-ML/ML Hr-Lr h[**l-h**]l	*!W	L

Tableaus (32), (33) and (34) show how markedness constraint NOJUMP-t that ranks higher than IDENT-T provides the expected outputs. But again a problem arises since since there are some pairs that do not undergo tone sandhi, such as MM-HM (Hr,l-hl,Hr), MM-H (Hr,l-h,Hr), and MM-HH (Hr,l-h,Hr). This means NOJUMP-t should not rank higher than IDENT-T. In agreement tone sandhi, it is also found that the trigger is the low register head. Thus, the same strategy is then applied where two markedness constraints are merged in to a conjoined constraint, NOJUMP-t &*HD/Lr. The least marked NOJUMP-t is ranked lower than IDENT-T.

(35) NOJUMP-t &*HD/Lr: Assign one violation mark for every tonal pairs which violate both NOJUMP-t and &*HD/Lr.

(36) *tsu*MM-*tu*ML→ *tsu*MH-*tu*ML 'pork bowel'

*su*MM-*tsok*ML → *su*MH-*tsok* ML/ML 'desk'

MM-ML/ML Hr-Lr l-hl	NOJUMP-t &*HD/Lr	IDENT-T	NOJUMP-t	*HD/Lr
☺ 1. MH- ML/ML Hr-Lr l[h-h]		*		*
2. MM-ML/ML Hr-Lr [**l-h**]l	*!W	L	*	*

(37) *pu*ML-*k*[h]*au*ML → *pu*MM- *k*[h]*au*ML 'make up examination'

*tu*ML- *pok*ML → *tu*ML- *pok*ML 'gambling'

ML-ML/ML Lr-Lr hl-hl	NOJUMP-t &*HD/Lr	IDENT-T	NOJUMP-t
☺ 1. MM- ML/ML Lr-Lr [h-h]l		*	
2. MM-ML/ML Hr-Lr [**l-h**]l	*!W	L	*

(38) *ki*HM-*tsa*ML → *ki*HH-*tsa*ML 'reporter' and,

*fu*HM-*tsuk*ML → *fu*HH-*tsuk*ML 'rotten bamboo'

HM-ML/ML Hr-Lr hl-hl	NOJUMP-t&*HD/Lr	IDENT-T	NOJUMP-t
☺ 1. HH- ML/ML Hr-Lr [h-h]l		*	
2. HM-ML/ML Hr-Lr h[**l-h**]l	*!W	L	*

The argument that NOJUMP-t&*HD/Lr should rank higher than faithfulness constraint IDENT-T can be observed at tableau (36), (37), and (38). All candidates 2 of the tableaus are not optimal in Meixian Hakka because it has different intersyllabic tone melodies. On the other hand, all candidates 1 of the tableaus have similar tone melody and adheres the ranking hierarchy of Meixian Hakka tone sandhi.

3.3.3 OCP-t(l)&*HD/Lr vs. NOJUMP-t&*HD/Lr

We arrive to a question of the ranking of two conjoined constraints while dealing with adjacent mid level tone alternations. Due to their contrasting effect on the grammar of Meixian Hakka tone sandhi, one of them should rank higher than the other. The ranking argument could be proven by the mid level tone dissimilation case. This dissimilation case shows the conjoined constraint of OCP and * HD/Lr is preferred over NOJUMP-t&*HD/Lr.

(39) OCP-t(l) &*HD/Lr >> NOJUMP-t&*HD/Lr

MM-LL Hr-Lr [l-l]	OCP-t(l)& *HD/Lr	NOJUMP-t &*HD/Lr
☺ 1. MH-LL Hr-Lr l[h-l]		*
2. MM-LL Hr-Lr [l-l]	*!W	L

The ranking argument of both CCTs which interact with each other is provided in tableau (39). In Meixian Hakka, the prohibition of intersyllabic low tone melody with low register head tone is more prominent than tone melody assimilation making OCP-t(l) & *HD/Lr is ranked higher than NOJUMP-t&*HD/L.

3.3.4 Register Tier Preservation

In every disyllabic tonal alternation in Meixian Hakka, the concept that every sandhi tone keeps its original register value is proposed. For example, when it is a high register tone, it always has high register sandhi tone and the same situation also takes place for the low register tones as we can see in (41) and (42). This becomes the reason why the concept the dual representations of mid-level tone in Meixian Hakka is proposed. The stability of the register is expressed in a undominated faithful constraint as follows:

(40) IDENT-reg - Assign one violation mark for every tone which changes its register value.

(41) Preservation of high register value

MM-LL Hr-Lr l-l	IDENT-reg	OCP-t(l)& *HD/Lr
☺ 1. MH-LL Hr-Lr l[h-l]		
2. MM-LL **Lr**-Lr [h-l]	*!W	

(42) Preservation of low register value

ML-LL Lr-Lr hl-l	IDENT-reg	OCP-t(l)& *HD/Lr
☺ 1. MM-LL Lr-Lr [h-l]		
2. MH-LL **Hr**-Lr l[h-l]	*!W	

Tableau (41) and (42) show conditions where the tones might change in Meixian Hakka due to markedness constraint. However, instead of alternating to other one with different register value as we see from the tableaus, the sandhi tones in Meixian Hakka are those with the change in their melody only.

3.3.5 Initial Target Preservation

According to Yip (2001), every tone has initial target specification. Following this proposal, a constraint for this feature is proposed. Furthermore, it is also observed that the initial target of tone does not change in Meixian Hakka tonal alternations as shown below:

1. *Yinping* **M**M → **M**H, ***H**M, ***H**H

2. Qusheng **M**L → **M**M, ***L**L, ***H**M

3. Shangsheng **H**M → **H**H, ***M**M, ***M**H

So, it is obvious that every sandhi tone in Meixian Hakka preserves their initial target. This kind of preservation is different to the register difference where sometimes register is divided into two register system (high and low), while the classification of tonal intial features give us idea that there is a clear separation between high tone, mid tone, and low tone category as argued by Yip (2001). So based on the existence of tonal intial target argument and the fact that Meixian Hakka tonal system does not change its starting phonetic target of tone, a faitfulness constraint, IDENT-IT which is undominated in the tone sandhi grammar is posited.

(43) IDENT-IT: Assign one violation for every initial target of tone which changes its value.

(44) Preservation of IT of Meixian Hakka tone

MM-LL Hr-Lr l-l	IDENT-IT	OCP-t(l)& *HD/Lr
☺ 1. MH-LL Hr-Lr l[h-l]		
2. **H**H-LL Hr-Lr [h-l]	*!W	

Tableau (44) presents two strategies in order not to violate the markedness constraint OCP-t(l)& *HD/Lr, by high rising and high level tone in the left syllable. But as the initial target of Candidate 2 in the tableau alternates from M to H so it violates the undominated IDENT-IT and these changes are not allowed by the constraint. Candidate 1 surfaces as the most harmonic output as it does not violate this constraint.

3.3.6 Tone Duration Preservation

Tone system in traditional Chinese phonology is divided into two kinds of tone according to its syllable characteristics. *Shu* tones end in sonorants, and *Ru* tones end in obstruents or checked syllables. *Shu* tones have longer tonal and *ru* tones have shorter duration. *Ru* tones are usually underlined to differentiate it with other tones. Due to the syllable's property that differ the length of tone which is attached into the syllable, tone alternations in Bangkok Hakka must preserve its original tonal duration. In this analysis, the identity which tone should attached to which syllable is protected by an undominated faithfulness constraint as in (49).

(45) IDENT-TD - Assign one violation mark for every tone which has different tone duration from its input form.

(46) Preservation of tone duration

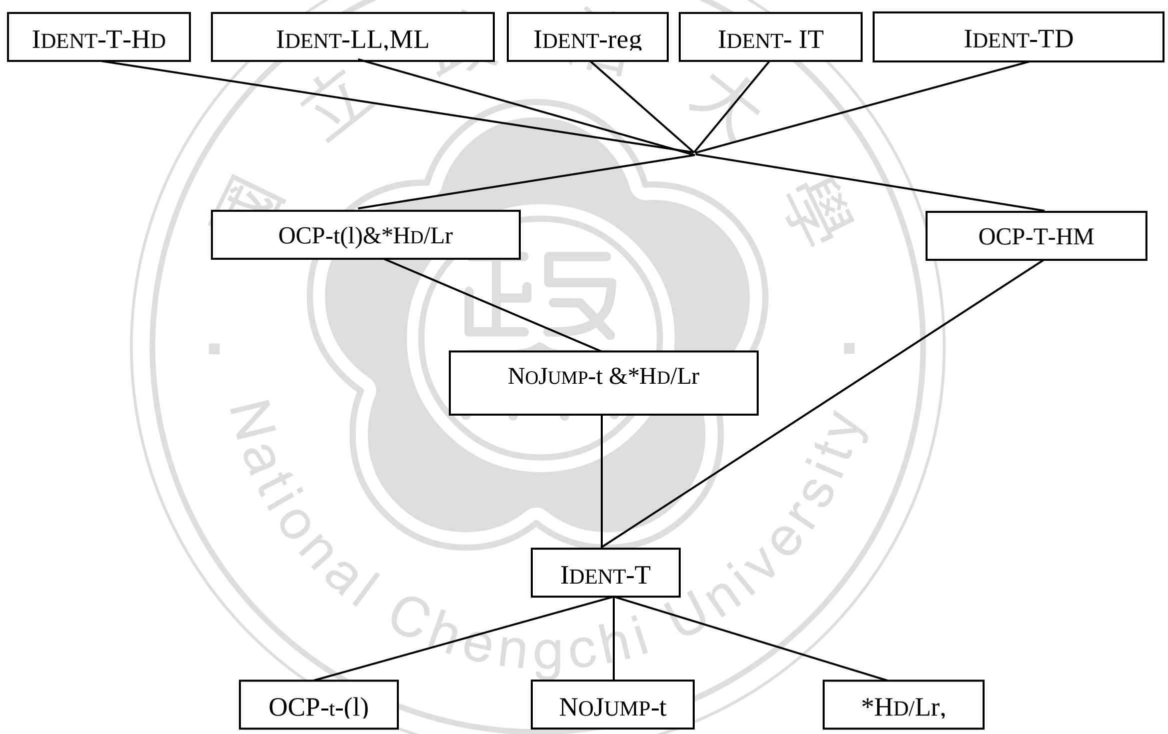
HM-ML *ki tsa* Hr-Lr hl-hl	IDENT-TD	NOJUMP-t &*HD/Lr
☺ 1. HH-ML Hr-Lr [h-hl]		
2. **H**- ML Hr-Lr [h-hl]	*!W	

Tableau (46) shows how both undominated constraint on tonal duration governs the output candidates. Despite having the same internal structures and not violating the NOJUMP-t&*HD/Lr, HH and H have different tonal duration in term of their syllable structures. That is why candidate (2) is ruled out as the input-output tone duration is different phonemically.

3.4 Constraint Ranking and Overall Summary of Tonal Pairs

After going through every single tone alternation and preservation of certain structures, we come to the overall ranking of these constraints. This ranking is a parameter where every tonal pair generated by GEN will be sorted in order to have the optimal candidate surface. The grammar is attested with all possible candidates.

(47) Hasse Diagram of Meixian Hakka Tone sandhi



OT differs with rule based theory where the candidates generated in GEN are unlimited. Some of these unlimited candidates are governed by language possible output constraints which mean that certain segment and suprasegmental properties simply cannot surface (governed by certain markedness constraint such as *LM – no rising tone as there is no this tone in the language). In the analysis of tonal alternations, the OT framework analyzes tones in the inventory since tones other than in the inventory will be ruled out by tonal constraint. The following table is a summary which is specifically designed to see how possible tones are ruled out.

(48) Winning and losing candidates in Meixian Hakka tone sandhi

Input Tones	Input combinations which change	Outputs	Ruled out by
MM (Hr,l)	MM-LL [(Hr,l)-(l,Lr)]	MH-LL [(Hr,lh)-(l,Lr)]	Winning Candidate
		*MM-LL [(Hr,l)-(l,Lr)]	OCP-t(l) & *HD/Lr
		*LL-LL [(Lr,l)-(l,Lr)]	IDENT-IT
		*ML-LL [(Lr,hl)-(l,Lr)]	IDENT-reg
		*HM-LL [(Hr,hl)-(l,Lr)]	IDENT-IT
		*ML-LL [(Lr,hl)-(l,Lr)]	IDENT-TD
		*H-LL [(Hr,h)-(l,Lr)]	IDENT-TD
		* MM –LL [(Lr,h)-(l,Lr)]	IDENT-reg
		*HH –LL [(Hr,h)-(l,Lr)]	IDENT-IT
MM (Hr,l)	MM-ML [(Hr,l)-(hl,Lr)]	MH-ML [(Hr,lh)-(hl,Lr)]	Winning Candidate
		*MM-ML [(Hr,l)-(hl,Lr)]	NOJUMP-t &*HD/Lr
		*LL-ML [(Lr,l)-(hl,Lr)]	IDENT-IT
		*ML-ML [(Lr,hl)-(hl,Lr)]	IDENT-reg
		*HM-ML [(Hr,hl)-(hl,Lr)]	IDENT-IT
		*ML-ML [(Lr,hl)-(hl,Lr)]	IDENT-TD
		*H-ML [(Hr,h)-(hl,Lr)]	IDENT-TD
		* MM –ML	IDENT-reg

		[(Lr,l)-(hl,Lr)]	
		*HH –ML [(Hr,h-hl,Lr)]	IDENT-IT
MM (Hr,l)	MM-ML [(Hr,l)-(hl,Lr)]	MH-ML [(Hr,lh)-(hl,Lr)]	Winning Candidate
		*MM-ML [(Hr,l)-(hl,Lr)]	NOJUMP-t &*HD/Lr
		*LL-ML [(Lr,l)-(hl,Lr)]	IDENT-IT
		*ML-ML [(Lr,hl)-(hl,Lr)]	IDENT-reg
		*HM-ML [(Hr,hl)-(hl,Lr)]	IDENT-IT
		*ML-ML [(Lr,hl)-(hl,Lr)]	IDENT-TD
		*H-ML [(Hr,h)-(hl,Lr)]	IDENT-TD
		* MM –ML [(Lr,l)-(hl,Lr)]	IDENT-reg
		*HH –ML [(Hr,h-hl,Lr)]	IDENT-IT
ML (Lr,hl)	ML-LL [(Lr,hl)-(l,Lr)]	MM –LL [(Lr,h)-(l,Lr)]	Winning Candidate
		*ML-LL [(Lr,hl)-(l,Lr)]	OCP-t(l) & *HD/Lr
		*MM –LL [(Hr,h)-(l,Lr)]	IDENT-reg
		*LL-LL [(Lr,l)-(l,Lr)]	IDENT-IT
		*HM-LL [(Hr,hl)-(l,Lr)]	IDENT-IT
		*ML-LL [(Lr,hl)-(l,Lr)]	IDENT-TD
		*H-LL [(Hr,h)(l,Lr)]	IDENT-TD
		* MH-LL [(Hr,lh)(l,Lr)]	IDENT-reg
		*HH –LL [(Hr,h)-(l,Lr)]	IDENT-IT
ML (Lr,hl)	ML-ML [(Lr,hl)-(hl,Lr)]	MM –ML [(Lr,h)-(hl,Lr)]	Winning Candidate
		*ML-ML [(Lr,hl)-(hl,Lr)]	NOJUMP-t &*HD/Lr
		*MM-ML [(Hr,l)-(hl,Lr)	IDENT-reg

		*LL-ML [(Lr,l)-(hl,Hr)]	IDENT-IT
		*HM-ML [(Hr,hl)-(hl-Lr)]	IDENT-IT
		*ML-ML [(Lr,hl)-(hl,Lr)]	IDENT-TD
		*H-ML [(Hr,h)-(hl,Lr)]	IDENT-TD
		* MH-ML [(Hr,lh)-(hl,Lr)]	IDENT-reg
		*HH –ML [(Hr,h)-(hl,Lr)]	IDENT-IT
ML (Lr,hl)	ML-ML [(Lr,hl)-(hl,Lr)]	MM –ML [(Lr,h)-(hl,Lr)]	Winning Candidate
		*ML-ML [(Lr,hl)-(hl,Lr)]	NOJUMP-t &*HD/Lr
		*MM –ML [(Hr,l)-(hl,Lr)	IDENT-reg
		*LL-ML [(Lr,l)-(hl,Hr)]	IDENT-IT
		*HM-ML [(Hr,hl)-(hl-Lr)]	IDENT-IT
		*ML-ML [(Lr,hl)-(hl,Lr)]	IDENT-TD
		*H-ML [(Hr,h)-(hl,Lr)]	IDENT-TD
		* MH-ML [(Hr,lh)-(hl,Lr)]	IDENT-reg
		*HH –ML [(Hr,h)-(hl,Lr)]	IDENT-IT
HM (Hr,hl)	HM-LL [(Hr,hl)-(l,Lr)]	HH-LL [(Hr,h)-(l,Lr)]	Winning Candidate
		*HM-LL [(Hr,hl)-(l,Lr)]	OCP-t(l) & *HD/Lr
		*MM-LL [(Hr,l)-(l,Lr)]	IDENT-IT
		*LL-LL [(Lr,l)-(l,Lr)]	IDENT-IT
		*ML-LL [(Lr,hl)-(l,Lr)]	IDENT-IT
		*ML-LL [(Lr,hl)-(l,Lr)]	IDENT-TD
		*H-LL [(Hr,h)-(l,Lr)]	IDENT-TD
		* MM-LL [(Lr,h)-(l,Lr)]	IDENT-IT

		* MH-LL [(Hr,lh)-(l,Lr)]	IDENT-IT
HM (Hr,hl)	HM-ML [(Hr,hl)-(hl,Lr)]	HH-ML [(Hr,h)-(hl,Lr)]	Winning Candidate
		*HM-ML [(Hr,hl)-(hl,Lr)]	NOJUMP-t &*HD/Lr
		*MM-ML [(Hr,l)-(hl,Lr)]	IDENT-IT
		*LL-ML [(Lr,l)-(hl,Lr)]	IDENT-IT
		*ML-ML [(Lr,hl)-(hl,Lr)]	IDENT-IT
		*<u>ML</u>-ML [(Lr,hl)-(hl,Lr)]	IDENT-TD
		*<u>H</u>-ML [(Hr,h)-(hl,Lr)]	IDENT-TD
		* MM –ML [(Lr,h)-(hl,Lr)]	IDENT-IT
		* MH-ML [(Hr,lh)-(hl,Lr)	IDENT-IT
HM (Hr,hl)	HM-HM [(Hr,hl)-(hl,Lr)]	HH-HM [(Hr,h)-(hl,Hr)]	Winning Candidate
		*HM-HM [(Hr,hl)-(hl,Hr)]	OCP-T (HM)
		*MM-HM [(Hr,l)-(hl,Hr)]	IDENT-IT
		*LL-HM [(Lr,l)-(hl,Hr)]	IDENT-IT
		*ML-HM [(Lr,hl)-(hl,Hr)]	IDENT-IT
		*<u>ML</u>-HM [(Lr,hl)-(hl,Hr)]	IDENT-TD
		*<u>H</u>-HM [(Hr,h)-(hl,Hr)]	IDENT-TD
		* MM –HM [(Lr,h)-(hl,Hr)]	IDENT-IT
		* MH-HM [(Hr,lh)-(hl,Hr)]	IDENT-IT
HM (Hr,hl)	HM-<u>ML</u> <u>[(Hr,hl)-(hl,Hr)]</u>	HH-<u>ML</u> [(Hr,h)-(hl,Lr)]	Winning Candidate
		*HM-<u>ML</u> [(Hr,hl)-(hl,Lr)]	NOJUMP-t &*HD/Lr
		*MM-<u>ML</u> [(Hr,l)-(hl,Lr)]	IDENT-IT
		*LL-<u>ML</u> [(Lr,l)-(hl,Lr)]	IDENT-IT

		*ML-ML [(Lr,hl)-(l,Lr)]	Ident-IT
		*ML-ML [(Lr,hl)-(hl,Lr)]	Ident-TD
		*H-ML [(Hr,h)-(hl,Lr)	Ident-TD
		* MM (Lr,l)-ML [(Lr,h)-(hl,Lr)]	Ident-IT
		* MH-ML [(Hr,lh)-(hl,Lr)	Ident-IT

3.5 Conclusion

The chapter presents the OT analysis of Meixian Hakka tone sandhi. After investigating the tonal alternations from their internal structures, the tonal alternations of Meixian Hakka are grouped into two categories: assimilation and dissimilation. The general IDENT constraints are dominated by markedness constraints to have the sandhi. Nevertheless, the IDENT-T is not dominated by basic OCP and NO-JUMP constraints. A more complex constraint conjunction is needed to solve the tonal alternations. Lin's (2011) ideas by conjoining OCP and NO-JUMP with headedness constraints like *HD/Lr is followed. Another markedness constraint, OCP-T(HM) is also posited to deal with the assimilation of sequence of HM tone.

Aside from the tone sandhi grammar constraints, there are also several undominated faitfulness constraints proposed in Meixian Hakka. First, IDENT-LL and IDENT-ML since LL and ML of Meixian Hakka tone are highly prominent and retain the tone value in the grammar. Second, IDENT-reg and IDENT-IT since the sandhi tones always retain the same register and initial target specifications. Third, IDENT-TD since tone duration in Meixian Hakka does not change. The natural characteristics of open and closed syllable determine the duration of the tone. The Hasse diagram (47) presents the grammar of Meixian Hakka tone sandhi by showing how the faithfulness and markedness constraint interact with each others.

CHAPTER 4

OT ANALYSIS OF BANGKOK HAKKA

Chapter 4 presents an analysis of disyllabic tone sandhi in Bangkok Hakka. Bangkok Hakka is a sub-dialect of Meixian Hakka spoken in Bangkok, Thailand. The data for this analysis are taken from Siripen (2008) which describes the phonetic value of its segments and tone and rule-based approach towards its tonal alternation phenomena. This chapter is divided into several sections as follows: Section 4.1 gives the value of citation tones and sandhi tones in the combined model of Bao's (1999) and Yip's (2001). Section 4.2 presents the tone sandhi pattern of Bangkok Hakka and its generalization. Section 3 of this chapter provides the constraint based approach of OT and the application of constraint conjunction (CCT) to analyze the alternations of tones in Bangkok Hakka. Several tonal structure preservation constraints to shape the structure of the tones are also provided in this chapter. Section 4.4 presents a Hasse Diagram and a summary table for the grammar of Bangkok Hakka tone sandhi. Conclusion of this chapter is provided in section 4.5.

4.1 Tone Inventory

In Siripen (2008), there are six citation tones in Bangkok Hakka: *Yinping* 33 (mid level/MM), *Yangping* 21 (low level/LL); *Shangsheng* 31 (low falling/ML); *Qusheng* 44 (high level/HH); *Yinru* 32 (short low falling/ML) and *Yangru* 4 (short high level/H). Furthermore, Bangkok Hakka has two sandhi tones: 35 (high rising/MH), and 53 (high falling/HM) from *Yinping* and *Qusheng* respectively. In this thesis, the analysis depends on the tonal preservation and change of register and tone melody values as proposed in Bao (1999). Therefore, the detail information for every tone and its features are provided below.

(1) Bangkok Hakka Tone Inventory.

Citation Tones	Sandhi Tones
MM, (Hr,l)	MH (Hr,lh)
LL (Lr, l)	
ML (Lr, hl)	
HH (Hr,h)	HM (Hr, hl)
ML (Lr, hl)	
H (Hr,h)	

4.2 Tone Sandhi Patterns

There are two citation tones that undergo tonal change in Bangkok Hakka. First, mid level tone (MM) alternates to high rising tone when it is preceded by low level tone (LL), low falling tone (ML) and short low falling tone (ML). Second, high level tone (HH) changes to high falling tone (HM) when it is preceded by mid level tone (MM) and short high level tone (H). The other tones (low level, mid falling, short mid falling and short high level) do not undergo tone alternations. To enable us to see better picture of tones that undergo alternations, and those that do not, a full chart (6x6) of the tonal combination are presented in the table (2).

(2) Bangkok Hakka Tonal combinations

S2 / S1	*Yinping* MM Hr, l	*Yangping* LL Lr, l	*Shangsheng* ML Lr, hl	*Qusheng* HH Hr, h	*Yinru* ML Lr, hl	*Yangru* H Hr, h
Yinping MM Hr, l	MM-MM Hr-Hr l-l	MH-LL Hr-Lr lh-l	MH-ML Hr-Lr lh-hl	MM-HH Hr-Hr l-h	MH-ML Hr-Lr lh-hl	MM-H Hr-Hr l-h
Yangping LL Lr, l	LL-MM Lr-Hr l-l	LL-LL Lr-Lr l-l	LL-ML Lr-Lr l-hl	LL-HH Lr-Hr l-h	LL-ML Lr-Lr l-hl	LL-H Lr-Hr l-h
Shangsheng ML Lr, hl	ML-MM Lr-Hr hl-l	ML-LL Lr-Lr l-l	ML-ML Lr-Lr hl-hl	ML-HH Lr-Hr hl-h	ML-ML Lr-Lr hl-hl	ML-H Lr-Hr hl-h
Qusheng HH Hr, h	HM-MM Hr-Hr hl-l	HH-LL Hr-Lr h-l	HH-ML Hr-Lr h-hl	HH-HH Hr-Hr h-h	HH-ML Hr-Lr h-hl	HM-H Hr-Hr hl-h
Yinru ML Lr, hl	ML-MM Lr-Hr hl-l	ML-LL Lr-Lr hl-l	ML-ML Lr-Lr hl-hl	ML-HH Lr-Hr hl-h	ML-ML Lr-Lr hl-hl	ML-H Lr-Hr hl-hl
Yangru H Hr, h	H-MM Hr-Hr h-l	H-LL Hr-Lr h-l	H-ML Hr-Lr h-hl	H-HH Hr-Hr h-h	H-ML Hr-Lr h-hl	H-H Hr-Hr h-h

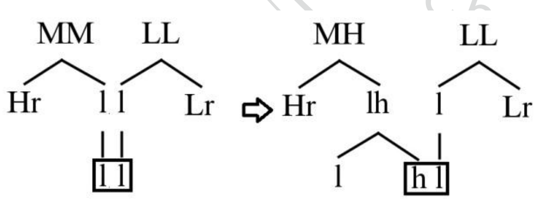
There are two tones which undergo tonal change. The mid level tone alternates to high rising tone when it is followed by low level tone, low falling tone and short low falling tone. The mid level tone sandhi pattern has a similar pattern to Meixian Hakka mid level tone sandhi. The following table contains the mid level tonal alternations with their structural details.

(3) Mid level tone sandhi in Bangkok Hakka

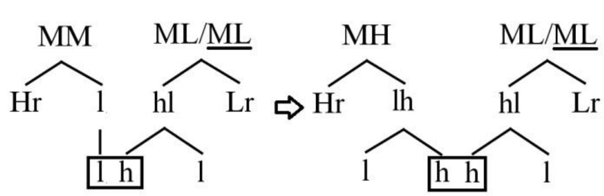
1.	MM-LL [(Hr,l)-(l,Lr)] *ke* $p^{h}i$ 'chicken skin'	→	MH-LL [(Hr,lh)-(l,Lr)] *ke* $p^{h}i$ 'chicken skin'
2.	MM-ML [(Hr,l)-(hl,Lr)] *wu suj* 'black water'	→	MH-ML [(Hr,lh)-(hl,Lr)] *wu suj* 'black water'
3.	MM-<u>ML</u> [(Hr,l)-(hl,Lr)] *ke kut* 'chicken bone'	→	MH-<u>ML</u> [(Hr,lh)-(hl,Lr)] *ke kut* 'chicken bone'

We see that there are two different forces that trigger mid level tone alternations: tone melody dissimilation (MM-LL) and tone melody assimilation (MM-ML&<u>ML</u>). The trigger of the sandhi is the low register tone in head position of tonal combinations. The process can be observed from following trees.

(4) MM-LL tone sandhi (low tone melody dissimilation)



(5) MM-ML/<u>ML</u> tone sandhi (high tone melody assimilation)



In tree (4), the adjacent low tone melody dissimilates to high tone melody making them not identical. Meanwhile, tree (5) shows how the different tone melody value is assimilated from the head position/right syllable of the tonal pair.

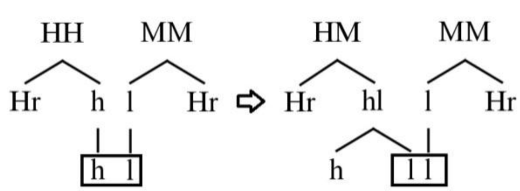
Two tonal alternations are found in the high level tone of Bangkok Hakka: The high level tone alternates to high falling tone when it precedes mid level tone, and short high falling tones and the details are presented in the following table.

(6) High level tone sandhi in Bangkok Hakka

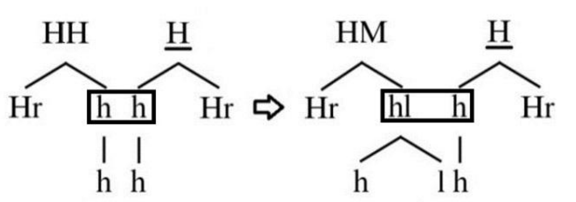
1.	HH-MM [(Hr,h)-(l, Hr)] *koŋ sin* ‘made of steel’	→	HM-MM [(Hr,hl)-(l,Hr)] *koŋ sin* ‘made of steel’
2.	HH-H [(Hr,h)-(h,Hr)] *koŋ ts*^{h}*ap* ‘fence made of steel’	→	HM- H [(Hr,hl)-(h, Hr)] *koŋ ts*^{h}*ap* ‘fence made of steel’

According to the type of the alternation, the HH-MM tone sandhi is categorized as assimilation of low tone melody that is triggered by the mid level tone in the head position. On the other hand, HH-H is a dissimilation of high level contour. And the trigger for the assimilation and dissimilation are the tones in the right syllable as shown in the following trees.

(7) HH-MM tone sandhi (low tone melody assimilation)



(8) HH-<u>H</u> tone sandhi (high level contour dissimilation)



Tree (7) shows the process of tone melody assimilation when the head/right syllable is mid level tone. The low tone melody of the head spreads to the non head syllable making it similar in term of their melody features. In tree (8) the dissimilation of the intersyllabic high level contour is triggered by short high level tone in head position, this makes its longer counterpart have another contour form in order to be different.

From the data above, we arrive to a generalization where there are two mechanisms of the Bangkok Hakka disyllabic tone sandhi: intersyllabic dissimilation and intersyllabic assimilation at tone melody tier and contour tier. The dissimilation of the low tone melody is preferred over assimilation at the same tier with low register tone as the trigger. The alternations of tone in Bangkok Hakka is right headed where the alternations only affects the left syllable. The tones of right syllable/head syllable are intact, and it is governed by undominated head position constraint, IDENT-HD (following Lin 2011). There are 3 low register tones (LL, ML, <u>ML</u>) and short high level tone (<u>H</u>) that do not undergo alternations despite they are provided the same environment. In addition, the citation tones and their sandhi counterparts always retain the same register value, intial tone value and tonal duration.

4.3 OT Analysis

This section starts from the analysis of tone sandhi phenomena found in Bangkok Hakka. It is followed by several preservations of tonal features, and ends with a summary table of all possible candidates.

4.3.1 Obligatory Contour Principle Effect

The OCP effect that captures Meixian Hakka’s tonal alternation also play important role in the tonal dissimilation of Bangkok Hakka. From the alternation analysis of MM-LL→MH-LL and HH-H → HM-H in section 4.2, we could see the dissimilation are triggered by different structures. The analysis begins with the case of MM-LL→MH-LL where the change of tone is enforced by a same set of constraints found in Meixian Hakka. As we have already tried in Meixian Hakka disyllabic tone sandhi, the single OCP-t(l) constraint is unable to capture the sequence of MM-LL in Bangkok Hakka. Thus, a combination of the constraint and positional constraint, *HD/Lr is again posited to promote the tone alternation. The effect of OCP-t(l)&*HD/Lr can be seen from tableau (9).

(9) *ke*MM-p^h*i*LL → *ke*MH-p^h*i*LL 'chicken skin'

MM-LL Hr-Lr l-l	OCP-t(l) & *HD/Lr	IDENT-T	OCP-t(l)	*HD/Lr
☺ 1. MH-LL Hr-Lr lh-l		*		*
2. MM-LL Hr-Lr l-l	*!W	L	*	*

From tableau (9), we could see the alternation of MM to MH when it is followed by LL as the trigger. The similar adjacent tone melody is prohibited by the markedness OCP-t(l) & *HD/Lr. This constraint outranks IDENT-T to trigger the sandhi in order the grammar to take the dissimilated candidate as the well-formed one. Since *HD/Lr is ranked lower than IDENT-T, it is inactive in the grammar. The OCP-t(l)&*HD/Lr, however, should rank lower than IDENT-T-Lr, a faithfulness constraint that prevent changes for low register tones. The reason why the low register tone does not change is not clearly understood. They could by hypothetically more prominent tones in Bangkok Hakka tone system. However, OT provides the tool to preserve the unchanged tones in the grammar in form of faithfulness constraints.

The following are tableaus showing the selection of optimal candidate for low register tones under the same trigger.

(10) IDENT-T-Lr: Input-output of low register tone is identical

(11) LL-LL→LL-LL

LL-LL Lr-Lr l-l	IDENT-T-Lr	OCP-t(l) & *HD/Lr	IDENT-T
☺ 1. LL-LL Lr-Lr l-l		*	
2. MM-LL Lr-Lr h-l	*!W	L	*

(12) ML-LL→ML-LL

ML-LL Lr-Lr hl-l	IDENT-T-Lr	OCP-t(l) & *HD/Lr	IDENT-T
☺ 1. ML-LL Lr-Lr hl-l		*	
2. MM-LL Lr-Lr h-l	*!W	L	*

(13) <u>ML</u>-LL→<u>ML</u>-LL

<u>ML</u>-LL Lr-Lr hl-l	IDENT-T-Lr	OCP-t(l) & *HD/Lr	IDENT-T
☺ 1. <u>ML</u>-LL Lr-Lr hl-l		*	
2. <u>MM</u>-LL Lr-Lr h-l	*!W	L	*

Tableaus (11), (12) and (13) present ranking arguments between a tonal specific constraint and highly marked conjunction constraint. To preserve these tones from changes, OCP-t(l) & *HD/Lr needs lower ranking compared to IDENT-T-Lr. The IDENT-T-Lr constraint should be the winner in the ‘conflict’ against other markedness constraints in the dialect.

The other dissimilatory tone sandhi, HH-H→HM-H, presents another dimension/tier of tone alternation. It is because the tone sandhi has specific behavior for it is only found in HH-H tonal sequence but not in HH-HH pair which have similar feature except the duration of the head. Here, it is hypothesized that the trigger for this sandhi is the *ru/*short tones in the head position.

To let the tonal alternate but without affecting other pairs, the combination the OCP-c(h) and *ST which prevent a sequence of high level contour with the short tone in the head position is posited. It is necessary to mention the status of *ST constraint. This constraint is an inactive constraint in this dialect. This inactivity is due to the characteristics of Hakka tonal inventory and most Chinese dialects. In the syllables of Bangkok Hakka, the *ru*/short or *shu*/long tones have been predetermined according to their syllable types.

(14) OCP-c(h) : Assign one violation mark for sequence of high level contour.

(15) *HD/ST: Assign one violation mark for every short tone in the head position

(16) OCP-c(h)&*HD/ST: assign one violation that violates both OCP-c(h) and *HD/ST

(17) *tsuŋ*HH-*t^h^uk*H → *tsuŋ*HM-*t^h^uk*H 'poisoned'

H**H**- **H** Hr-Hr h-h	OCP-c(h) &*HD/ST	IDENT-T	OCP-c(h)	*HD/ST
☺ 1. H**M**- **H** Hr-Hr hl-h		*		*
2. H**H**- **H** Hr-Hr h-h	*!W	L	*	*

In tableau (17), it is recognized that *HD/ST constraint is violated by two possible candidates generated by GEN here however there is no effect here. The existence of the constraint in the tableau is intended to show us the interaction between the conjoined constraint and single markedness constraint. Candidate 2 does not surface since they violate the higher ranked OCP-c(h) &*HD/ST, then candidate 1 is the most optimal output.

(18) H-H→H-H

H- **H** Hr-Hr h-h	IDENT-H	OCP-c(h) &*HD/ST	IDENT-T
☺ 1. **H**- **H** Hr-Hr h-h		*	
2. **HM**- **H** Hr-Hr hl-h	*!W	L	*

Tableau (18) presents the ranking of IDENT-H which is higher than OCP-c(h) &*HD/ST in order for a faithful candidate win. IDENT-H along with other specific tonal identity constraints (IDENT-LL, ML, ML) are undominated in the ranking hierarchy of Bangkok Hakka tone sandhi.

4.3.2 No-Jumping Principle Effect

There are two sets of tonal change in Bangkok Hakka which are included in the intersyllabic tonal agreement/assimilation category. They are MM-ML/ML and HH-MM. We could see the requirements of same tonal feature tone melody tier. The agreement of MM-ML/ML is firstly accounted for it has a similar environment found in Meixian Hakka. Thus this agreement of high tone melody can be captured by a similar CCT approach applied in Meixian Hakka. The combination of NOJUMP-t (assimilation) and *HD/Lr which solve inadequacy of NOJUMP-t to deal with this tonal alternation is again presented.

(19) *wu*MM-*suj*ML → *wu*MH-*suj*ML
*ke*MM-*kut*ML → *ke*MH-*kut*ML

MM-ML/ML Hr-Lr l-hl	NOJUMP -t&*HD/Lr	IDENT-T	NOJUMP-t
☺ 1. MH- ML/ML Hr-Lr l[h-h]		*	
2. MM-ML/ML Hr-Lr [**l-h**]l	*!W	L	*

Tableau (19) shows that NOJUMP-t&*HD/Lr must outrank IDENT-T in order MM to alternate. Candidate 1 survives as it obeys the higher ranked constraint. On the other hand, candidate 2 violates the constraint and it does not surface. In addition, since NOJUMP-t constraint is low ranked so despite being violated, it does not impact the candidate selection.

In the beginning of this section, it is mentioned that despite involving tonal melody agreement, NOJUMP-t or NOJUMP-t &*HD/Lr can not captured HH-MM sandhi simply because the head is high register MM. Positing a constraint that combining NOJUMP-t and *HD/Hr itself also does not help as it will affect non tone sandhi candidate such as MM-HH and MM-H.

The tone sandhi is triggered by high register MM only. Due to the characteristic, the tone sandhi case is becomes very specific. To solve the problem, this thesis follows de Lacy's proposal (2002) that every tone in the language actually has markedness constraints depending on their prominence position. When these inactive constraints are conjoined with tonal alternations constraints such as NOJUMP-t and OCP-t then they play important role in ruling out the worst of the worst candidate.

(20) *HD/MM: No mid level tone in head position

(21) NOJUMP-t&*HD/MM: Assign one violation mark for every tonal pair which violates both NOJUMP-t and *HD/MM

(22) *tsie*HH-*su*MM → *tsie*HM-*su*MM 'borrowing book'

HH-MM Hr-Hr h-l	NOJUMP-t& *HD/MM	IDENT-T	NOJUMP-t	*HD/MM
☺ 1. HM-MM Hr-Hr h[l-l]		*		*
2. HH-MM Hr-Hr [h-l]	*!W	L	*	*

Tableau (22) shows the assimilation of HH tone to HM as it is triggered by the MM tone in the head position. The MM tone itself is inactive as other tonal markedness in this dialect. Nevertheless the conjoining of *MM and assimilation constraint favors candidate 1.

4.3.3 OCP-t(l)& *HD/Lr vs. NOJUMP-t&*HD/Lr

In the generalization provided in the previous section, it is mentioned that low tone dissimilation is preferred to tone melody assimilation. This is proven in mid level tone alternation. A ranking argument where OCP-t(l) & *HD/Lr should rank higher than NOJUMP-t&*HD/Lr is provided in this sub-section.

(23) OCP-t(l) & *HD/Lr >> [NOJUMP-t&*HD/Lr

MM-LL Hr-Lr [l-l]	OCP-t(l) & *HD/Lr	NOJUMP- t&*HD/Lr
☺ 1. MH-LL Hr-Lr l[h-l]		*
2. MM-LL Hr-Lr [l-l]	*!W	L

Tableau (23) shows us how MH-LL is more optimal than the faithful MM-LL which violates OCP-t(l)&*HD/Lr constraint. This ranking shows us the preference of Bangkok Hakka grammar towards low tone melody dissimilation over tone melody assimilation.

4.3.4 Register Tier Preservation

In every disyllabic tonal alternation in Bangkok Hakka, it is evident that every tone that changes its value keep its original register value as in Meixian Hakka. For example, when it is a high register tone, it always has high register sandhi tone and the same situation also takes place for the low register tone. The stability of the register is expressed into a similar identity constraint as follow

(24) IDENT-reg- Assign one violation mark for every tone's register value which is not identical from the input.

(25) Preservation of high register value

MM-LL Hr-Lr l-l	IDENT-reg	OCP-t(l) & *HD/Lr
☺ 1. MH-LL Hr-Lr l[h-l]		
2. MM-LL **Lr**-Lr [h-l]	*W	

(26) Preservation of low register value

ML-LL Lr-Lr hl-l	IDENT-reg	OCP-t(l) & *HD/Lr
☺ 1. MM-LL Lr-Lr [h-l]		
2. MH-LL **Hr**-Lr l[h-l]	*W	

Tableau (25) and (26) present conditions where the tones may be different in Bangkok Hakka due to the markedness constraints but the changes are not allowed in their register tier so sandhi tones in Bangkok Hakka always have similar register from its input tone.

4.3.5 Initial Target Preservation

This thesis follows the assumption that every tone in Chinese dialects has initial target specifications (cf. Yip 2001). The assumption is kept in Bangkok Hakka as shown in the following sandhi tones.

1. *Yinping* **M**M → **M**H, ***H**M, ***H**H

2. *Qusheng* **HH** → **H**M , ***L**L, ***M**M, ***M**H

This means that it is obligatory that every tone in Bangkok Hakka preserve their initial target and any changes of it will violate a faithfulness constraint which is expressed as follows:

(27) IDENT- IT: Assign one violation for every initial target of tone which is not identical to input.

(28) Preservation of the initial target of Bangkok Hakka tone.

MM-LL Hr-Lr l-l	IDENT-IT
☺ 1. MH-LL Hr-Lr l[h-l]	
2. **H**H-LL Hr-Lr [h-l]	*!W

Tableau (28) shows the ranking argument for two candidates that undergo changes. The tone's initial target of candidate 2 in the tableau alternates from M to H so it violates the undominated IDENT-IT. Candidate 1 wins as the initial target remain the same input-output.

4.3.6 Tone Duration Preservation

Due to the syllable's property which determine the length of tone to which it is attached to the syllable, tone alternations in Bangkok Hakka are prevented from changes in their duration value. In this analysis, the identity which tones should attach to what syllable is protected by two constraints (Zhang 1998) which both are highly ranked to prevent the mismatching tone length. However, the mismatching of the tonal duration in this dialect is prevented by a faithfulness constraint.

(29) IDENT-TD- assign one violation mark for every tone which changes its duration.

(30) Preservation of tone duration

HH-H *koŋ tsʰap* Hr-Hr h-h	IDENT-TD	OCP-T(H) &*HD/ST
☺ 1. HM- H Hr-Hr [hl-l]		
2. **M**- H Hr-Hr [l-h]		

Tableau (30) presents two candidate sets which do not violate markedness constraint. Candidate two changes its tonal duration and thus it violates tone duration constraint so it is ruled out. Candidate 1 obeys both faithful duration and surface as an optimal output.

4.4 Constraint Ranking and Overall Summary of Tonal Pairs

In this chapter, the interaction faithfulness and markedness constraints for analyzing the Bangkok Hakka tone sandhi is shown. The faithfulness constraints preserve the elements of the tone while the markedness constraint chooses certain sandhi form. Following, we can find the Hasse diagram to express the relation among constraints as the reflection of Bangkok Hakka's grammar of disyllabic tonal alternations.

(31) Hasse Diagram of Bangkok Hakka Tone sandhi

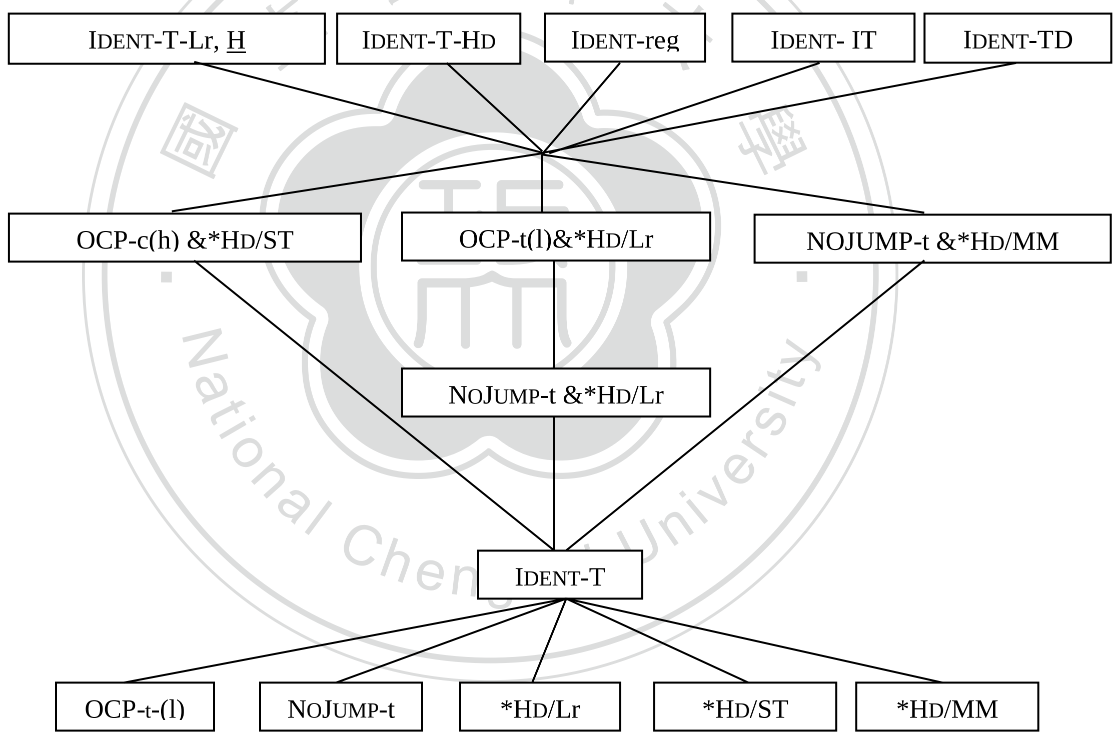


Table (31) provides an overall test for the constraint hierarchy. The test let us see how the constraints work with kinds of tone candidates available in tonal inventories of Bangkok Hakka.

(32) Winning and losing candidates in Bangkok Hakka tone sandhi

Input Tones	Input combinations which change		Outputs	Ruled out by
MM (Hr,l)	MM-LL [(Hr,l)-(l,Lr)]	1	MH-LL [(Hr,lh)-(l,Lr)]	Winning Candidate
		2	*MM-LL [(Hr,l)-(l,Lr)]	OCP-t(l) & *HD/Lr
		3	*LL-LL [(Lr,l)-(l,Lr)]	IDENT-IT
		4	*ML-LL [(Lr,hl)-(l,Lr)]	IDENT-reg
		5	*HH-LL [(Hr,h)-(l,Lr)]	IDENT-IT
		6	*<u>ML</u>-LL [(Lr,hl)-(l,Lr]]	IDENT-TD
		7	*<u>H</u>-LL [(Hr,h)-(l,Lr)]	IDENT-TD
		8	* HM –LL [(Hr,hl)-(l,Lr)]	IDENT-IT
MM (Hr,l)	MM-ML [(Hr,l)-(hl,Lr)]	1	MH-ML [(Hr,lh)-(hl,Lr)]	Winning Candidate
		2	*MM-ML [(Hr,l)-(hl,Lr)]	NOJUMP-t &*HD/Lr
		3	*LL-ML [(Lr,l)-(hl,Lr)]	IDENT-IT
		4	*ML-ML [(Lr,hl)-(hl,Lr)]	IDENT-reg
		5	*HH-ML [(Hr,h)-(hl,Lr)]	IDENT-IT
		6	*<u>ML</u>-ML [(Lr,hl)-(hl,Lr)]	IDENT-TD
		7	*<u>H</u>-ML [(Hr,h)-(hl,Lr)]	IDENT-TD
		8	* HM –ML [(Hr,hl)-(hl,Lr)]	IDENT-IT
MM (Hr,l)	MM-<u>ML</u> [(Hr,l)-(hl,Lr)]	1	MH-<u>ML</u> [(Hr,lh)-(hl,Lr)]	Winning Candidate
		2	*MM-<u>ML</u> [(Hr,l)-(hl,Lr)]	NOJUMP-t &*HD/Lr
		3	*LL-<u>ML</u> [(Lr,l)-(hl,Lr)]	IDENT-IT
		4	*ML-<u>ML</u> [(Lr,hl)-(hl,Lr)]	IDENT-reg

		5	*HH-ML [(Hr,h)-(hl,Lr)]	IDENT-IT
		6	*ML-ML [(Lr,hl)-(hl,Lr)]	IDENT-TD
		7	*H-ML [(Hr,h)-(hl,Lr)]	IDENT-TD
		8	* HM –ML [(Hr,hl)-(hl,Lr)]	IDENT-IT
HH (Hr,h)	HH-MM [(Hr,h)-(l,Hr)]	1	HM-MM [(Hr,hl)-(l,Hr)]	Winning Candidate
		2	*HH-MM [(Hr,h)-(l,Hr)]	NOJUMP-t & *HD/MM
		3	*MM-MM [(Hr,l)-(l,Hr)]	IDENT-IT
		4	*LL-MM [(Lr,l)-(l,Hr)]	IDENT-IT
		5	*ML-MM [(Lr,hl)-(l,Hr)]	IDENT-IT
		6	*ML-MM [(Lr,hl)-(l,Hr)]	IDENT-TD
		7	*H-MM [(Hr,h)-(l,Hr)]	IDENT-TD
		8	*MH-MM [(Hr,lh)-(l,Hr)]	IDENT- IT
HH (Hr,h)	HH-H [(Hr,h)-(h,Hr)]	1	HM-H [(Hr,l)-(h,Hr)]	Winning Candidate
		2	*HH-H [(Hr,h)-(h,Hr)]	OCP-c(h) &*HD/ST
		3	*MM-H [(Hr,l)-(h,Hr)]	IDENT- IT
		4	*LL-H [(Lr,l)-(h,Hr)]	IDENT- IT
		5	*ML-H [(Lr,hl)-(h,Hr)]	IDENT- IT
		6	*ML-H [(Lr,hl)-(h,Hr)]	IDENT-TD
		7	*H-H [(Hr,h)-(h,Hr)]	IDENT-TD
		8	*MH-H [(Hr,lh)-(h,Hr)]	IDENT-IT

4.5 Conclusion

In this chapter, OT analysis on the tonal alternations of Bangkok Hakka is presented. Similar to its Meixian counterpart, Bangkok Hakka tonal alternation are grouped into assimilation and dissimilation. The tonal alternations of Bangkok Hakka take place at tone melody and contour tier of the tone structure. Despite so, the basic OCP and NO-JUMP constraints is not adequate capture the tricky phenomena of the tone sandhi. Thus, the concept of constraint conjunction is introduced to solve the tone sandhi. The concept conjoins the basic constraints (OCP and NO-JUMP) with several kinds of triggers in the head position. The combination with triggers like (OCP-t(l) & *HD/Lr , NOJUMP-t & *HD/MM, and OCP-c(h) &*HD/ST) present a motivation for the certain tone to change its value. These constraints dominate general IDENT-T. OCP-t, NO-JUMP-t, *HD/Lr, *HD/ST and *HD/MM are inactive in the grammar of this dialect.

In the overall grammar, there are several undominated identity constraints that dominate the tone sandhi constraints to show how certain tones and sandhi tones in Bangkok Hakka preserve their value and features. The faithfulness constraints are listed as follows: First, IDENT-T-Lr (LL, ML and <u>ML</u>) since it is clear that low register tones do not change their tonal value. Second, IDENT-reg and IDENT-IT since the sandhi tones always have the same register and initial target features as their citation tones. Third, IDENT-TD since tone duration in Bangkok Hakka does not change due to the natural characteristics of syllable where they are attached. In conclusion, this kind of approach proves to be successful in explaining the disyllabic tonal alternations phenomena in the grammar of Bangkok Hakka.

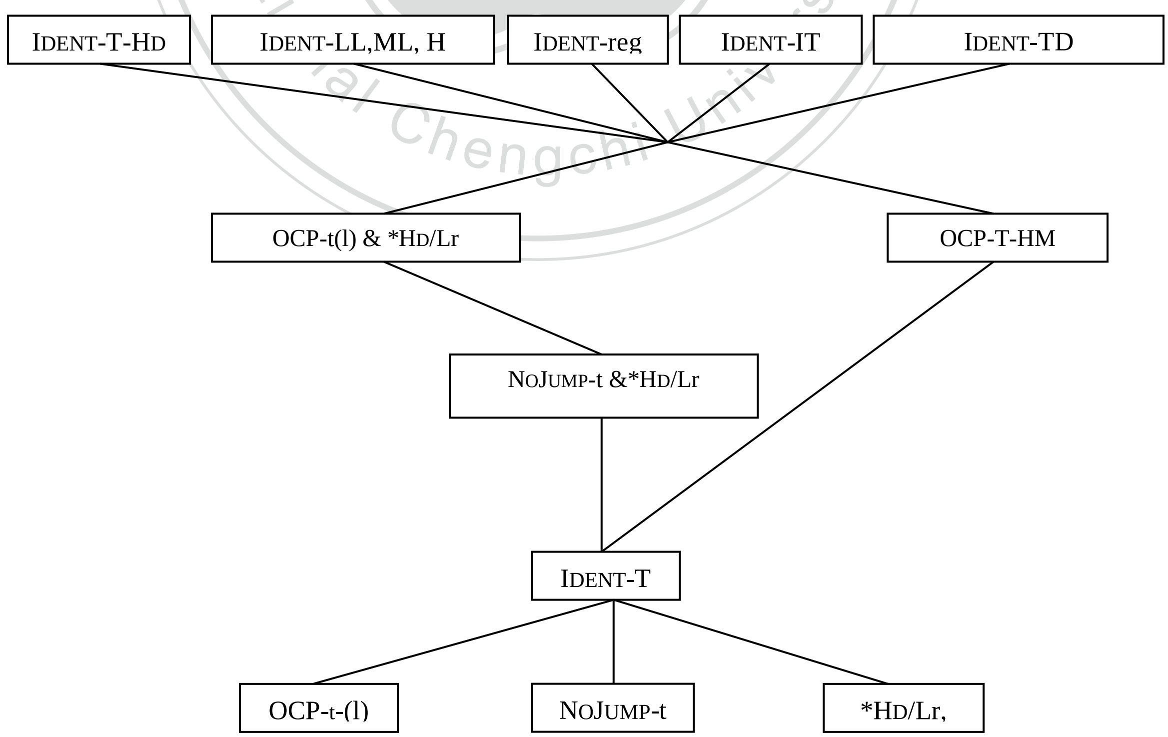
CHAPTER 5

CONCLUSION

5.1 Summary of the Thesis

This thesis presents an analysis on tone sandhi of Hakka dialects of Meixian and Bangkok using the Optimality Theory. The mechanism of constraint conjunction (CCT) is applied. The CCT promotes a combination of OCP and agreement type constraints with tonal prominence constraints. These constraints are ranked against identity constraints to show the mechanism of the tonal alternations within various dialects. Several identity constraints are also listed and they are ranked as in (1) to produce the grammar of the two dialects. In (1), the constraint ranking of the disyllabic tone sandhi of Meixian Hakka is represented and some information on the tonal alternation is summarized.

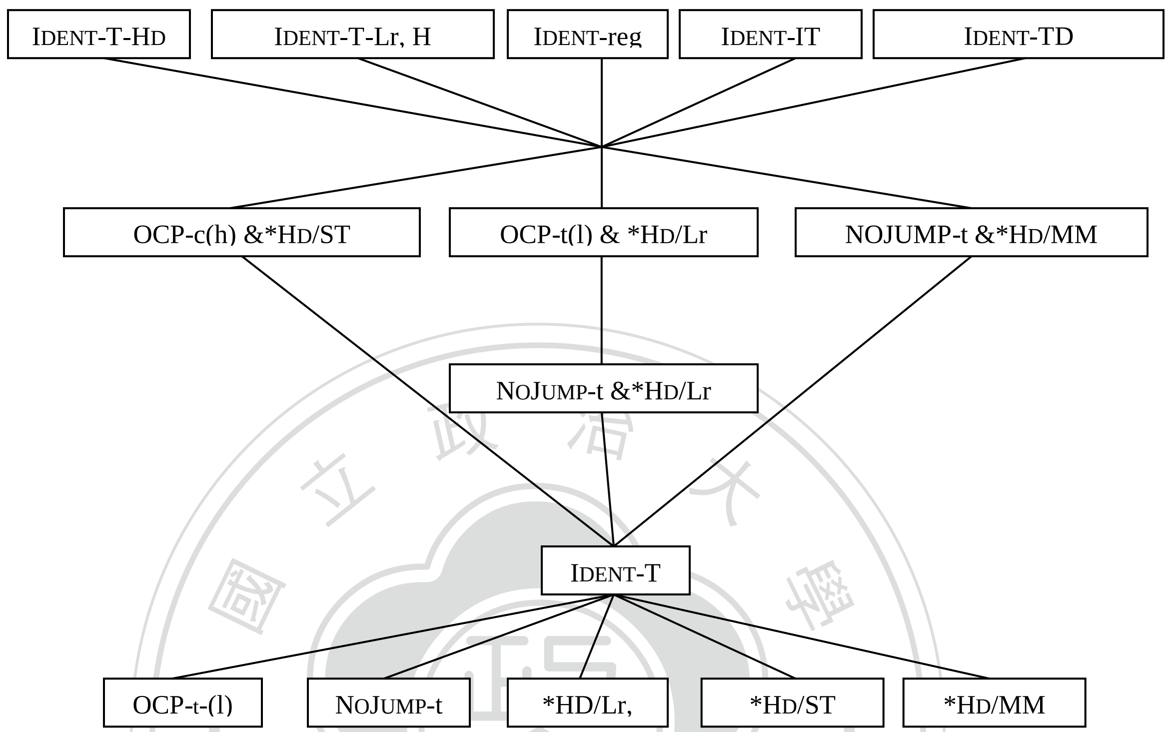
(46) Hasse Diagram of Meixian Hakka tone sandhi



Several identity constraints that determine the shape of the output of the sandhi are undominated/highly ranked. For example, the register and initial target value of Meixian Hakka Sandhi Tone remain the same as its citation tone. And this requirement is fulfilled by positing IDENT-reg and IDENT- IT. Several tones which do not undergo changes are also protected by undominated single identity constraint on their tone value (IDENT-LL, ML, H). Moreover, IDENT-T-HD (following Lin 2011) gives a prediction that only the left syllable of the domain may undergo changes.

Because the tonal alternations are triggered by assimilatory and dissimilatory forces which require certain tone features in the head position, two conjoined constraints and a single contour tier OCP constraint need to dominate IDENT-T. These constraints are ranked below the identity constraints which define the shape of the output sandhi. Furthermore, since the the dissimilation of low level tone melody is preferred over assimilation, the dissimilatory constraints which demand the violation of both OCP-t(l) and *HD/Lr are ranked higher than its assimilation counterpart. Since high falling/HM possess unique characteristics which cannot be captured by other constraints, the OCP-T-HM constraint is needed and it does not interact with NOJUMP-t &*HD/Lr. The ranking argument of Bangkok Hakka tone sandhi provided in the Hasse diagram (2).

(2) Hasse Diagram of Bangkok Hakka tone sandhi



From diagram (2), it is shown that several identity constraints that govern the possible tone/shape of the output of the sandhi rank higher than other constraints. The tonal change in Bangkok Hakka is closely related to its input tone with no changes in their register value, initial target specification, duration etc. Alternations of tone of Bangkok Hakka are triggered by a variety of constraint conjunctions depending on the head position features. Nevertheless, they are still within dissimilatory and assimilatory type tone sandhi. When these markedness constraints are not interacting with each other, they sit comfortably below the shaping identity constraints such as NOJUMP-t & *HD/MM and OCP-c(h)&*HD/ST. However, since the low tone melody dissimilation is preferred, OCP-t(l) & *HD/Lr always ranks higher than NOJUMP-t &*HD/Lr. Finally, several markedness constraints are ranked below the General IDENT constraints meaning they are inactive in the grammar of Bangkok Hakka. The reason is clear: they are simple and it is not possible to describe the tone sandhi phenomena in the language.

5.2 Final Remarks

Despite Meixian and Bangkok Hakka tone alternations are all about assimilation and dissimilation, they present a highly marked grammar of tonal alternations. These complexities make basic OCP and NO-JUMP constraints inadequate to capture the phenomena, and this thesis presents a solution by positing some markedness constraints and conjoined constraints. It is also assumed that certain tones have prominent status that they do not change their value. The prominence is expressed theoretically into several undominated identity constraints. Finally, the changing from citation tones to sandhi tones of the two dialects does not include the change of prominent internal features. Thus, the shape of the optimal candidate should be governed by several higher ranked faithfulness constraints.

5.3 Further Issues

This thesis deals specifically with disyllabic tone sandhi of Meixian and Bangkok Hakka. There is possibility of trisyllabic, and syntactic tone sandhi of the dialects. Therefore, it would be interesting to explore more from the field work, and develop it into another theoretical work. It is also interesting to see and compare the other data of Hakka and other Chinese dialects from the perspective of this constraint based model, Optimality Theory.

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