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Master Thesis



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華語焦點變調

Mandarin Focal Tone Sandhi

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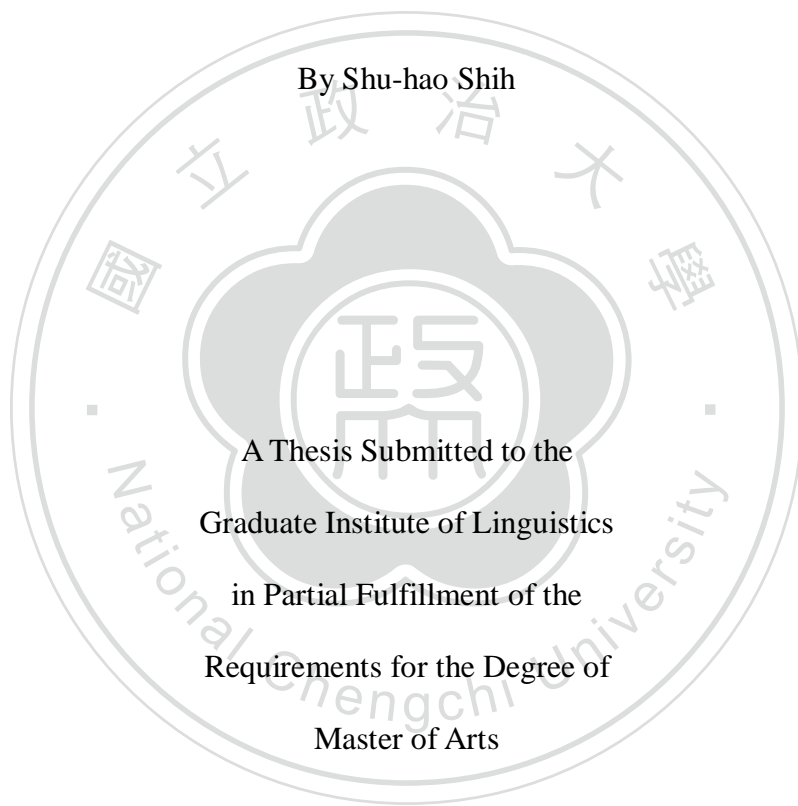
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Mandarin Focal Tone Sandhi

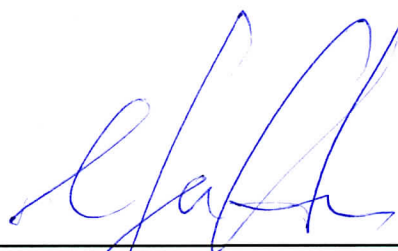
By Shu-hao Shih



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The members of the Committee approve the thesis of Shu-hao Shih  
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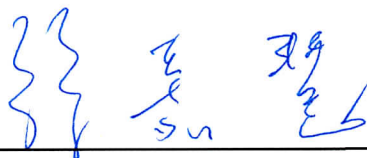


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**Kawai Chui, Director, Graduate Institute of Linguistics**



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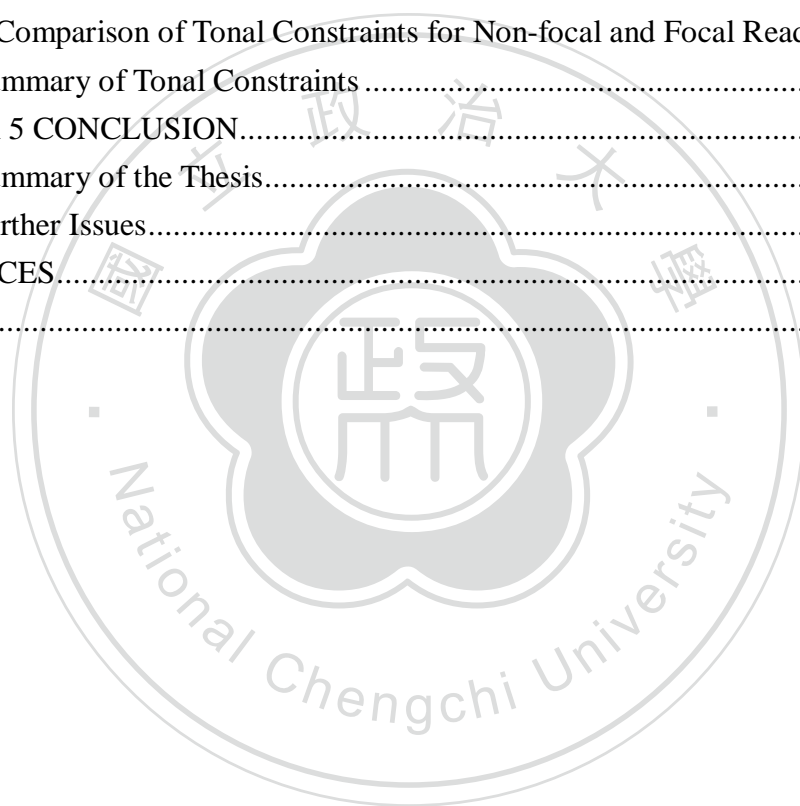
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# 國立政治大學語言學研究所碩士論文提要

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論文提要內容：(共一冊，一萬八千一百八十四個字，分五章)

本文旨在探討華語焦點變調，並以青年語者為主。本文分別檢驗三種不同的句型，第一類為焦點助動詞和焦點副詞，第二類為平坦結構，第三類則是其它類型的句子。在優選理論的架構下，本文分別提出韻律制約和聲調制約來詮釋華語的焦點變調。筆者透過並存音韻理論(Cophonology Theory)來說明焦點韻律結構的劃分是多個次語法的運作結果。焦點韻律結構的劃分有兩種，主要由(ALIGN-L(F, FP), ALIGN-L(FP, Ft))和(ALIGN-R(F, FP), ALIGN-R(FP, Ft))這兩組可移動的對整制約來決定，當它們在制約排序中移動到不同的位置時會形成不同的韻律結構劃分。本研究發現焦點詞組等同於語調詞組，因此提出另一個對整制約 ALIGN-E(FP, IP)來解釋。排序最高的韻律制約則是[FtMIN & NON-FINALITY]，目的在於避免單音節音步出現在句末。至於聲調制約，筆者採用 IDENT-BOT 來處理三音節音步的變調結果。此外，焦點韻律結構的劃分會造成兩個相鄰的上聲出現在不同的音步之中，OCP-L(ft)可以確保此形式的保留。簡言之，本文藉由優選理論的觀點，以及韻律制約和聲調制約的互動，對華語焦點變調提出了一個整體分析。



## Abstract

This thesis examines Mandarin focal tone sandhi among Taiwan youngsters. Three types of sentences are under investigation: Type A includes the focused auxiliary verbs and adverbs in a simple sentence, Type B the flat structure, and Type C the other types of structures. Under the framework of Optimality Theory, this thesis proposes prosodic constraints and tonal constraints to account for Mandarin focal tone sandhi. This thesis adopts Cophonology Theory to explain the subgrammars of focal phrasings. There are two types of focal phrasing patterns governed by the reranking of two sets of alignment constraints (ALIGN-L(F, FP), ALIGN-L(FP, Ft)) and (ALIGN-R(F, FP), ALIGN-R(FP, Ft)). The focal phrase pertains to a special kind of intonational phrase. This thesis proposes ALIGN-E(FP, IP) to explain this condition. The undominated constraint, [FtMIN & NON-FINALITY], is proposed to ban a monosyllabic foot in sentence-final positions. IDENT-BOT is adopted to deal with the tri-tonal strings such as  $(\sigma(\sigma\sigma))$  and  $((\sigma\sigma)\sigma)$  in non-focal and focal readings. In addition, focal phrasing may force adjacent L tones to appear in different feet. OCP-L(ft) is proposed to explain this situation. To conclude, based on the constraint-based theory, and the interaction of prosodic constraints and tonal constraints, this thesis has provided a theoretical generalization of Mandarin focal tone sandhi.

## CHAPTER 1

### INTRODUCTION

#### 1. Introduction

This study investigates the Mandarin focal tone sandhi under the theoretical framework of Optimality Theory (OT). Mandarin third tone sandhi has intrigued many scholars in the previous literature (Cheng, 1973; Shih, 1986; Zhang 1988; Hung 1989, among others). Third tone sandhi is a process in Mandarin Chinese that changes a third tone into a second tone when the third tone is immediately followed by another third tone. However, the interaction between focus and third tone sandhi has not attracted much attention. Shih (1990) and Hsiao (1991, 1995) propose that in Mandarin, the focal boundary is placed at the left edge of the focal element and that the foot formation ends at this boundary. Nevertheless, these studies lack a thorough investigation of the focal tone sandhi in different parts of speech and syntactic structures.

The term focus in this study is used to indicate the phonological and semantic contrast occurring in syntactic elements. In other words, focus indicates interconnections between syntax, phonology, and semantics. Specifically, a focus is contrastive when it explicitly contradicts a set of stated or predicted alternatives.

When a syntactic element is under focus, the tone sandhi domain and the tone sandhi pattern are different from the regular reading. In other words, the prosodic domain is restructured so that the tone sandhi pattern is changed. Prosodic restructuring due to focus is common among languages and often displays an interface between syntax, phonology, and semantics (Condoravdi, 1990, Kanerva, 1990, Nagahara, 1994).

This thesis examines Mandarin focal tone sandhi based on following questions. First, since the original studies of Mandarin focal tone sandhi were done roughly two decades ago, there is a question as to whether the findings from studies of the intuitions of youngsters who were born in the 1990s are the same or different from the claims of the operation of Mandarin focal tone sandhi in the previous literature? Second, what is the focal phrasing pattern in terms of different syntactic structures and parts of speech? Third, how is the focused element aligned in relation to focal phrase? More specifically, is the focused element located at the right or left edge of focal phrase when the focus is in different syntactic structures or on different parts of speech? Fourth, what is the tone sandhi pattern of the focused element? Does the focused element undergo tone sandhi or retain the citation tone? Fifth, under the framework of OT, what are the prosodic constraints, tonal constraints, and the rankings that determine the output form of Mandarin focal tone sandhi?

The organization of this thesis is as follows. Chapter 1 introduces the general

background of Mandarin tone sandhi and the definition of focus. Chapter 2 reviews some previous rule-based studies, and some related theoretical background. Chapter 3 surveys the data from Taiwan youngsters and proposes certain generalizations about Mandarin focal tone sandhi. Chapter 4 adopts Optimality Theory and posits prosodic constraints and tonal constraints to account for Mandarin focal tone sandhi. Chapter 5 is the summary of this thesis.



## CHAPTER 2

### LITERATURE REVIEW

This chapter will review some related theoretical frameworks dealing with the syntax-phonology interface and some recent studies in relation to Mandarin focal tone sandhi. I will also discuss the basic concepts of Optimality Theory, Correspondence Theory, Generalized Alignment, and Cophonology Theory.

#### 2.1 Tonotactics of Mandarin

Mandarin is a tone language. Different tones will change the meaning of the words. There are four tones in the Mandarin tonal system: high level (H), rising (LH), low (L), and falling (HL). In particular, the low tone (L) is treated as the phonological representation of MLH (Hsiao 1991; Lin 2000). The Mandarin third tone sandhi rule and the application of the rule are illustrated below:

(1) Mandarin Tone Sandhi Rule:  $L \rightarrow LH / \_ L$

lao ban 'bosses'

L L base tone

LH L surface tone sandhi pattern

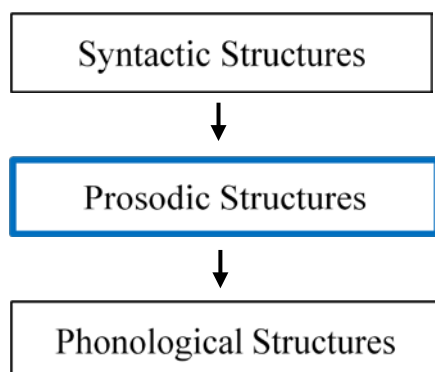
This example shows that the first syllable *lao*, which carries a L tone, changes to a LH tone, when it is followed by another L tone. The last syllable *ban* does not undergo tone sandhi and retains its base tone in surface.

## 2.2 Syntax-Phonology Interface

In the literature, there are two main approaches to the mapping between syntax and phonology: the Direct Reference Hypothesis and the Indirect Reference Hypothesis. The Direct Reference Hypothesis claims that phonological rules are sensitive to syntactic structures, and that phonological rule domains are determined by syntactic surface structures (Kaisse, 1985; Odden 1987, among others). There is no intermediate level between syntax and phonology.

However, the Indirect Reference Hypothesis argues that phonological rules do not operate directly on syntactic structures. Instead, they operate on the intermediate level between syntax and phonology, namely, prosodic structures (Selkirk, 1984; Nespor and Vogel, 1986; Shih, 1986; Hung, 1987; Hsiao, 1991, 1995, among others). Prosodic structures are constructed based on syntactic information and serve as the domains for phonological rules, as illustrated in (2).

## (2) Indirect Reference Hypothesis



There is a separate prosodic hierarchy, paralleling syntactic structure. Its main components include utterance, intonational phrase, phonological phrase, clitic group, phonological word, foot, syllable, and mora, as in (3).

## (3) Prosodic Hierarchy

U (utterance)  
|  
I (intonational phrase)  
|  
 $\varphi$  (phonological phrase)  
|  
C (clitic group)  
|  
 $\omega$  (phonological word)  
|  
F (foot)  
|  
 $\sigma$  (syllable)  
|  
 $\mu$  (mora)

The hierarchy is governed by the Strict Layer Hypothesis. The Strict Layer Hypothesis determines the geometry of this constituent structure, as follows:

(4) Strict Layer Hypothesis (Selkirk 1984; Nespor & Vogel 1986)

- a. A given non-terminal unit is composed of one or more units of the immediately lower category.
- b. A unit of a given level is exhaustively contained in the superordinate unit of which it is a part.

## 2.3 Previous Studies

### 2.3.1 Zhang's (1988) and Shih's (1990) Analyses

Shih (1986) convincingly demonstrated that foot is not formed by surface syntactic structure, but it is a mediating prosodic structure partially conditioned by syntactic structure. Shih (1986) modified Chen's (1984) rules, which were originally designed for scanning Chinese poetry and verse:

(5) Foot Formation Rules

- a. Immediate Constituency (IC): Link immediate constituents into disyllabic feet.
- b. Duple Meter (DM): Scanning from left to right, string together unpaired



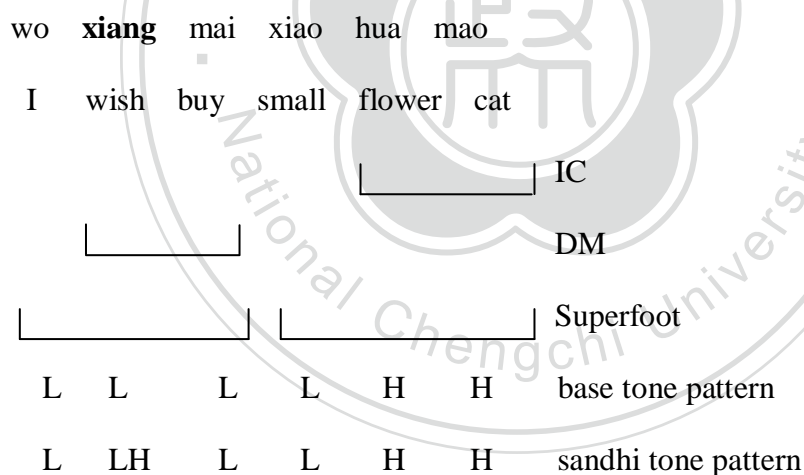
syllables into binary feet, unless they branch in the opposite direction.

c. Superfoot (f'): Join any leftover monosyllable to a neighboring binary foot

according to the direction of the syntactic branching.

Zhang (1988), based on Shih's Foot Formation Rules, posits that foot formation starts with this accented syllable so that restructured foot domains would derive tone patterns different from the non-focal renditions. Example (6) is given for illustration.

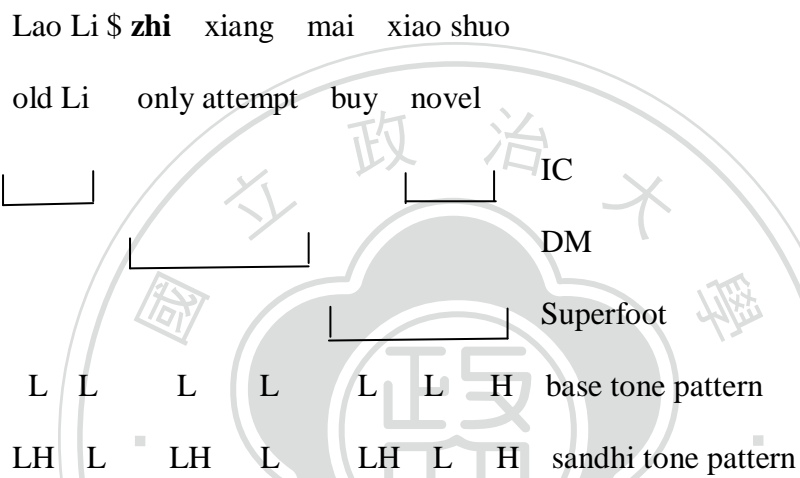
(6) 'I want to buy small cats'



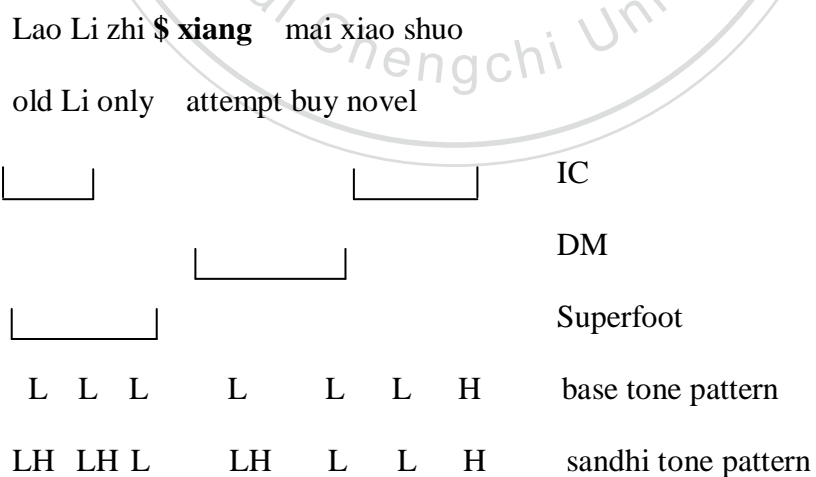
In (6), the DM starts scanning from the accented syllable *xiang* rightward, in order to string *xiang* and *mai*, instead of *wo* and *xiang*, into a foot. Then, *wo* joins the existing foot to form a trisyllabic foot to which tone sandhi is applied, and hence the low tone of *wo* remains invariant, unlike the non-focal reading is (LH.(LH.L))(L.(H.H)).

Shih (1990), on the other hand, posits an ‘emphatic boundary’ before the focal element, suggesting that foot formation ends at the boundary (\$ = emphatic boundary).

(7) a. ‘Old Li only attempts to buy a novel.’



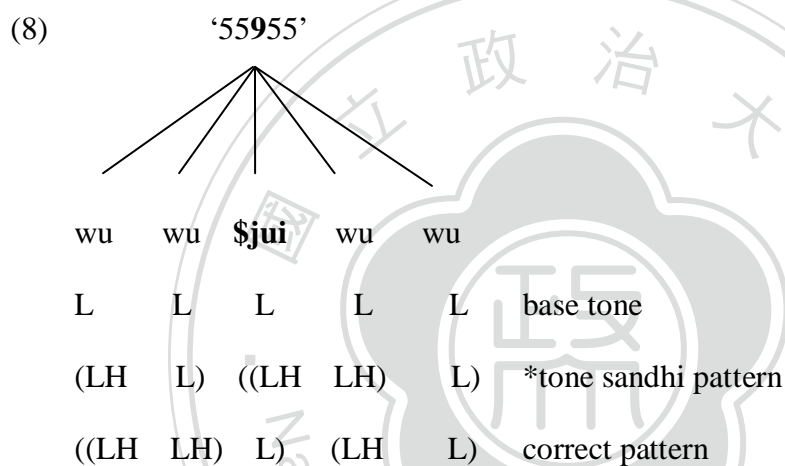
b. ‘Old Li only attempts to buy a novel.’



In (7a), **zhi** is the focal element, and thus the preceding syllables *lao* and *li* form a foot.

In addition, *xiang* in (7b) is the focal element, and an emphatic boundary is placed before it. As a result, *zhi* must join *lao li* to form a foot, and retains its base tone.

However, the parameters proposed by Zhang (1988) and Shih (1990) fail to make a correct prediction of focal phrasing in flat structures. Consider the example of the flat structure in (8) where the focus is on the central syllable.



As in (8), Zhang and Shih would decide that the foot formation starts at the focused element *jui*. As a consequence, the focused element *jui* inevitable carries a sandhi tone instead of a base tone, but the output is ill-formed. In fact, in a flat structure, the focused element stands at the right edge of the focal phrase, and thereby the foot formation ends at the focused element. To account for this problem, I will propose a right-edge constraint in chapter 4 to explain the phrasing of the focal tone sandhi in a flat structure.

### 2.3.2 Hsiao (1991, 1995)

In order to capture the psychological reality of the native intuition, Hsiao (1991, 1995) proposes a beat-counting device, showing that the structure of the foot should be built upon metrical beats, which mediate between the foot and the syllable. Lexical syllables and functor syllables are distinguished in his beat-counting theory:

#### (9) Beat Assignment

- a. Lexical Beat-Assignment (LB): Every lexical syllable is assigned a metrical beat.
- b. Functor Beat-Assignment (FB): A functor syllable is assigned a beat in normal or slow speech, behaving like a lexical syllable, and is left-adjoined to the nearest beat in fast speech.
- c. FB takes place after lexical syllables have been made into ICFs or ABFs.

#### (10) Foot Formation Revisited

- a. Immediate Constituent Foot (ICF): Any adjacent beats which are assigned to ICs form an ICF.
- b. Adjacent Beat Foot (ABF): Any two adjacent beats which are not assigned to

ICs are paired into an ABF.

- c. Jumbo Foot (JF): Any unpaired single beat is recruited by a neighboring foot to form a Jumbo Foot if the beat c-commands the adjacent beat contained in the foot.
- d. Minifoot (MF): The leftmost single beat constitutes a Minifoot iff it is followed by an intonational phrase boundary %.

(11) Application Criteria

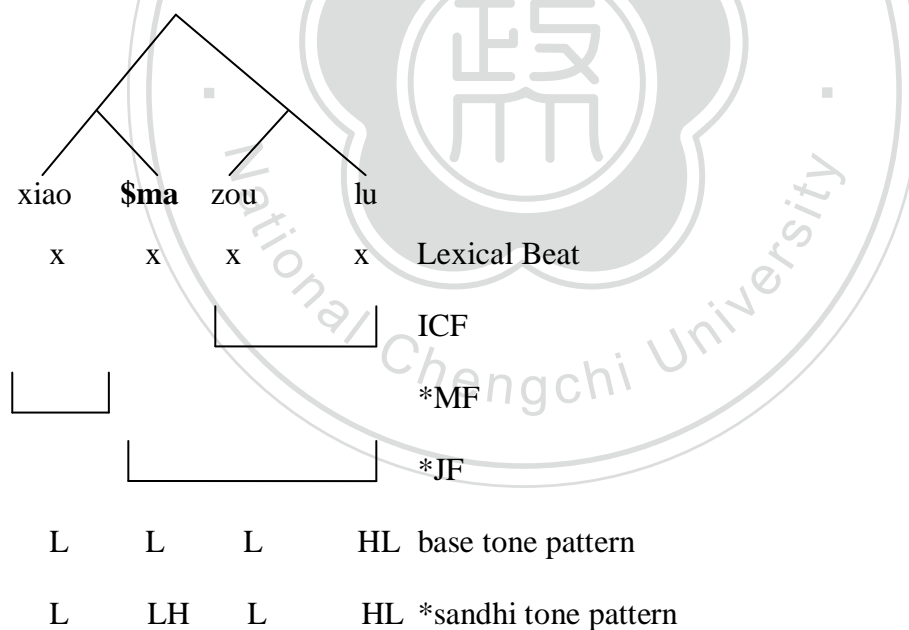
- a. When all conditions are met, the ICF prevails over other footing processes.
- b. Scanning starts from left to right and stops as soon as the environmental requirements for either MF, ABF or JF are met, and the principle triggered applies to the whole line.
- c. Footing must not cross any intonational phrase boundary.

To account for tone sandhi in relation to focus, Hsiao proposes the principle of focal phrasing:

- (12) Focal Phrasing (FB): A focal boundary \$ is placed before a focused lexical syllable iff it is outside of an ICF or a JF.

The general assumption is that foot construction cannot operate across the focal boundary \$, which, however, can not be placed within an ICF or a JF. That is, a functor syllable does not have the ability to take the focal boundary \$. ABF does not resist a focal boundary as ICF and JF do. This is because ABF usually renders a metrical tension, and hence is more breakable. The following example shows the application of focal phrasing.

(13) 'A small horse is walking.'

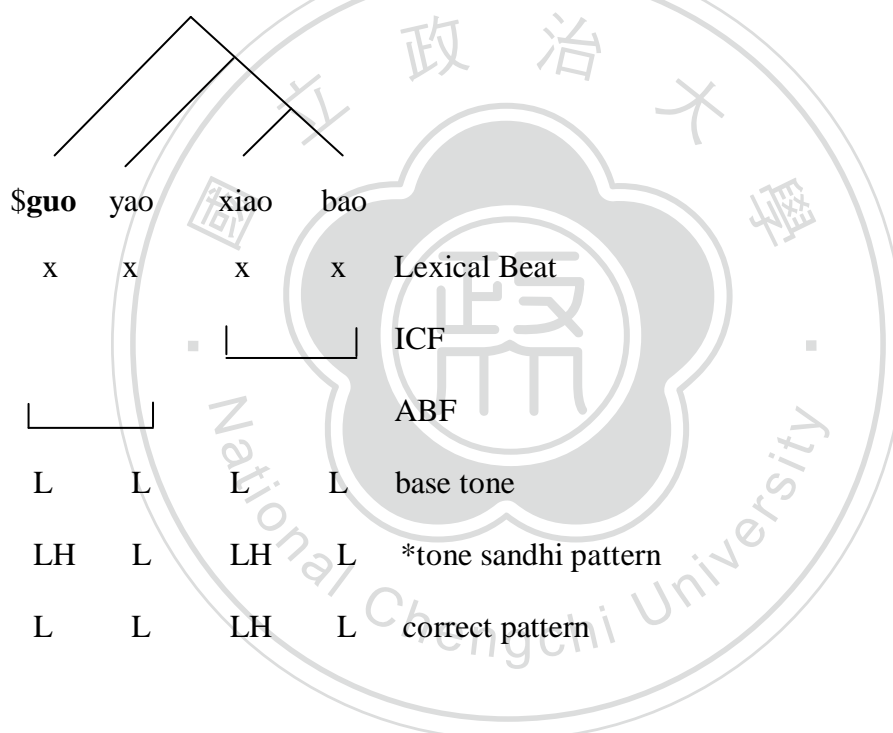


When *ma* in (13) is focused, \$ is placed before it, forcing *xiao* to emerge as a Minifoot. The focal *ma* then joins the ICF to form a Jumbo Foot. As a consequence, *ma* inevitably carries a LH tone, and the derived reading is ill-formed. The placement

of a focal boundary \$ is prevented after the first ICF, as dictated by the Focal Phrasing Principle.

Nevertheless, when focal phrasing occurs in the marked reading of Type C<sup>1</sup>, Hsiao's focal phrasing is unable to make a correct prediction, as illustrated in (14).

(14) 'Dogs bite Small Bao.'



The focal boundary is required to be placed before the focused element *guo* since it is a lexical syllable. As a result, *guo* undergoes tone sandhi and changes to a LH tone.

Yet, this is not the correct pattern because in a marked reading, the focused element usually retains the base tone. Therefore, this study will propose a right-edge parameter

<sup>1</sup> As Chapter 3 will show, there are two alternative focal phrasing patterns among youngsters when focal phrasing occurs in Type C. One is common and unmarked while the other is less frequent and marked.

to account for the focal phrasing patterns in Mandarin.

The foot formation should be stopped before the boundary. The boundary itself does not reveal any phonetic cues, such as the change of pitch or duration. By using the term focal phrase, there is no need to further point out the phonetic properties once the phrase is under focus.

### 2.3.3 Cho (1990) & Kanerva (1990)

Cho (1990) examines the relationship of syntax and phrasing in Korean. She discovered that the semantic notion of focus, together with its phonological realization as high pitch, plays a crucial role in phrasing. The focus phrasing data in the study show that the determination of prosodic structure is not entirely dependent on syntactic notions. Consider how the presence of focus affects phrasing in (15).

- (15) a. nuka 'who(Nom)' [+high]  
       [núga gayo] 'Who is going?'  
       who goes
- b. [Súni-ga gayo] 'Suni is going.' (in answer to (a))
- c. [Suni-ga] [kayo] 'Suni is going.' (normal declarative sentence)  
       Suni-Nom goes



As shown in (15b), the accented subject is phrased with the non-branching verb phrase. It is necessary to include one more clause in phonological phrasing of Korean. That is, phrase any focused word with the next word, unless that word is already phrased.

Kanerva (1990) investigated the focus in relation to phonological phrasing in Chichewa, a Bantu language spoken in East Central Africa. The major finding in his study is that Chichewa phonological phrases are strongly dependent on focus, and are generally larger and more variable with respect to syntax than what is reported for phonological phrases in other languages. In light of this, the Chichewa domains could represent a truly distinct pattern of prosodic organization since no phonological phrase algorithms hold up under scrutiny of focus. Four focal phrasings of VP are given below. Focus is indicated by bold typeface.

- (16) a. (VP)                    A-namenya nyumba ndi mwála.  
   ‘pro-hit the house with a rock’
- b. (VP)                        (Anaményá nyumbá ndí mwáála)
- c. (V OBJ OBL)    (Anaményá nyumbá **ndí mwáála**)
- d. (V **OBJ**) (OBL) (Anaményá **nyumbá**) (ndí mwáála)
- e. (V) (OBJ) (OBL) (**Anaményá**) (nyumbá) (ndí mwáála)

The phrasing pattern above is that when there is a focus inside the VP, a domain starts at the verb and ends at the focused constituent and any non-focus constituents each form their own domain.

Collectively, the phonological phrase algorithms of Nespor and Vogel (1982), Mchugh (1986), Selkirk (1986), and Chen (1987) expectedly allow (16d) and (16e). However, they fail to derive (16b) and (16c). Therefore, Kanerva proposes that Chichewa domains instantiate a previously unrecognized level of prosodic structure, Focal Phrase (FP), and that this level is intermediate between the phonological phrase and the intonational phrase.

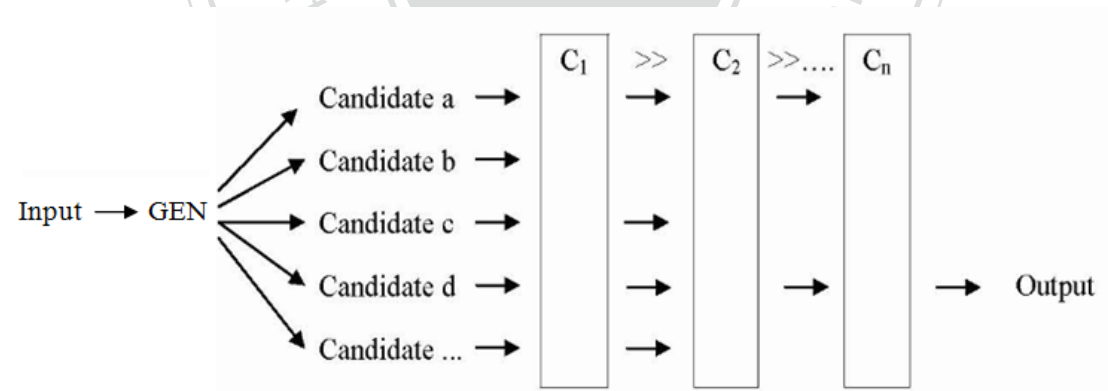
In summary, the studies of Cho (1990) and Kanerva (1990) have shown a problem that the focal phrase of Chichewa and Korean is generally larger than the phonological phrase but smaller than the intonational phrase. This problem could be resolved by two ways. One way is to include one more focus rule in the phonological phrase formation, as Cho (1990) suggests. The other is to posit a new distinct level between phonological phrase and intonational phrase, as Kanerva (1990) proposes. This thesis will examine the size of the Mandarin focal phrase as to whether it matches the phonological phrase, intonational phrase, or whether it is a truly distinctive pattern of prosodic organization.

## 2.4 Theoretical Background

### 2.4.1 Optimality Theory

Optimality Theory (OT) is a constraint-based framework which is proposed by Prince and Smolensky (1993/2004). Unlike traditional transformations, OT disallows serial derivations. The operation in OT mainly involves two systems: Generator (GEN) and Evaluator (EVAL). An OT grammar can be schematically represented as in (17). For every possible input, the generator (GEN) produces a candidate set. Inputs are in principle unconstrained linguistic objects such as lexical items in word phonology.

(17) OT Schema



A candidate set contains output structures. These structures are possible analyses of the input. According to the principle of inclusiveness, GEN produces all of the analyses of the input that 'are admitted by very general considerations of structural


well-formedness' (McCarthy and Prince 1993), which could include universal properties. The evaluator (EVAL) evaluates candidate sets with respect to particular rankings of the constraint inventory Con. It is often assumed that Con is universal. Its members are simple and conflicting statements about the form of the output or the relation between the output and the input. Because of the conflict between constraints, all conceivable linguistic structures will be assumed to violate at least some of the constraints.

(18) Constraint A >> Constraint B >> {Constraint C, Constraint D}

/Input/	Constraint A	Constraint B	Constraint C	Constraint D
☞ Candidate (a)			*	
Candidate (b)	*!			*
Candidate (c)		*!		

The operation of OT can be demonstrated with the tableau as shown in (18). In the left column, the input is placed at the top left cell and the other columns show the candidates generated from the input by GEN. In the right columns, the constraints of interest are each named in separate columns. The ranking constraints are ranked lower from left to right. Thus, constraint A is ranked higher than constraint B, followed by

constraint C in a certain language. The finger marker indicates the optimal output of the evaluation while the reverse one indicates the wrong prediction of the optimal output. The solid line distinguishes the priority accorded to one constraint over another. The dotted line between two constraints shows that the ranking is unknown. The asterisk denotes a violation and the exclamation mark represents a fatal violation that rules out a losing candidate. Shaded areas in the tableau indicate that the constraints in the shaded areas should no longer be considered since a higher ranked constraint has already been violated.

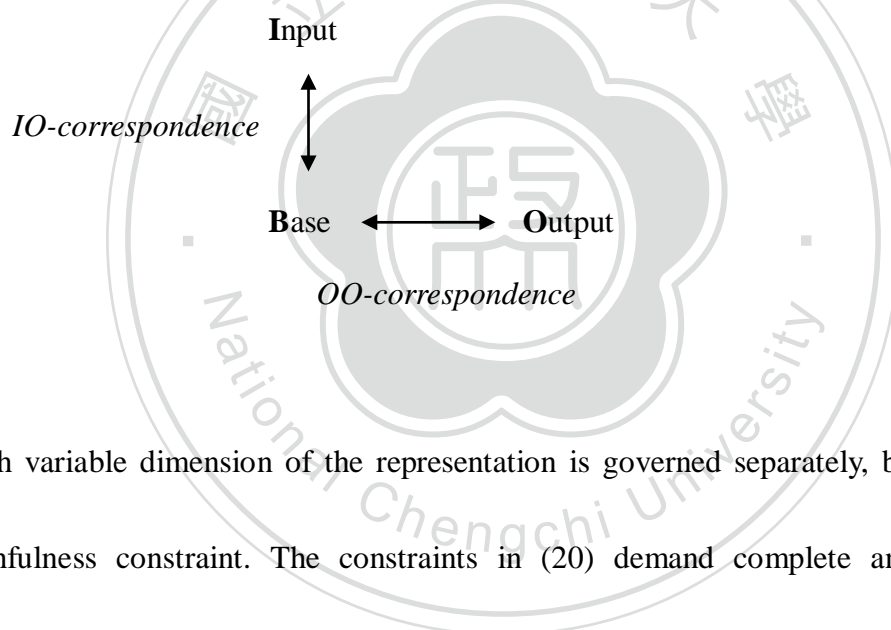
As can be seen in (18), Candidate (b) is ruled out because Candidate (b) violates Constraint A, the highest ranked constraint. Candidate (c) violates Constraint B, and Candidate (a) violates Constraint C. In this tableau, Constraint B is ranked higher than Constraint C, so Candidate (c) is ruled out. Candidate (a) is the optimal output which is indicated by a finger marker .

#### 2.4.2 Correspondence Theory

McCarthy and Prince (1995) enriched the OT grammar with Correspondence Theory, which defines faithfulness constraints as evaluating the individual elements of the input and the output so that constraints must assess the correspondence and identity of the correspondent elements. Elaborated in many subsequent researches (Ito,

Kitagawa and Mester 1996, Kager 1999, Nelson 2003), this theory posits the correspondence between the output base and the reduplicant. In Benua (1997), the Basic Model was developed into Transderivational Correspondence Theory, in which identity relation holds between two surface words. The correspondence model can be summarized as (19).

(19) Output-to-output Correspondence



Each variable dimension of the representation is governed separately, by a separate faithfulness constraint. The constraints in (20) demand complete and exclusive correspondence between strings.

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

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

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

In this study, the IDENT constraint will be adopted to constrain not only the correspondence between input-to-output tones but also the correspondence between base-to-output tones in Mandarin focal tone sandhi.

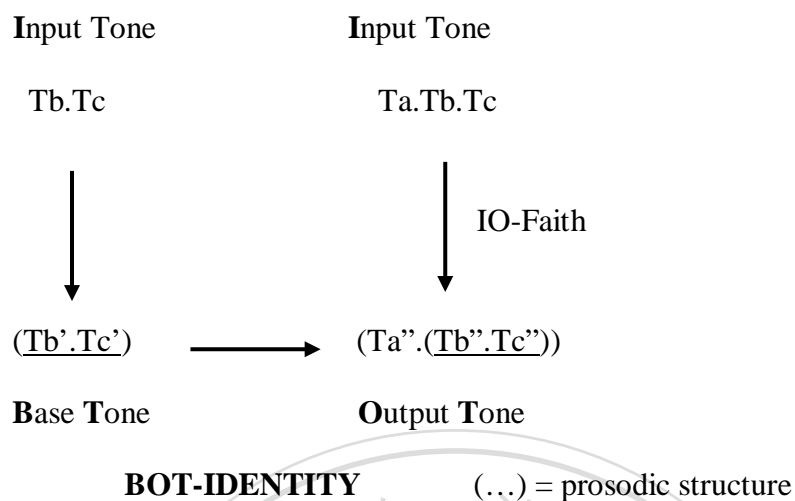
### 2.4.3 Prosodic Correspondence in Tone Sandhi

Drawing evidence from tone sandhi in Mandarin, Lin (2005) argues that the correspondence relation can be extended to stand between outputs that are related in the prosodic structures. Consider the following examples.

- (21) a. *mai ba san* ‘buy an umbrella’ a’ {σ{σσ}}
- Input: L.L.L → Output: **LH.LH.L** ((**LH.LH**).L)
- b. *ya er ma* ‘Armagh’ b’ {σ{σσ}}
- Input: L.L.L → Output: **LH.LH.L** ((**LH.LH**).L)

In (21a) and (21b), while the morphosyntactic structure is right branching {σ{σσ}}, the tonal domain is left branching ((σσ)σ). In the above examples, the tone sandhi domains cannot be morphosyntactically defined. Thus, Lin proposes a correspondence model for tone sandhi, as in (22).

## (22) Output-to-output Correspondence for Tone Sandhi



In this correspondence model, two correspondence relations are involved, an input-to-output relation and a base-to-output relation. Unlike the transderivational model proposed in Benua (1997), the two tonal outputs are related by the prosodic structures rather than by the morphosyntactic structures. Two freestanding tonal outputs that are compositionally related are governed by the base-tone-to-output-tone correspondence. For prosodic structures such as  $((\sigma\sigma)_1\sigma)_2$  and  $(\sigma(\sigma\sigma)_1)_2$ , the tonal information in prosodic constituent 1 would serve as the base for constituent 2. The bi-tonal sequence in the inner domain of the tonal output is evaluated with a bi-tonal base with which it shares the same underlying tones. In (22), the base is  $Tb'.Tc'$  and the reference output is  $Tb''.Tc''$ . The tonal sequence  $Tb''.Tc''$  within the inner prosodic constituent of  $(Ta''.(Tb''.Tc''))$  is evaluated with  $Tb'.Tc'$  for correspondence.



#### 2.4.4 Generalized Alignment

Developed from the edge theory of Selkirk (1986), and Inkelas (1989), McCarthy and Prince (1993) propose the idea of Generalized Alignment, in which the phonological representation of a sentence is constructed through the mapping of the edges of syntactic constituents to the corresponding edges of phonological constituents. Namely, the structural relations between grammatical categories (morphological and phonological) are governed by a single family of constraints under Optimality Theory: these demand that one type of grammatical constituent share a designated edge with some other type of constituent. The definition of Generalized Alignment is listed below:

##### (23) Generalized Alignment

Align (Cat1, Edge1, Cat2, Edge2) =def

$\forall$  Cat1  $\exists$  Cat2 such that Edge1 of Cat1 and Edge2 of Cat2 coincide.

Where Cat1, Cat2  $\in$  ProsCat  $\cup$  GramCat

Edge1, Edge2  $\in$  {Right, Left}

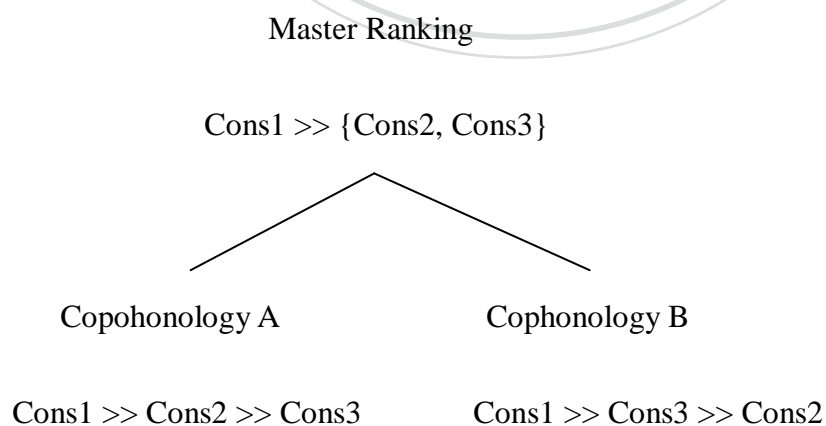
In the investigation into Mandarin focal tone sandhi, alignment constraints will be applied to explain the alignment of focal phrase and prosodic foot.

### 2.4.5 Cophonology Theory

The Theory of Cophonology (Orgun, 1996, Anttila, 1997, and Inkelas & Zoll, 2007) accounts for the nature of the diversity, such as registers, dialects, and free variations, within a language. This theory deals with language-internal diversity by way of re-ranking a set of unspecified constraints. There are different phonological systems that co-exist in a language, and the differences between them lie in reranking constraints in different morphological or grammatical structures.

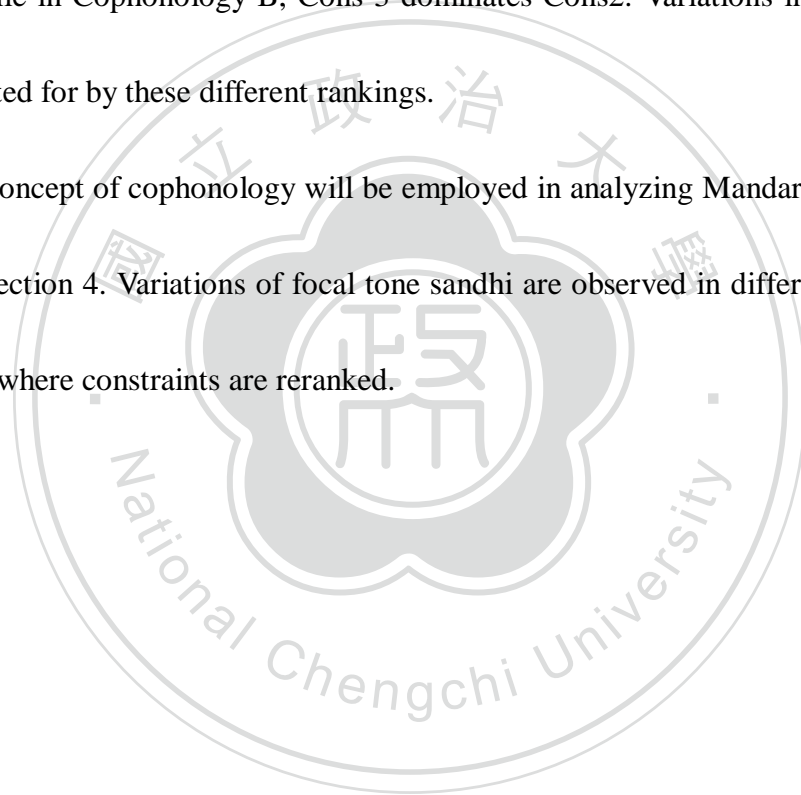
In the Cophonology model, constraints are general and purely phonological and are not indexed for specific contexts. The core concept of Cophonology can be schematized as in (24).

(24) A grammar lattice of language L (Inkelas and Zoll, 2007)



In a grammar lattice, the core grammar of a language L is placed in the superordinate node, that is, 'Master Ranking'. Constraints in the core grammar are partially ranked. That is, Cons1 dominates Cons2 and Cons3, but the ranking of Cons2 and Cons3 are not specified. Such specification is determined in the two subgrammars in language L, they are, Cophonology A and Cophonology B. In Cophonology A, Cons2 dominates Cons3, while in Cophonology B, Cons 3 dominates Cons2. Variations in language L are accounted for by these different rankings.

This concept of cophonology will be employed in analyzing Mandarin focal tone sandhi in section 4. Variations of focal tone sandhi are observed in different syntactic structures, where constraints are reranked.



## CHAPTER 3

### DATA ANALYSIS

This chapter analyzes the data from Taiwan youngsters who were born in the 1990s, and proposes certain generalizations about Mandarin focal tone sandhi. Three types of syntactic structures will be discussed, including adverbs and auxiliary verbs in a simple sentence, the flat structure, and the others. I will also define the size of the focal phrase.

#### 3.1 Data Collection

This thesis investigates focal tone sandhi based on data from youngsters, who were born in the 1990s. The studies of Shih (1990) and Hsiao (1991, 1995) were done over twenty years ago, so the intuition of the young generation would be quite different from that of the earlier generation. The intuition of the young generation about focal tone sandhi is the primary concern in this study. We restrict our attention to contrastive focus. Other kinds of focus, for instance informational focus (Li, 2009), will not be tested in this study because it does not contradict with a set of stated or predicted alternatives in an explicit way. Consider (1) and (2) for comparison.

## (1) Informational Focus

Q: zhangH sanH yaoHL quHL naL?

‘Where will Zhangsan go?’

A: zhangH sanH yaoHL quHL **faHL guoLH**.

‘Zhangsan will go to France.’

## (2) Contrastive Focus

Q: zhangH sanH yaoHL quHL meiL guoLH ma?

‘Will Zhangsan go to the United States?’

A: buHL, zhangH sanH yaoHL quHL **faHL guoLH**.

‘Zhangsan will go to France.’

In the above examples, *fa guo* in (1) is an informational focus and *fa guo* in (2) is a contrastive focus. In (1), there is no explicit contrast with reference to *fa guo*, whereas in (2), *fa guo* contradicts with the stated alternative, *mei guo*. With the explicit contrast, informants may be easier to aware what and where the focus is.

In this thesis, I use question-answer pairs to test the informants. The rationale underlying this test is that a ‘natural’ response to a question should have the same presupposition as the question, that is, the question and answer should have equivalent

focus structures (Chomsky 1971, Jackendoff, 1972). In this study we make a slight revision. That is, all the pairs include two elements in essence: an interrogative sentence and a response with negation and statement, as shown in (3).

(3) Question-answer Pairs

Q: shiHL xiaoL liL maiL mianHL baoH ma?

‘Is it bread which Small Li buys?’

A: buHL, buLH shiHL mianHL baoH, shiHL xiaoL liL maiL shuiL jiaoL.

‘No, it’s not bread. It is dumplings which Small Li buys.’

The purpose of the interrogative sentence is to arouse the attention of the informants and, more importantly, give them a context to stimulate their production of focal tone sandhi patterns. As for the response, it negates what is asked previously and then re-describes the statement with the correct target, and so indicates where the contrastive focus lies. In (3), the focus is not on *mian bao* ‘bread’ but on *shui jiao* ‘dumplings’ instead. This statement is introduced by the emphatic *shi* ‘it is’, which is similar to the English cleft construction. In addition, abstract and abstruse contexts are avoided for fear that informants cannot get the meaning.

The underlined sentence is our target sentence in this study. At first, informants

are requested to read the questions and the answers in their mind so that they may familiarize themselves with the context and also realize what the focus is. When the informants are ready and have no problem in reading the test words, the underlined sentences are read at normal speed for recording. In all the examples below, the focus is indicated in the schematic in bold typeface.

### 3.2 Type A: Adverbs and Auxiliary Verbs in a Simple Sentence

Adverbs and auxiliary verbs may be classified as one category since their syntactic behaviors are similar. Adverbs in Mandarin usually occur in pre-predicate position, after the subject or after the topic (if there is no subject), as in (4a). Auxiliary verbs also occur in a pre-predicate position, as in (4b). To test the focal tone sandhi of such words, we have chosen the following members which bear a base tone, as shown in (4).

#### (4) Adverbs and Auxiliary Verbs

	Examples & gloss
a. Adverbs	yeL 'also' zhiL 'only'
b. Auxiliary Verbs	ganL 'dare to' kenL 'be willing to'

Example (5a) and (5b) illustrate the focal tone sandhi patterns of adverb *zhi* and auxiliary verb *ken*, respectively.

(5) Focused Adverbs and Auxiliary Verbs

a. Q: shiHL xiaoL liL buHL zhiL maiL yuL sanL ma?

‘Does Small Li not only want to buy umbrellas?’

A: shiHL xiaoL liL **zhiL** maiL yuL sanL. (LH.L)(**LH**.L)(LH.L)

‘Small Li only wants to buy umbrellas.’

b. Q: shiHL xiaoL liL buHL kenL maiL yuL sanL ma?

‘Is Small Mei unwilling to buy umbrellas?’

A: buHL, buLH shiHL buHL kenL,

shiHL xiaoL liL **kenL** maiL yuL sanL. (LH.L)(**LH**.L)(LH.L)

‘No, it’s not that he’s unwilling. Small Li is willing to buy umbrellas.’

Notice that adverbs differ from auxiliary verbs in the lack of verb-like properties.

Although an auxiliary verb must occur with a full-fledged verb, it may occur along with the subject in a context in which the verb is omitted, as in an answer to yes-no question. This implies that there is no context in which an adverb may occur alone



with the subject of a verb. In (5a), no negation sentence like *bu shi bu zhi* is provided; instead, the answer is given to the informants in a straightforward way.

As shown in (5a) and (5b), respectively, both *zhi* and *ken* are at the left edge of the focal phrase and change to a LH tone. They form a disyllabic foot with the main verbs instead of the subjects. This fact indicates that the foot formation starts at the focused adverb and auxiliary verb. In addition, semantic constraints could play a role in the focal phrasing for a focused adverb and auxiliary verb. Take *zhi* for instance. Since it is a predicate-modifying adverb, it modifies the entire predicate phrase but not the subject. Thus, it forms a disyllabic foot with the main verb *mai*<sup>3</sup>.

When the focal adverb *zhi* is followed by the verb phrase *xiang mai* ‘want to buy’, the foot formation still starts at the focal adverbs.

(6) Focused Adverb *zhi*

Q: shiHL xiaoL liL buHL zhiL xiangL maiL yuL sanL ma?

‘Does Small Li not only want to buy umbrellas?’

A: shiHL xiaoL liL zhiL xiangL maiL yuL sanL. (LH.L)((**LH**.LH).L) (LH.L)

‘Small Li only wants to buy umbrellas.’

As in (6), *zhi* forms a trisyllabic foot with the verb phrase *xiang mai*. The focused

element *zhi* is at the left edge of the focal phrase and undergoes tone sandhi. The subject *xiao li* does not form a trisyllabic foot with *zhi* but forms a disyllabic foot itself.

In short, when adverbs and auxiliary verbs are focused, they are at the left edge of the focal phrase. The foot formation starts at the focused adverbs and auxiliary verbs, so they undergo tone sandhi.

### 3.3 Type B: the Flat Structure

This section discusses sentence structures that are syntactically considered as flat structures, such as repetition and coordination. We first examine how odd-numbered syllables in a flat structure are grouped with respect to tone sandhi domains. The relevant examples are given in (7). All the elements in (7) have a base tone and the emphatic elements are in boldface.

#### (7) Numeral Repetition

Q: shiHL wuL wuL wuL wuL ma?

‘Is it 55555?’

a. A: buHL, buLH shiHL, shiHL wuL wuL **juiL** wuL wuL. ((LH.LH.)L)(LH.L)

‘No, it’s not. It is 55955.’

b. A: buHL, buLH shiHL, shiHL wuL **ju**iL wuL wuL wuL. (LH.**L**)((LH.LH.)L)

‘No, it’s not. It is 59555.’

c. A: buHL, buLH shiHL, shiHL wuL wuL wuL **ju**iL wuL. ((LH.LH.)L)(**LH**.L)

‘No, it’s not. It is 55595.’

The surface tone patterns of the five consecutive same numbers in the interrogative sentence could be (LH.L)((LH.LH.)L), ((LH.LH.)L)(LH.L) or (LH.LH.LH.LH.L). All of the readings are acceptable without the interference of focus. However, only one reading is acceptable when contrastive focus occurs in numeral repetition. When the focus is on the number *ju* in (7a) and (7b), the focused syllables retain the base tone<sup>2</sup>. Therefore, the surface tone patterns of (7a) and (7b) are ((LH.LH.)L)(LH.L) and (LH.L)((LH.LH.)L), respectively. This result indicates that the focused element is located at the right edge of the focal phrase and that foot formation ends at the focused element. Notice that in (7c), the only acceptable reading is ((LH.LH.)L)(LH.L). The plausible explanation for this is that in Mandarin, the last syllable is forbidden being isolated as a monosyllabic foot. Thus, the penultimate syllable inevitably forms a disyllabic foot with the last syllable.

<sup>2</sup> This finding is identical to Wee’s (2010) study on Tianjin focal tone sandhi. Wee discovers that any syllable in a given string that receives focal stress will retain its citation tone in Tianjin. The effect of focal stress is that it creates a rhythmic break which effectively determines prosodic constituency.

a. /RRR/ → HRR      b. /LLL/ → RLL  
c. /RRR/ → RHR      d. /LLL/ → LRL

Similar focal phrasing takes place in coordination structures. Equally, all of the syllables in the following instances have a base tone. The possible regular reading could be (LH.L)((LH.LH.)L), ((LH.LH.)L)(LH.L) or (LH.LH.LH.LH.L). When focus occurs in coordination structure, only one reading is acceptable.

### (8) Coordination Structure

a. Q: shiHL MaL JiangL HaoL LiL XuL ma?

‘Is it Ma, Jiang, Hao, Li, Xu?’ (last names)

A: buHL, buLH shiHL JiangL,

shiHL MaL LuL HaoL LiL XuL. (LH:L)((LH. LH.) L)

‘No, it’s not Jiang. It is Ma, Lu, Hao, Li, Xu.’

b. Q: shiHL maL gouL yiL shuL niaoL ma?

‘Is it horses, dogs, ants, rats, and birds?’

A: buHL, buLH shiHL huL,

shiHL maL gouL huL shuL niaoL. ((LH.LH.)L)(LH.L)

‘No, it’s not ants. It is horses, dogs, tigers, rats, and birds.’

In (8a), **Lu** is where the focus lies and it forms a disyllabic foot with the monosyllabic word *Ma*. As for (8b), the focused syllable **hu**, which is located in the middle of the

five sequential monosyllabic words, forms a trisyllabic foot with *ma* and *gou*. Both *Lu* and *hu* retain their base tones. Based on the instances above, the focused syllable would still be at the right position in a foot. This fact confirms the previous assumption that foot formation ends at focused syllables.

When a focused element is of more than one syllable, the focal tone sandhi patterns still accord with the previous assumption. Examples (9a) to (9c) show the focal tone sandhi patterns of disyllabic focal elements in different sentence positions.

(9) Disyllabic Numeral Repetition

Q: shiHL wuL wuL wuL wuL ma?

‘Is it 55555?’

a. A: buHL, buLH shiHL, shiHL juil juil wuL wuL wuL. (LHL)(LH.LH.)L)

‘No, it’s not. It is 99555.’

b. A: buHL, buLH shiHL, shiHL wuL juil juil wuL wuL. ((LH.LH.)L)(LH.L)

‘No, it’s not. It is 59955.’

c. A: buHL, buLH shiHL, shiHL wuL wuL wuL juil juil. ((LH.LH.)L)(LHL)

‘No, it’s not. It is 55599.’

d. A: buHL, buLH shiHL, shiHL wuL wuL juil juil wuL. (LH.L)((LHLH.)L)

‘No, it’s not. It is 55995.’

The focal elements are *juí juí*. As seen in (9a), (9b) and (9c), the second focal syllable, number *juí*, retains its base tone. This fact indicates that the foot formation ends at the last focal element no matter how many focal syllables exist in a sentence. Notice that in (9d), the focal syllables form a group with the last syllable to create a trisyllabic foot. Again, this is an undesirable foot formation pattern, as it is not permissible for the last syllable to remain isolated in Mandarin. In the next section we will look at how focus affects foot formation with respect to other types of sentence.

### 3.4 Type C: Other Types of Sentences

Aside from Type A and Type B, this study investigates other types of sentences. The pattern which is common among the informants is considered the unmarked reading, whereas the pattern which appears less frequently is considered the marked reading. Section 3.3.1 will discuss the unmarked focal tone sandhi while section 3.3.2 the marked focal tone sandhi.

#### 3.4.1 Unmarked Focal Tone Sandhi Patterns

The unmarked focal tone sandhi is discussed in this section. Focused elements are examined in the following order: subjects, verbs, and objects. First consider the

focused subjects, as in (10).

(10) Focused Subjects

a. Q: shiHL maoH yaoL xiaoL baoLma?

‘Is it cats which bite Small Bao?’

A: buHL, buLH shiHL maoH, shiHL guoL yaoL xiaoL baoL. (LH.L)(LH.L)

‘No, it’s not cats. It is dogs which bite Small Bao.’

b. Q: shiHL xiaoL mingLH maiL xiaoL shuoH ma?

‘Is it Small Ming who buys novels?’

A: buHL, buLH shiHL xiaoL mingL,

shiHL xiaoL meiL maiL xiaoL shuoH. (LH.L)(LH.(L.H))

‘No, it’s not Small Ming. It is Small Mei who buys novels.’

In (10a), the monosyllabic focal subject *guo* forms a disyllabic foot with the verb, *yao*, and undergoes tone sandhi. In (10b), since the disyllabic subject *xiao mei* contains a pair of immediate constituents, it forms a disyllabic foot. The verb *mai* and the object *xiao shuo* together construct a trisyllabic foot. Based on the above examples, it appears that foot formation starts at the focused element. Because subjects are usually in sentence-initial positions, foot formation would start with the subjects in non-focal readings. Hence, the focal readings in (10a) and (10a) are inevitably the

same as non-focal readings. Let us now look at the situation where the verb and object are under focus.

(11) Focused Verbs

Q: shiHL gouL zhuiH nuL renLH ma?

‘Do dogs chase women?’

A: buHL, buLH shiHL zhuiH, shiHL gouL **yaoL** nuL renLH. (L)(**LH**).(L.LH))

‘No, it’s not chasing (that the dogs do). Dogs bite the boss.’

The non-focal reading in (11) is (LH.L)(LH.L). The subject *gou* and the verb *yao* form a disyllabic foot while the object *nu ren* form another disyllabic foot. However, the focal verb *yao* in (11) forms a trisyllabic foot with the object *nu ren*, located at the left edge of the trisyllabic foot. This causes *yao* to change to a LH, which is different from non-focal reading.

(12) Focused Objects

a. Q: shiHL niL youL yuL yiH ma?

‘Is it raincoats which you have?’

A: buHL, buLH shiHL yuL yiH, shiHL niL youL yuL sanL. (LH.L)(**LH.L**)



‘No, it’s not raincoats. It is umbrellas which you have.’

b. Q: shiHL nuL youL maiL shouL lianHL ma?

‘Is it bracelets which (my) girlfriend buys?’

A: buHL, buLH shiHL shouL lianHL,

shiHL nuL youL maiL **shouL biaoL**. ((LH.LH.)L) (**LHL**)

‘No, it’s not bracelets. It is watches which (my) girlfriend buys.’

The focal tone patterns of objects, illustrated in (12), are similar to those of the subjects in (10) and the verbs in (11), respectively. As for the focused *yu san* in (12a) and *shou biao* in (12b), they are in sentence-final positions. The focused object does not form a foot with the verb. Take (12b) for instance. The phrasing pattern is ((LH.LH.)L)(**LHL**) but not (LH.L)(L.(**LHL**)). This fact indicates that the foot formation starts with the focused element and includes the following syllables, so the focused element undergoes tone sandhi.

The focal phrasing patterns can be predicted by Shih’s and Hsiao’s proposals, when the focal boundary is placed at the left side of the focal element. However, their proposals have problems in (13).

(13) Q: shiHL niL maiL chiL ma?

‘Is it rulers which you buy?’

A: buHL, buLH shiHL chiL, shiHL niL maiL biL. (LH.(LH.L)) (cf.\*(LH.L.)(L))

‘No, it’s not rulers. It is pens which you buy.’

In (13), the focal boundary does not occur at the left edge of the focused monosyllabic object *bi*, which is thus able to join with the verb first and the subject to form a trisyllabic foot. This phenomenon could be attributed to the prosodic constraint in Mandarin that a monosyllabic foot cannot occur in sentence-final position.

### 3.4.2 Marked Focal Tone Sandhi Patterns

Let us now turn to the marked focal tone sandhi patterns. Some data from 3.4.1 are reanalyzed here for comparison. The following examples display the tone sandhi patterns of the focused subject.

(14) Focused Subjects

a. Q: shiHL maoH yaoL xiaoL baoL ma?

‘Is it cats which bite Small Bao?’

A: buHL, buLH shiHL maoH, shiHL guoL yaoL xiaoL baoL. (L)(L.(LH.L))

‘No, it’s not cats. It is dogs which bite Small Bao.’

b. Q: shiHL xiaoL mingLH maiL shuiL guoL ma?

‘Is it Small Ming who buys fruits?’

A: buHL, buLH shiHL xiaoL mingLH,

shiHL xiaoL meiL maiL shuiL guoL. (**LH.L**)(L.(LH.L))

‘No, it’s not Small Ming. It is Small Mei who buys fruits.’

As we can see, when the subject is emphasized, the subject retains its base tone. In (14a), the non-focal reading is (LH.L)(LH.L), but in focal reading the focal boundary is placed at the right edge of the focused subject; *guo* thus forms a monosyllabic foot and retains a low tone. Similarly, in (14b), the non-focal reading is ((LH.LH.)L)(LH.L), but in focal reading the focal boundary appears after the focused subject *xiao mei*, which form a disyllabic foot and the second syllable *mei* does not undergo tone sandhi. In addition, we also observe that the focal syllables can be followed by a short prosodic pause, causing prosodic restructuring and stopping foot formation after the focused elements.

#### (15) Focused Verbs

a. Q: shiHL xiaoL liL maiHL xiaoL maoH ma?

‘Does Small Li sell kittens?’

A: buHL, buLH shiHL maiHL,

shiHL xiaoL liL maiL xiaoL maoH. ((LH.LH.)L)(L.H)

‘No, it’s not selling (that Small Li does). Small Li buys kittens.’

b. Q: shiHL gouL zhuiH laoL banL ma?

‘Do dogs chase the boss?’

A: buHL, buLH shiHL zhuiH, shiHL gouL yaoL laoL banL. (LH.L)(LH.L)

‘No, it’s not chasing (that the dogs do). Dogs bite the boss.’

The same phenomenon is observed when the verb is under focus. The phrasing pattern in (15a) is different from the regular reading, (LH.L)(LH.(L.H)). In (15a), the focused verb *mai* forms a trisyllabic foot with the subject *xiao li* and maintains a base tone. The focused verb *mai* does not form a trisyllabic foot with the object *xiao mao*. As a result, *xiao mao* can only form a disyllabic foot. In (15b), the verb *yao* does not form a trisyllabic foot with the object *lao ban*. Instead, it is located at the right edge of the disyllabic foot. The focal tone sandhi pattern ends up just matching the regular reading, (LH.L)(LH.L).

Even though the sentence lacks a subject, as (16) illustrates, some speakers perform pause after the focused verb *mai*. The focused verb *mai* is isolated as a monosyllabic foot and retains a base tone. The focal reading is thus different from the

regular reading, (LH.L)(LH.L).

(16) Focused Verb in Subjectless Sentence

Q: shiHL maiHL xiaoL miL jiuL ma?

‘(Do you) sell rice wine?’

A: buHL, buLH shiHL maiHL, shiHL maiL xiaoL miL jiuL. (L)(L.(LH.L))

‘No, it’s not selling (that I do). (I) buy rice wine.’

Now let us turn to focused objects, as in (17).

(17) Focused Objects

a. Q: shiHL niL youL yuL yiH ma?

‘Is it raincoats which you have?’

A: buHL, buLH shiHL yuL yiH, shi4 niL youL yuL sanL. (LH.L)(LH.L)

‘No, it’s not raincoats. It is umbrellas which you have.’

b. Q: shiHL nuL youL maiL shouL lianHL ma?

‘Is it bracelets which (my) girlfriend buys?’

A: buHL, buLH shiHL shouL lianHL,

shiHL nuL youL maiL shouL biaoL. ((LH.LH)L)(LH.L)

‘No, it’s not bracelets. It is watches which (my) girlfriend buys.’

Since the word order of Mandarin limits the appearance of an object in the sentence-final position, the object cannot precede the verb or subject except for the effect of topicalization. The focused element at the right edge of sentence sanctions the surface tone patterns of (17a) and (17b), which are inevitably the same as the non-focal readings.

In sum, the marked pattern reveals an opposite focal phrasing pattern compared with that of the unmarked pattern. That is, the focused element can be followed by a prosodic pause, causing prosodic restructuring and stopping foot formation after the focused elements. Thus, the focused syllable always retains the base tone. Certainly, as Shih (1990) argues, it is hard to have a prosodic pause in such a short sentence. However, if a shift in the focal phrasing rule, regulating that the focused element be placed at the right edge of the foot, were indeed to occur, it could be attributed to an ongoing language change. The adoption of this change may be quite slow but it may be observed in the production of some speakers.

### **3.5 Focal Boundary vs. Lexical Items**

The previous data show that the focal boundary can be freely placed before or

after the focused element in different types of sentence. However, there are some restrictions on the application of the focal boundary. Take the immediate disyllabic constituent for example. When the internal element is under focus, the boundary will not lie inside the word. In other words, the focal boundary is unable to affect the foot formation of lexical items. The evidence is shown in the focal phrasing patterns in (18a) and (18b).

(18) Focused Lexical Items

a. Q: shiHL tieL chiL ma?

‘Are these iron rulers?’

A: buHL, buLH shiHL tieL chiL, shiHL tieL biL. (LH.L)

‘No, these are not iron rulers. These are iron pens.’

b. Q: shiHL luL yiL ma?

‘Are these aluminum chairs?’

A: buHL, buLH shiHL luL yiL, shiHL tieL yiL. (LH.L)

‘No, these are not aluminum chairs. These are iron chairs.’

The contrastive meaning in (18a) lies in the circumstance that different objects are made of the same material. The former referent is rulers but the later pens. If speakers

maintain the use of the left-edge grammar of the focal phrasing, the focal boundary would be put at the left edge of the focused syllables since the only difference between these two words is *chi* and *bi*. And, under such a situation, the output \*(L)(L) would be ill-formed. However, this is not the case because the first syllable still undergoes tone sandhi. On the other hand, for (18b), the difference in the objects, the chairs, is that they are made of different materials. If speakers hold the right-edge grammar of the focal phrasing, they would separate the first syllable and the second syllables, creating an incorrect focal phrasing pattern, \*(L)(L).

Here the Lexical Integrity Hypothesis (Siegel 1974, Bauer 1978, Williams 1981, DiSciullo & Williams 1987) can throw some light on this mystery. The hypothesis proposes that no phrasal-level rules may affect a proper subpart of a word. For example, the form of conjunction reduction like [*tie han lu*] *yi* ‘iron and aluminum chair’ can never be found. Thus, *tie yi* should be considered a word and the internal structure is not affected by the focal boundary.

The disyllabic names, such as *xiao ming* ‘Small Ming’ and *lao li* ‘Old Li’, provide other evidence that the internal structure of lexical item is not affected by the application of focal boundary. Take *xiao ming* ‘Small Ming’ for example. Since *xiao ming* ‘Small Ming’ is not necessarily someone who is really small or short, it is awkward to say the semantic counterpart is *da ming* ‘Big Ming’. Such words should



be treated as a word or a single lexical item. The focal boundary should be placed at the edge of a lexical item no matter how many syllables the word has.

### 3.6 Generalization of Focal Tone Sandi in Mandarin

This thesis has investigated three types of focal tone sandhi in Mandarin. Importantly, three types of focal tone sandhi patterns are found among these data. The generalization of this concern can be formulated as in (19), (20) and (21):

(19) **Type A:** If the focus is on auxiliary verbs and adverbs in a simple sentence:

- a. The focused element is at the left edge of the focal phrase;
- b. The foot formation starts at the focused element;
- c. The focused element undergoes tone sandhi with the following syllable;
- d. The remaining syllables undergo regular foot formation.

(20) **Type B:** If the focus is on the syntactic element in the flat structure:

- a. The focused element is at the right edge of focal phrase;
- b. The foot formation ends at the focused element;
- c. The focused element retains the base tone;
- d. The remaining syllables undergo regular foot formation.

In essence, the above two parameters display an opposite way in focal phrasing. Namely, (19) requires the foot formation to start at the focused element, whereas (20) requires it to be ended at the focused element. The remaining non-focused syllables, from left to right, undergo regular foot formation.

When focus occurs in Type C, two alternative focal phrasing patterns are observed among the informants. In other words, these two patterns are considered free variations, as illustrated in (21).

(21) **Type C:** If the focus is on the syntactic element in other types of sentences:

a. Unmarked Pattern

- (i) The focused element is at the left edge of the focal phrase;
- (ii) The foot formation starts at the focused element;
- (iii) The focused element undergoes tone sandhi with the following syllable;
- (iv) The remaining syllables undergo regular foot formation.

b. Marked Pattern

- (i) The focused element is at the right edge of the focal phrase;
- (ii) The foot formation ends at the focused element;
- (iii) The focused element retains the base tone;

- (iv) The remaining syllables undergo regular foot formation.

In this present study, the pattern which shows that the foot formation starts at the focused element is more common among the informants, whereas the foot formation ends at the focused element occurs less frequently among them. In terms of markedness, the common pattern is unmarked while the less frequent pattern is marked.

### 3.7 The Size of the Mandarin Focal Phrase

This section examines the size of the Mandarin focal phrase and tries to see whether the Mandarin focal phrase is identical to foot, phonological phrase, or intonational phrase.

This study adopts the phrasing principles proposed by Hsiao (1991, 1995) to examine the size of the focal phrase in Mandarin. The principles are shown below:

#### (22) Mandarin Phrasing Principles

- a. Intonational Phrase (IP):

[...x...] <sup>SU</sup>, where x = phonological phrase

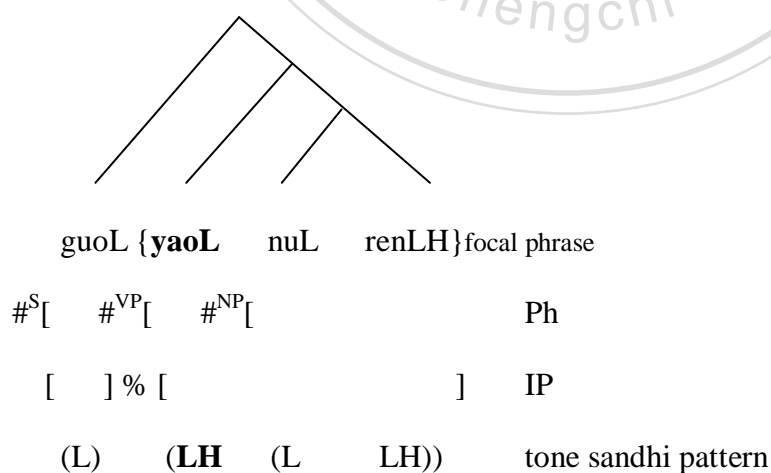
- b. Phonological Phrase (Ph):

{left,  $X^{\max(+b)}$ }, where (+ b) = branching

As (22) dictates, IPs are sense units (SUs) phrased by grouping together Phs, which are marked at the left edge of an Xmax only if the Xmax is branching. Xmax means the maximal projection of certain parts of speech, such as VP, NP, etc.. When an IP consists of two or more syllables, it must be subject to the Sense Unit Condition (SUC)<sup>3</sup>. An intonational phrase is built upon a phonological phrase so an intonational phrase could contain several phonological phrases. In other words, a phonological phrase cannot cross the boundary of an intonational phrase.

Consider Type C first. In this study, it is found that there are unmarked and marked focal patterns in Type C, as shown in (23) and (24), respectively.

(23) 'Dogs bite women.' (unmarked reading)

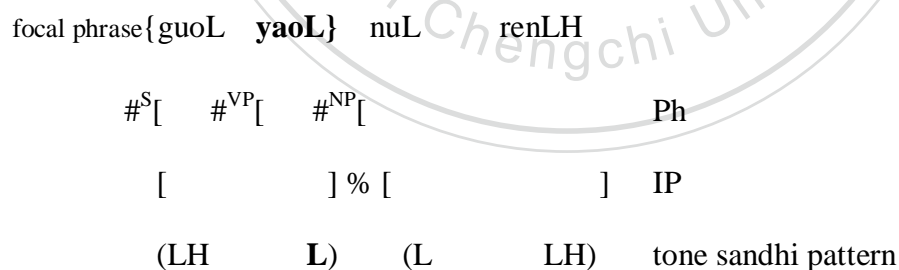


<sup>3</sup> Selkirk (1984) proposes a sense unit to condition intonational phrasing in English, assuming that two constituents Ci, Cj form a sense unit if (a) or (b) is true of the semantic interpretation of the sense:

- a. Ci modifies Cj (a head)
- b. Ci is an argument of Cj (a head).

In (23), the Ph boundary #S, #VP, and #NP are placed before *guo*, *yao*, and *nu*, respectively because these words are maximal projections and have syntactic branching. Thus, in (23), there are three phonological phrases: *guo*, *yao*, and *nu ren*. Since the focal phrase is *yao nu ren*, the size of the focal phrase is proved to be larger than that of the phonological phrase. However, the IP boundary (%) reveals that the focal phrase matches the intonational phrase. The tone sandhi pattern does not cross the IP boundary.

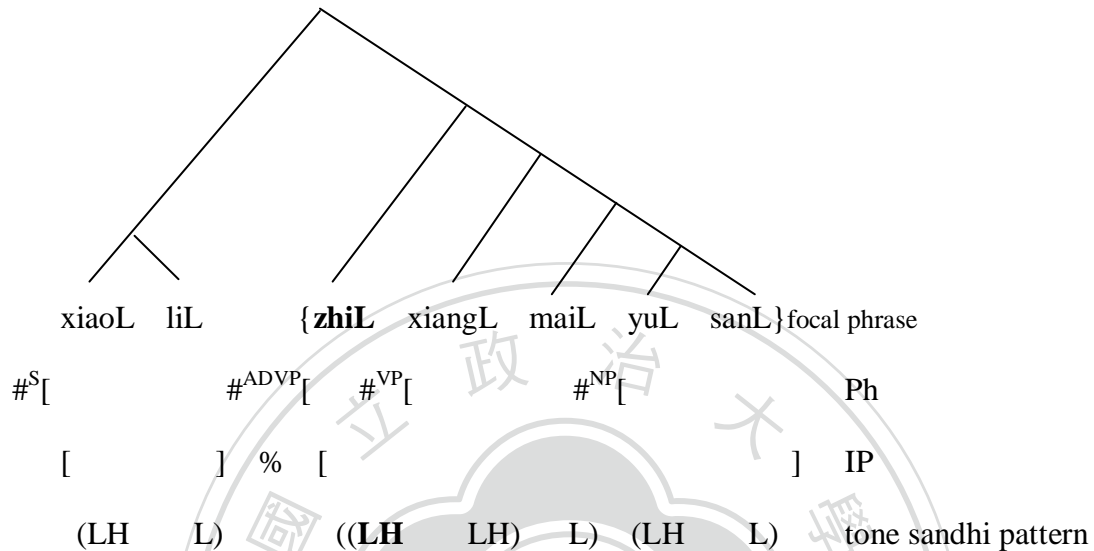
(24) ‘Dogs bite women.’ (marked reading)



In (24), the focal phrase *guo yao* is built upon two phonological phrases but is identical to an intonational phrase. In short, the examination shows that when focal phrasing occurs in Type C, the focal phrase is identical to the intonational phrase.

Following are example of the adverb *zhi* from Type A.

(25) ‘Small Li only wants to buy umbrellas.’



In (25), there are four phonological phrases: *xiao li*, *zhi*, *xiang mai*, and *yu san*. The focal phrase begins at the focused element *zhi* and ends at NP *yu san*. Clearly, the focal phrase is bigger than the phonological phrase. However, since *zhi* modifies the verb phrase *xiang mai* and *yu san* is the internal argument of *xiang mai*, they together form an intonational phrase. As a result, the focal phrase matches the intonational phrase.

In conclusion, the size of the focal phrase in Mandarin is bigger than the phonological phrase, which seems to support the findings of Cho (1990) and Kanerva (1990) in Korean and Chichewa, respectively. However, though bigger than the

phonological phrase, the focal phrase does not belong to an intermediate prosodic hierarchy between phonological phrase and intonational phrase because the focal phrase matches the intonational phrase. In other words, no mismatch between the focal phrase and the intonational phrase could be found in the present data. Thus, I suggest that the focal phrase in Mandarin matches the intonational phrase.



## CHAPTER 4

### OT ANALYSIS

This chapter analyzes Mandarin focal tone sandhi under the framework of Optimality Theory. Two sets of constraints are proposed in this chapter, the prosodic constraints, which evaluate the prosodic candidates and determine the tonal domain, and the tonal constraints, which evaluate the tonal candidates. It will show that with these two sets of constraints, focal tone sandhi in Mandarin can be accounted for successfully.

#### 4.1 Prosodic Constraints for Mandarin Regular Tone Sandhi

According to the theory proposed by Shih (1986), the best units of prosodic structure in Mandarin are disyllabic feet. The immediate constituents in a sentence are joined into disyllabic feet. In non-focal speech, there is no monosyllabic foot; it joins with a neighboring foot; assuming that each of the syllables should be parsed into feet.

With these basic properties, four prosodic constraints are listed in (1-5).

(1) **PARSE- $\sigma$** : parse syllables into feet. (Prince & Smolensky 1993)

(2) **ALIGN-L(IC, Ft)**: the left edge of every pair of terminal immediate constituents (IC) coincides with the left edge of a foot (Ft).



(3) ALIGN-R(IC, Ft): the right edge of every pair of terminal immediate constituents

(IC) coincides with the right edge of a foot (Ft).

(4) FT<sub>MIN</sub>: at least two syllables per foot. (Hsiao 2006)

(5) FT<sub>MAX</sub>: no more than two syllables per foot. (Hsiao 2006)

The idea of Foot Binararity comes from the widely attested observation that feet ideally consist of exactly two elements, morae or syllables (cf. Prince 1980, McCarthy & Prince 1986, Kager 1989, Hayes 1994). In other words, metrical feet can be either syllabic or moraic. The foot types laid out in (6) below is proposed in McCarthy and Prince (1986) and Hayes (1987) to account for Hayes' (1985) typological findings. L stands for light syllable and H stands for heavy syllable:

(6) Foot Types

Iambic	Trochaic	Syllabic
LH	H, LL	$\sigma\sigma$
LL, H		

The Prosodic Hierarchy and Foot Binararity, taken together, license the notion of “Minimal Word” (Prince 1980, Broselow 1982, McCarthy and Prince 1986, 1990, 1991a, 1991b). According to the Prosodic Hierarchy, any instance of the category

Prosodic Word (PrWd) must contain at least one foot (Ft). Under Foot Binariness, every foot must be either bimoraic or disyllabic. And, under transitivity, then, a Prosodic Word must contain at least two moras or syllables. Since Mandarin is a quantity-insensitive language, which does not distinguish syllable weight, the minimal word is disyllabic.

In addition, Hsiao (2010) built a corpus of Chinese *gu-shi* and found that the number of disyllabic nouns is more than that of monosyllabic nouns. Duanmu (2012) used The Lancaster Corpus of Mandarin Chinese and examined the word-length references in Chinese. One of Duanmu's findings is that for NN compound, the total number of disyllabic compounds accounts for roughly 60 percent in the corpus, which is more than that of trisyllabic and quadrisyllabic compounds. The result of VO compound is similar to that of NN compound. In sum, the typological evidence supports that foot in Chinese is disyllabic.

(7) zhao xiao li 'Looking for Small Li.'

zhao xiao li [σ[σσ]]	PARSE-σ	FtMIN	FtMAX	ALIGN-L(IC, Ft)	ALIGN-R(IC, Ft)
a. (σ(σσ))	✓		*		
b. σ(σσ)	*!				
c. (σ)(σσ)		*!			
d. ((σσ)σ)			*	*!	

(8) *ju qi shou* ‘Raise hands.’

<i>ju qi shou</i> [[ $\sigma\sigma$ ] $\sigma$ ]	PARSE- $\sigma$	FtMIN	FtMAX	ALIGN-L(IC, Ft)	ALIGN-R(IC, Ft)
a. ( $\sigma(\sigma\sigma)$ )	✓		*		*!
b. $\sigma(\sigma\sigma)$	*!				
c. ( $\sigma$ )( $\sigma\sigma$ )		*!			
d. (( $\sigma\sigma$ ) $\sigma$ )			*		

Tableau (7) and (8) illustrate the ranking of PARSE- $\sigma$ , FtMIN, ALIGN-L(IC, Ft), ALIGN-R(IC, Ft), and FtMAX in trisyllabic sentences. The PARSE- $\sigma$  constraint requires that every syllable must be parsed into a foot; candidates that contains unparsed syllables, such as (7b) and (8b), is ruled out. Candidates (7c) and (8c) violate the FtMIN constraint because the first syllable forms a monosyllabic foot. A monosyllabic foot does not occur in regular reading; it is more marked than a disyllabic foot. FtMIN, which sets a minimum of binarity, must dominate FtMAX to prevent a monosyllabic foot from occurring.

The ALIGN-L(IC, Ft) constraint requires the left edge of the terminal immediate constituent to align with the left edge of the foot. Take *zhao xiao li* in (7) for example. The right branching structure contains a verb *zhao* and an object *xiao li*. The disyllabic object *xiao li* is a pair of immediate constituents, so both syllables should be phrased into the same foot. The foot structure will be ( $\sigma(\sigma\sigma)$ ). Therefore, candidate

(7d),  $((\sigma\sigma)\sigma)$ , violates the  $\text{ALIGN-L(IC, Ft)}$  constraint because the left edge of the immediate constituent does not align with the left edge of the foot. On the other hand, The  $\text{ALIGN-R(IC, Ft)}$  constraint requires the right edge of the terminal immediate constituent to align with the right edge of the foot. Take *ju qi shou* in (8) for example. The left branching structure contains a verb *ju qi* and an object *shou*. The disyllabic verb *ju qi* is a pair of immediate constituents, so both syllables should be phrased into the same foot. The foot structure will be  $((\sigma\sigma)\sigma)$ . As a consequence, candidate (8a),  $(\sigma(\sigma\sigma))$ , violates the  $\text{ALIGN-R(IC, Ft)}$  constraint because the right edge of the immediate constituent does not align with the right edge of the foot. Finally,  $\text{PARSE-}\sigma$  and  $\text{FtMIN}$  do not conflict with each other; therefore, these two constraints are at the same ranking. Since unparsed syllables all violate the  $\text{Parse-}\sigma$  constraint, I will not list this constraint in order to save space.

(9) *gou yao xiao bao* ‘Dogs bite Small Bao.’

<i>gou yao xiao bao</i> [ $\sigma[\sigma[\sigma\sigma]]$ ]	$\text{FtMIN}$	$\text{FtMAX}$	$\text{ALIGN-L(IC, Ft)}$	$\text{ALIGN-R(IC, Ft)}$
☞ a. $(\sigma\sigma)(\sigma\sigma)$				
b. $(\sigma)(\sigma(\sigma\sigma))$	*!	*		
c. $(\sigma)((\sigma\sigma)\sigma)$	*!	*	*	
d. $(\sigma\sigma\sigma\sigma)$		*!	*	

In (9), the syntactic bracketing of *gou yao xiao bao* is  $[\sigma[\sigma[\sigma]]]$ , but the prosodic phrasing is  $(\sigma\sigma)(\sigma\sigma)$ . Candidates (9b) and (9c) contain a monosyllabic foot so they violate the  $F_{TMIN}$  constraint. Thus, candidates (9b) and (9c) are rejected. Candidate (9d) is ruled out since the prosodic phrasing takes all the syllables as a single domain, which violates the lower ranked  $F_{TMAX}$  constraint. It also violates the  $ALIGN-L(IC, Ft)$  constraint since the left edge of the pair of immediate constituent *xiao bao* does not align with the left edge of foot. Consequently, candidate (9a), the unmarked reading, is selected as the optimal output successfully and naturally. In short, the present prosodic constraint ranking for Mandarin tone sandhi is listed below.

(10) Prosodic Constraint Ranking for Mandarin Tone Sandhi (in regular speech):

$PARSE-\sigma, F_{TMIN} \gg F_{TMAX}, ALIGN-L(IC, Ft), ALIGN-R(IC, Ft)$

#### 4.2 Prosodic Constraints for Mandarin Focal Tone Sandhi

In Chapter 3, I have described how there are three types of focal phrasing patterns: Type A includes the focused auxiliary verbs and adverbs in a simple sentence, Type B the flat structure, and Type C the others. We will propose two alignment constraints,  $ALIGN-R(F, FP)$  and  $ALIGN-L(F, FP)$ , to ensure that the focused element is

at the edge of the focal phrase, and two additional alignment constraints,  $\text{ALIGN-R}(\text{FP}, \text{Ft})$  and  $\text{ALIGN-L}(\text{FP}, \text{Ft})$ , to align the edge of the focal phrase with the edge of foot.

#### 4.2.1 $\text{ALIGN-L}(\text{F}, \text{FP})$ & $\text{ALIGN-L}(\text{FP}, \text{Ft})$

According to the generalization in Chapter 3, the focused element is at the left edge of the focal phrase when the focal phrasing occurs in Type A and the unmarked reading of Type C. Hence, to capture this fact, an alignment constraint is needed, as defined in (11).

- (11)  $\text{ALIGN-LEFT}(\text{focused element}, \text{focal phrase})$ : the left edge of the focused element (F) coincides with the left edge of the focal phrase (FP).

In Type A and the unmarked Type C, the candidates which do not align the left edge of the focused element with the left edge of the focal phrase will be ruled out by  $\text{ALIGN-LEFT}(\text{F}, \text{FP})$ .  $\text{ALIGN-L}(\text{F}, \text{FP})$  must outrank  $\text{ALIGN-R}(\text{F}, \text{FP})$  to avoid the situation that the right edge of the focused element aligns with the right edge of the focal phrase. Tableau (12) presents Type A for illustration.

(12) xiao li **zhi** xiang mai yu san ‘Small Li only wants to buy umbrellas.’

xiao li zhi xiang mai yu san [σσ[σ[σ[σ[σ]]]]	ALIGN-L(F, FP)	ALIGN-R(F, FP)
☞ a. {σσ}{σσσσσ}FP		*
b. {σσσ}FP{σσσσ}	*!	

The focused element is the adverb **zhi**. Candidate (12b) does not align the left edge of focused element **zhi** with the left edge of the focal phrase so it is ruled out by ALIGN-L(F, FP). Instead, candidate (12a) incurs no violation in ALIGN-L(F, FP) because the left edge of **zhi** aligns with the left edge of the focal phrase.

In addition, the left edge of the focal phrase should coincide with the left edge of the foot. Thus, another alignment constraint is needed, as defined in (13).

(13) ALIGN-LEFT(focal phrase, foot): the left edge of the focal phrase (FP) coincides with the left edge of the foot (Ft).

The ALIGN-L(FP, Ft) requires that the left edge of the focused element must align with the left edge of the focal phrase in Type A and the unmarked Type C. Notably, the alignment of the focal phrase and the foot at the left edge indicates that foot formation starts at the left edge of the focal phrase instead of at the end of foot formation. These

two constraints do not conflict with each other because the former is about the formation of focal phrase and the later is about the formation of foot.

The following tableau shows how ALIGN-L(FP, Ft) operates in Type A. The adverb *zhi* and auxiliary verb *gan* are shown as instances in (14) and (15), respectively. Here we discuss only those candidates that incur no violation in ALIGN-L(F, FP). That is, all the candidates have correct form of focal phrase during the evaluation.

(14) xiao li **zhi** xiang mai yu san ‘Small Li only wants to buy umbrellas.’

xiao li zhi xiang mai yu san [σσ[σ[σ[σ[σ]]]]	ALIGN-L(FP, Ft)	FtMIN	FtMAX	ALIGN-L(IC, Ft)
Focal Phrase: {σσ}{σσσσ}FP				
☞ a. (σσ)((σσ)σ)(σσ)			*	
b. ((σσ)σ)(σσ)(σσ)	*!		*	

(15) xiao li **ken** mai yu san ‘Small Li is willing to buy umbrellas.’

xiao li ken mai yu san [σσ[σ[σ[σ]]]]	ALIGN-L(FP, Ft)	FtMIN	FtMAX	ALIGN-L(IC, Ft)
Focal Phrase: {σσ}{σσσσ}FP				
☞ a. (σσ)(σσ)(σσ)				
b. ((σσ)σ)(σ(σσ))	*!			

As shown above, both candidates (14b) and (15b) violate ALIGN-L(FP, Ft). The left



edge of the focal phrase does not align with the left edge of the foot. To be concrete, the left edge of the focal phrase aligns with the right edge of the foot so that foot formation ends at the focused *zhi* and *gan*. As a consequence, (14b) and (15b) are ruled out by ALIGN-L(FP, Ft). The candidates (14a) and (15a) are successfully selected as the optimal output, respectively.

(16) *gou yao xiao bao* ‘Dogs bite Small Bao.’

<i>gou yao xiao bao</i> [σ[σ[σσ]]]	ALIGN-L(FP, Ft)	FtMIN	FtMAX	ALIGN-L(IC, Ft)
Focal Phrase: {σ}{σσσ} <sub>FP</sub>				
a. (σσ)(σσ) ■	*!			
☞ b. (σ)(σ(σσ))		*	*	
c. (σ)((σσ)σ)		*	*	*!
d. (σσσσ)	*!		*	*

As for the unmarked reading of Type C, ALIGN-L(FP, Ft) also plays an important role in focal phrasing. What’s more, ALIGN-L(FP, Ft) must outrank FtMIN to allow for the appearance of a monosyllabic foot, as shown in (16) above. Both candidates (16a) and (16d) incur one violation in the ALIGN-L(FP, Ft) constraint because the left edge of the focal phrase does not align with the left edge of the foot. Thus, (16a) and (16d) are ruled out. Although (16b) and (16c) satisfy ALIGN-L(FP, Ft), (16c) violates

ALIGN-L(IC, Ft) because the left edge of *xiao bao* does not align with the left edge of the foot. As a result, (16b) is successfully selected as the optimal output.

So far, one may ask why ALIGN-L(F, FP) and ALIGN-L(FP, Ft) operate in Type A and the unmarked Type C. To be specific, what is the theoretical implication of ALIGN-L(F, FP) and ALIGN-L(FP, Ft) with regard to Mandarin typology? A possible answer would be the interleaving between focus and Mandarin lexical tones. Phonetically, when focus occurs, the pitch range of the focused element is greatly expanded. In Mandarin, Tone2 is a LH tone while Tone3 is a L tone. A LH tone is more prominent than a L tone because it ends with a H pitch. Therefore, the focus would prefer to fall on the position where the pitch is prominent in surface representation. To be concrete, ALIGN-L(F, FP) and ALIGN-L(FP, Ft) let the focused element be at the sandhi position since a L tone always undergoes tone sandhi and changes to a LH tone if followed by another L tone. Thus, the sandhi position at which pitch raises from a L tone to a LH tone is where the focused element prefers to be.

#### 4.2.2 ALIGN-R(F, FP) & ALIGN-R(FP, Ft)

The ALIGN-R(F, FP) is proposed to capture the fact that the focused element is at the right edge of the focal phrase. The definition is given below.

- (17) ALIGN-R(F, FP): the right edge of the focused element (F) coincides with the right edge of the focal phrase (FP).

The ALIGN-R(F, FP) constraint aligns the right edge of the focused element with the right edge of the focal phrase. In Type B and the marked reading of Type C, every candidate which observes this requirement would incur a fatal violation in the ALIGN-R(F, FP) constraint. Take Type B, for example.

- (18) wu wu **jui** wu wu '55955'

wu wu <b>jui</b> wu wu [σσσσσ]	ALIGN-R(F, FP)	ALIGN-L(F, FP)
☞ a. {σσσ} <sub>FP</sub> {σσ}		*
b. {σσ}{σσσ} <sub>FP</sub>	*!	

Further, to ensure that the foot formation ends at the focused syllable, another alignment constraint is necessary.

- (19) ALIGN-RIGHT(focal phrase, foot): the right edge of the focal phrase (FP) coincides with the right edge of the foot (Ft)

The alignment of the focal phrase and the foot at the right edge means that the foot formation ends at the right edge of the focal phrase. The ALIGN-R(FP, Ft) constraint comes into play in Type B and the marked Type C. With regard to its ranking, the ALIGN-R(FP, Ft) constraint must dominate FtMIN to allow a focal syllable to form a monosyllabic foot. First, consider the example of the marked Type C.

(20) **gou** yao xiao bao ‘Dogs bite Small bao.’

gou yao xiao bao [σ[σ[σσ]]]	ALIGN-R(FP, Ft)	FtMIN	FtMAX	ALIGN-L(IC, Ft)
Focal Phrase: {σ} <sub>FP</sub> {σσ}				
a. (σσ)(σσ)	*!			
b. (σ)(σ(σσ))		*	*	
c. (σ)((σσ)σ)		*	*	*!
d. (σσσσ)	*!		*	*

As can be seen in tableau (20), the focused syllable is the monosyllabic subject **gou**.

Both candidates (20a) and (20d) violate ALIGN-R(FP, Ft) because the right edge of the focal phrase does not align with the right edge of the foot. Instead, **gou** continues associating with the following syllables to form a disyllabic foot and a quadrisyllabic foot, respectively. Thus, (20a) and (20d) are ruled out. Other the other hand, candidates (20c) and (20b) do not violate the ALIGN-R(FP, Ft) constraint because the

focal phrase *gou* aligns with the right edge of the foot. As a result, the focal phrase is isolated as a monosyllabic foot. Although (20b) and (20c) violate FtMIN, they are not rejected because of the full satisfaction of the higher ranked ALIGN-R(FP, Ft). However, in (20c), the left edge of *xiao bao* does not align with the left edge of the foot. It causes a fatal violation in the ALIGN-L(IC, Ft) constraint. Therefore, candidate (20b) is selected as the optimal output.

(21) *gou yao xiao bao* ‘Dogs bite Small Bao.’

<i>gou yao xiao bao</i> [σ[σ[σσ]]]	ALIGN-R(FP, Ft)	FtMIN	FtMAX	ALIGN-L(IC, Ft)
Focal Phrase: {σσ} <sub>FP</sub> {σσ}				
a. (σσ)(σσ)				
b. (σ)(σ(σσ))	*!	*	*	
c. (σ)((σσ)σ)	*!	*	*	*

Tableau (21) demonstrates the situation where the focus shifts to the verb *yao*. Candidates (21b) and (21c) fail to satisfy the highest ranked ALIGN-R(FP, Ft) constraint owing to the mismatch of the focal phrase and the foot. That is, the foot formation does not end at the focal syllable *yao*; instead, *yao* proceeds to form a trisyllabic foot with the object *xiao bao*. As a result, (21a) is the optimal candidate among all of the candidates.

(22) *gou yao xiao bao* ‘Dogs bite Small Bao.’

<i>gou yao xiao bao</i> [σ[σ[σσ]]]	ALIGN-R(FP, Ft)	FtMIN	FtMAX	ALIGN-L(IC, Ft)
Focal Phrase: {σσ}{σσ} <sub>FP</sub>				
a. (σσ)(σσ)				
b. (σ)(σ(σσ))		*!	*	

In (22), it seems that (22a) and (22b) may be grammatical output since there is no violation in the ALIGN-R(FP, Ft) constraint. The right edge of the focal phrase accurately aligns with the right edge of the foot. However, in (22b), the subject *gou* is isolated as a monosyllabic foot. Candidate (22b), therefore, is ruled out due to the violation of the FtMIN constraint. The optimal candidate is (22a). Now consider the focal phrasing in Type B.

(23) *wu wu jui wu wu* ‘55955’

<i>wu wu jui wu wu</i> [σσσσσ]	ALIGN-R(FP, Ft)	FtMIN	FtMAX
Focal Phrase: {σσσ} <sub>FP</sub> {σσ}			
a. ((σσ)σ)(σσ)			*
b. (σ)(σσ)(σσ)		*!	
c. (σσ)((σσ)σ)	*!		*

Tableau (23) demonstrates the focal phrasing of a list of digits. Candidate (23c) violates ALIGN-R(FP, Ft) since the right edge of the focal phrase does not align with the right edge of the foot. Candidates (23a) and (23b) fully satisfy the ALIGN-R(fp, ft) constraint because the phrasing ends at the focal digit. However, (23b) incurs one violation in the FTMIN constraint because the first syllable forms a monosyllabic foot. Consequently, candidate (23a) is successfully selected as the optimal output.

Then, what is the correlation between ALIGN-R(F, FP), ALIGN-R(FP, Ft), and Type B? Type B refers to the flat structure. By nature, a flat structure is composed of more than two constituents of the same type. The constituency of each constituent is not so tight as that of other types of sentence. Under such circumstances, the duration of the constituent would tend to be lengthened when it is under focus. The ALIGN-R(F, FP) and ALIGN-R(FP, Ft) constraints thereby regulate the focused element to be at the lengthening position.

#### 4.2.3 ALIGN-E(FP, IP)

Finally, the edges of the focal phrase and the intonational phrase should coincide; in other words, the focal phrase is equal to the intonational phrase. One more alignment constraint is needed.

(24) ALIGN-EDGE(focal phrase, intonational phrase): the edge of the focal phrase (FP)

coincides with the edge of the intonational phrase (IP)

Here we take Type A for demonstration. Notice that the intonational phrase is equal to the focal phrase.

(25) xiao li **zhi** xiang mai yu san ‘Small Li only wants to buy umbrellas.’

xiao li zhi xiang mai yu san [σ[σ[σ[σ[σσ]]]]	ALIGN-E(FP, IP)
Focal Phrase: {σσ}{σσσσ}FP	
a. {σσ}IP{σσσσ}IP	
b. {σσσ}IP{σσσσ}IP	*!

As the above tableau illustrates, the focal phrase in (25b) crosses the boundary of the intonational phrase. Thus, (25b) is eliminated in violation of the ALIGN-E(FP, IP) constraint. The focal phrase in (25a) does not cross the boundary of the intonational phrase so it is successfully selected as the optimal output.

#### 4.2.4 [FTMIN & NON-FINALITY]

So far, ALIGN-R and ALIGN-L can successfully account for most of the focal



phrasing data in Chapter 3. However, when the focus is on the penultimate or the last syllable, the use of ALIGN-R and ALIGN-L would lead to a wrong prediction. Examples are given in (26).

(26)

Sentence Type	Type C (unmarked reading)	Type C (marked reading)
Syntactic Structure	[gou [yao [gou]]]	[gou [yao [gou]]]
Focus	<b>gou</b>	<b>yao</b>
Constraint	ALIGN-L(FP, Ft)	ALIGN-R(FP, Ft)
Wrong Phrasing	(gou yao) ( <b>gou</b> )	(gou <b>yao</b> ) (gou)
Correct Output	(gou (yao <b>gou</b> ))	(gou ( <b>yao gou</b> ))

For the unmarked Type C, the focus is on the last syllable *gou*. One might assume that the ALIGN-L(FP, Ft) constraint would align the left edge of *gou* with the left edge of the foot. However, *gou* is not isolated as a monosyllabic foot but forms a trisyllabic foot with *gou* and *yao*. As for the marked Type C, the focus is on the verb *yao*, which is the penultimate syllable in the three-word sentence. It is expected that ALIGN-R(FP, Ft) makes application to align the right edge of *yao* with the right edge of foot. However, the foot formation continues grouping the last syllable *gou* to form a

trisyllabic foot.

Apparently, it is possible that  $\text{ALIGN-L}(\text{FP}, \text{Ft})$  and  $\text{ALIGN-R}(\text{FP}, \text{Ft})$  are unable to tackle such phrasing problems, as where, in tableau (27) candidate (27b) is wrongly selected as the optimal output.

(27) gou yao gou ‘Dogs bite dogs.’ (marked reading)

gou yao gou [σ[σ[σ]]]	$\text{ALIGN-R}(\text{FP}, \text{Ft})$	$\text{FT}_{\text{MIN}}$	$\text{FT}_{\text{MAX}}$	$\text{ALIGN-L}(\text{IC}, \text{Ft})$
Focal Phrase: {σσ} <sub>FP</sub> {σ}				
a. (σ)(σσ)	*!	*		
b. (σσ)(σ)		*		*
c. (σ(σσ))	*!		*	

Both candidates (27a) and (27c) violate the  $\text{ALIGN-R}(\text{FP}, \text{Ft})$  constraint because of the mismatch of the focal phrase and the foot. Among the three candidates in (27), only (27b) fully satisfies the constraint because the right edge of the focal phrase aligns with the right edge of the foot. However, the full satisfaction of the constraint would result in generating the wrong optimal candidate. Thus, a new constraint is needed to reject candidate (27b).

At this point, we can adopt the mechanism of local conjunction (Green 1993,

Smolensky 1993) to rule out the candidate which has final isolated syllable. Local conjunction is a mechanism in Optimality Theory for constructing complex constraints from simpler ones. If C1 and C2 are constraints, and D is a representational domain type (e.g. segment, cluster, syllable, stem), then  $(C1 \ \& \ C2)_D$ , the local conjunction of C1 and C2 in D, is a constraint which is violated whenever there is a domain of type D in which both C1 and C2 are violated. It is used in situations where violations of C1 alone or of C2 alone do not eliminate a candidate, but violations of both constraints simultaneously do. In short, local conjunction provides a rationale for constraints that rule out “the worst of the worst.” Based on (27), candidate (27b) violates not only FtMIN but also NON-FINALITY<sup>4</sup>. That is, (27b),  $(\sigma\sigma)(\sigma)$ , contains a monosyllabic foot and this monosyllabic foot is located at the sentence-final position. Thus, conjunction of FtMIN and NON-FINALITY could be helpful to solve the problem in (27).

(28) [FtMIN & NON-FINALITY]: FtMIN and NON-FINALITY must not be violated at the same time.

This conjoined constraint must outrank ALIGN-R(FP, Ft) to avoid the

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<sup>4</sup> Prince & Smolensky (1993) propose NON-FINALITY as a replacement for extrametricality as part of their initial work on Optimality Theory. The basic definition is: No PCat1-head occurs in final position in a PCat2 (where PCat1 and PCat2 are prosodic categories).

monosyllabic foot being at the sentence final position, as tableau (29) shows below.

(29) gou **yao** gou ‘Dogs bite dogs.’ (marked reading)

gou yao gou [σ[σ[σ]]]	[FtMIN & NON-FINALITY]	ALIGN-R (FP, Ft)	FtMIN	FtMAX	ALIGN-L (IC, Ft)
Focal Phrase: {σσ} <sub>fp</sub> {σ}					
a. (σ)(σσ)		*	*!		
b. (σσ)(σ)	*!		*		*
c. (σ(σσ))		*		*	

With [FtMIN & NON-FINALITY], candidate (29b) is rejected because it contains a monosyllabic foot at the sentence-final position. Candidate (29a) does not violate the [FtMIN & NON-FINALITY] constraint but it does violate the lower ranked constraint FtMIN. As a result, (29a) is ruled out. Consequently, candidate (29c) is successfully selected as the optimal output. In short, the use of the conjoined constraint [FtMIN & NON-FINALITY] successfully eliminates the candidate which contains the sentence-final monosyllabic foot and predicts Mandarin focal phrasing.

#### 4.2.5 Focal Variations

In order to account for the variations between Type A, Type B, and Type C, I propose two subgrammars under the cophonology model of a set of alignment

constraints. Subgrammar A (Align-L(F, FP), Align-L(FP, Ft) >> Align-R(F, FP), Align-R(FP, Ft)) accounts for focal tone sandhi of Type A and the unmarked Type C. To be specific, Align-L(F, FP) and Align-L(FP, Ft) must outrank Align-R(F, FP) and Align-R(FP, Ft) due to the fact that the focused element is at the left edge of the focal phrase and foot formation starts at the left edge of the focal phrase. On the other hand, Subgrammar B (Align-R(F, FP), Align-R(FP, FP) >> Align-L(F, FP), Align-L(FP, Ft)) deals with the focal tone sandhi of Type B and the marked Type C. The ranking of Align-L(F, FP) and Align-L(FP, Ft) must be demoted below Align-R(F, FP) and Align-R(FP, Ft) so that the focused element is able to align with the right edge of the focal phrase and the foot formation ends at the right edge of the focal phrase. Both subgrammars of the alignment constraints relating the focused elements will interact with other foot form constraints so that various prosodic phrasing phenomena will be included.

#### **4.3 A Comparison of Prosodic Constraints for Non-focal and Focal Readings**

To show the comparison, I will take the marked reading of Type C for example. Tableaus (30) and (31) illustrate the differences between the non-focal and focal readings in relation to prosodic constraints.

(30) gou yao xiao bao ‘Dogs bite Small Bao.’ (non-focal reading)

gou yao xiao bao [σ[σ[σσ]]]	F <sub>T</sub> MIN	F <sub>T</sub> MAX	ALIGN-L(IC, Ft)	ALIGN-R(IC, Ft)
☞ a. (σσ)(σσ)				
b. (σ)(σ(σσ))	*!	*		
c. (σ)((σσ)σ)	*!	*	*	
d. (σσσσ)		*!	*	

(31) gou **yao** xiao bao ‘Dogs bite Small Bao.’ (focal reading)

gou <b>yao</b> xiao bao [σ[σ[σσ]]]	ALIGN-L (F, FP)	ALIGN-L (FP, Ft)	ALIGN-E (FP, IP)	F <sub>T</sub> MIN	F <sub>T</sub> MAX	ALIGN-L (IC, Ft)
☞ a. (σ){(σ(σσ))} <sub>FP</sub>				*	*	
b. {(σ)(σ(σσ))} <sub>FP</sub>	*!			*	*	
c. (σ{σ}(σσ)) <sub>FP</sub>		*!				
d. {(σ){(σ(σσ))} <sub>FP</sub> } <sub>IP</sub>			*!	*	*	

For non-focal reading in (30a), ALIGN-L(F, FP), ALIGN-L(FP, Ft), and ALIGN-E(FP, IP)

are inactive because there is no contrastive focus. The undominated constraint, [F<sub>T</sub>MIN & NON-FINALITY], is also inactive because no candidate has a final monosyllabic foot.

The non-focal reading is evaluated by F<sub>T</sub>MIN, F<sub>T</sub>MAX, and ALIGN-L(IC, Ft). As to

focal reading in (31b), ALIGN-L(F, FP), ALIGN-L(FP, Ft), and ALIGN-E(FP, IP) are

active due to the fact that **yao** is the focused element. Candidate (31a) does not violate

those constraints so it is selected as the optimal output.

#### 4.4 Summary of Prosodic Constraints

The overall prosodic constraint ranking for non-focal and focal readings are given in (32) and (33), respectively.

(32) Prosodic Constraint Ranking for Mandarin Tone Sandhi (in regular speech):

PARSE- $\sigma$ , FtMIN >> FtMAX, ALIGN-L(IC, Ft), ALIGN-R(IC, Ft)

(33) Prosodic Constraint Ranking for Mandarin Focal Tone Sandhi:

a. Type A & unmarked Type C:

[FtMIN & NON-FINALITY] >> ALIGN-L(F, FP), ALIGN-L(FP, Ft), ALIGN-E(FP, IP)

>> PARSE- $\sigma$ , FtMIN >> FtMAX, ALIGN-L(IC, Ft), ALIGN-R(IC, Ft) >>

ALIGN-R(F, FP), ALIGN-R(FP, Ft)

b. Type B & marked Type C:

[FtMIN & NON-FINALITY] >> ALIGN-R(F, FP), ALIGN-R(FP, Ft), ALIGN-E(FP, IP)

>> PARSE- $\sigma$ , FtMIN >> FtMAX, ALIGN-L(IC, Ft), ALIGN-R(IC, Ft) >>

ALIGN-L(F, FP), ALIGN-L(FP, Ft)

In short, the occurrence of focus may result in prosodic restructuring, and this section shows that the phrasing of the focal domain is determined by the interaction between alignment and foot form constraints.

#### 4.5 Tonal Constraints for Mandarin Regular Tone Sandhi

Mandarin, like Min and Southern Wu dialects, belongs to a right-prominent tonal system. That is because these dialects tend to maintain the identity of the rightmost tone of words or even prosodic domains, while allowing tones to change on the non-final tones in sandhi contexts (Chen 1996). In addition, adjacent L tones are prohibited in Mandarin. Based on the above properties, Lin (2000) proposes a set of constraints to account for Mandarin tone sandhi.

(34) OCP-L: adjacent L tones are prohibited.

(35) IO-IDENT: the output tones must be identical to the input tones.

(36) PARSE<sub>R</sub>: parse the rightmost tone within a domain.

Tableau (37) demonstrates the ranking of PARSE<sub>R</sub>, OCP-L, and IO-IDENT and the evaluation of possible candidates.



(37) lao ban ‘boss’

lao ban (LL)	PARSER	OCP-L	IO-IDENT
☞ a. (LH L)			*
b. (L LH)	*!		*
c. (L L)		*!	

In (37), candidate (37b) is ruled out because *ban*, which is the rightmost tone within the Mandarin tone sandhi domain, is changed to a sandhi tone. On the other hand, candidate (37c) violates the OCP-L constraint because there are two adjacent L tones in the output. Consequently, candidate (37a) is selected as the optimal output. The ranking for Mandarin tone sandhi is PARSER >> OCP-L >> IO-IDENT.

However, there is a problem in the PARSER >> OCP-L ranking. That is, PARSER and OCP-L dominate IO-IDENT, but their ranking with respect to one another is unknown. Since candidate (37a) does not violate PARSER and OCP-L, the switching of these two constraints by no means changes the optimal output to candidate (37b) or (37c). In other words, if OCP-L dominates PARSER, the optimal output is still (37a). Since they are unranked with respect to one another, the constraint ranking is PARSER, OCP-L >> IO-IDENT.

In addition, Parse is the anti-deletion faithfulness constraint. However, it has the

form of a markedness constraint because it evaluates only the output and not the input-output relation in the early OT literature. The Parse constraint can be replaced by the IDENT constraint (McCarthy 2008). Hence, I adopt IDENT-TONE-RIGHT to substitute PARSER.

(38) IDENT-T-R: an output tone at the right edge must be identical to that in the input.

(Hsiao 2000)

As discussed in examples (7) and (8), trisyllabic strings, either right branching or left branching, will always constitute a single foot. Tableaus (39) and (40) demonstrate the tonal evaluation of the present constraint ranking in trisyllabic strings. Examples are taken from (7) and (8) in Chapter 4. The tonal output of (39) is (L.(LH.L)) while the tonal output of (40) is ((LH.LH.)L).

(39) zhao xiao li ‘Looking for Small Li.’

zhao xiao li (L(LL))	IDENT-T-R	OCP-L(ft)	IO-IDENT
a. (LH (LH L))			**!
b. (L (LH L))			*
c. (L (L L))		*!	
d. (L (LH LH))	*!		**

(40) *ju qi shou* ‘Raise hands.’

<i>ju qi shou</i> ((LL)L)	IDENT-T-R	OCP-L(ft)	IO-IDENT
a. ((LH LH) L)			**!
b. ((L LH) L)			*
c. ((L L) L)		*!	
d. ((L LH) LH)	*!		**

The present constraints can account for the tonal output of right branching structure as in (39), but cannot account for the tonal output of left branching structure as in (40).

For (40), candidate (40a) violates IO-IDENT twice because it contains two LH tones.

Candidate (40b), which has only one violation in the IO-IDENT, is wrongly selected as the optimal output.

Obviously, the present constraints cannot make a correct prediction in the odd-numbered syllables in Type B, indicating that a new constraint is needed to rule out candidate (40b) in tableau (40). Pulleyblank (2004), in order to explain the unstability of M tone in Yoruba, argues that a language specific tonal scale is needed, where M is the least marked tone, H is the most marked tone, and L is intermediate<sup>5</sup>.

<sup>5</sup> For example, *rí ṛgbá* ‘see a calabash’ is realized as *rígbá* in connected speech, the initial H tone being retained at the expense of the M. M tones are also lost in favor of L tones, as can be seen in a case such as *sē àjé* ‘engage in witchcraft’, realized as *sàjé* to avoid vowel hiatus. (Pulleyblank, 1986)

This proposal is inconsistent with the recent suggestion by de Lacy (2002a, b) that the tonal prominence scale is based strictly on descending pitch height, with H more prominent than M, which is in turn more prominent than L. Pulleyblank further claims that there is no single, cross-linguistic valid scale of tonal prominence and languages may vary in the precise tonal scales that they adopt.

Yin (1991) postulates that the default tone in Mandarin is the high level tone (H) based on the evidence from kinship reduplicates, onomatopoeic words, the reading of foreign alphabets and letters, national phonetic alphabet, and a disguised language. Some evidence is given below in (41).

- (41) a. sawL sawH                      ‘elder brothers’ wife’  
 b. p<sup>h</sup>iH liH p<sup>h</sup>aH laH                      ‘sound of fire-crackers etc.’  
 c. eyH tɕyaH biH təŋL üLH ɕiH                      ‘A + B = C’  
 d. nanLH k<sup>h</sup>anHL → nəH k<sup>h</sup>əH                      ‘ugly’

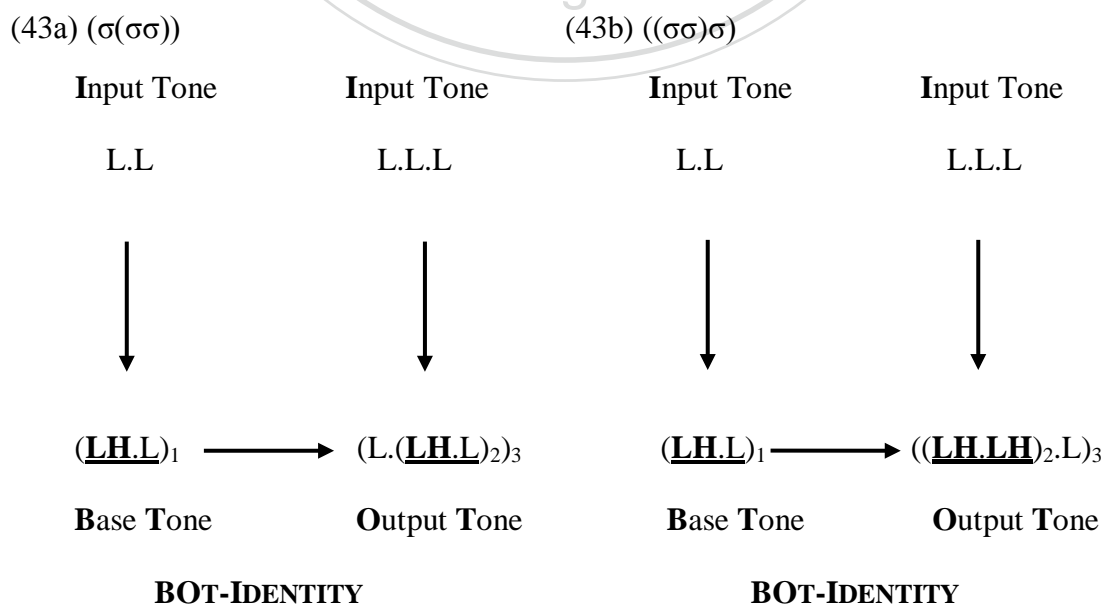
Because the high level tone (H) has a high frequency of appearance in Mandarin, we assume that a L tone is marked in Mandarin. A markedness constraint, \*L, which prohibits L tone in surface representation, may be a help in the evaluation of tri-tonal strings because (40b) contains more L tones than (40a). However, a LH tone is more

marked than a L tone due to the fact that a LH tone is a contour tone. Since a markedness constraint aims to forbid the marked form in a language, it is the LH tone which should be prohibited instead of the L tone. Thus, the \*L constraint needs to be reconsidered.

In light of this, a properly defined tone sandhi domain is necessary. To deal with the tri-tonal strings such as  $(\sigma(\sigma\sigma))$  and  $((\sigma\sigma)\sigma)$ , this study adopts the IDENT-BOT constraint proposed by Lin (2005), as defined below.

(42) IDENT-BOT: corresponding tones in the prosodically related bases and outputs must be identical. (Lin 2005)

The correspondence of the related base and output is given in the following figure:



In (43a) and (43b), the two adjacent L tones which trigger tone sandhi serve as the base,  $(\underline{\text{LHL}})_1$ . However, the main difference between (43a) and (43b) lies in the position of the additional L tone. In (43a), a L tone precedes the base  $(\underline{\text{LHL}})_1$ , so the output is  $(\text{L}.\underline{\text{LHL}})_2)_3$ , whereas in (43b), a L tone follows the base  $(\underline{\text{LHL}})_1$ , so the second tone undergoes tone sandhi and thus changes to a LH tone,  $((\underline{\text{LHLH}})_2.\text{L})_3$ . The IDENT-BOT constraint requires that the base tones,  $(\underline{\text{LHL}})_1$ , and the output tones,  $(\underline{\text{LHL}})_2$  or  $(\underline{\text{LHLH}})_2$ , are identical. Tableau (44) shows how IDENT-BOT operates in a trisyllabic foot like  $((\sigma\sigma)\sigma)$ .

(44) *ju qi shou* ‘Raise hands.’ Reference Output:  $(\text{juLH qiL})$

<i>ju qi shou</i> $((\text{LL})\text{L})$	IDENT-T-R	OCP-L	IDENT-BOT	IO-IDENT
a. $((\text{LH LH})\text{L})$			*	**
b. $((\text{L LH})\text{L})$			**!	*
c. $((\text{L L})\text{L})$		*!		
d. $((\text{L LH})\text{LH})$	*!		**	**

In (44), the tone sandhi domain of *ju qi shou* is  $((\sigma\sigma)\sigma)$ . The base  $(\underline{\text{ju qi}})$  and its correspondence in the output  $((\underline{\text{ju qi}})\text{ shou})$  is evaluated by IDENT-BOT. For (44a) and (44b), the former incurs fewer violations than the latter with respect to the IDENT-BOT

constraint. In (44a), only the second output tone in ((LH.LH).L) is not identical to the second base tone in (LH.L), whereas in (44b), the two output tones (L.LH) within ((L.LH).L) are not identical to the base tones in (LH.L). This is why candidate (44b) incurs more violations than candidate (44a). As a result, (44b) is ruled out and (44a) is correctly selected as the optimal output.

(45) zhao xiao li ‘Looking for Small Li.’ Reference Output: (xiaoLH liL)

zhao xiao li (L(LL))	IDENT-T-R	OCP-L	IDENT-BOT	IO-IDENT
a. (LH (LH L))				**!
b. (L (LH L))				*
c. (L (L L))		*!	*	
d. (L (LH LH))	*!		*	**

In (45), the IDENT-BOT constraint does not play an important role in the evaluation. As exhibited in the tableau, both (45a) and (45b) satisfy the IDENT-BOT constraint, but (45a) is ruled out by the IO-IDENT constraint. Thus, the optimal output is (45b).

In sum, the previous proposed \*L constraint is invalid and the IDENT-BOT constraint is adopted to replace \*L as it plays a crucial role in the evaluation of trisyllabic tonal domains such as ( $\sigma(\sigma\sigma)$ ) and ( $((\sigma\sigma)\sigma)$ ). The present tonal constraint

ranking for Mandarin tone sandhi is listed below.

(46) Tonal Constraint Ranking for Mandarin Tone Sandhi (in regular speech):

IDENT-T-R, OCP-L >> IDENT-BOT >> IO-IDENT

#### 4.6 Tonal Constraints for Mandarin Focal Tone Sandhi

##### 4.6.1 OCP-L(ft)

As generalized in Chapter 3, the focused element in the marked reading of Type C must retain its base tone. However, the present tonal constraint ranking, IDENT-T-R, OCP-L >> IO-IDENT, fails to make a correct prediction, as illustrated in (47).

(47) **guo** yao xiao bao ‘Dogs bite Small bao.’<sup>6</sup> Reference Output: (xiaoLH baoL)

gou yao xiao bao (L)(L(LL))	IDENT-T-R	OCP-L	IDENT-BOT	IO-IDENT
a. (L)(L (LH L))		*!		*
b. (L)(LH (L L))		*!	*	*
c. (L)(LH (LH L))				**
d. (LH)(LH (LH L))	*!			***

<sup>6</sup> The focal phrasing pattern is based on example (20) in Chapter 4. In the marked reading of Type C, foot formation ends at the focused element. The focused subject **guo** is isolated as a monosyllabic foot while the non-focal syllables form a trisyllabic foot.



Candidate (47d) is ruled out because it does not preserve its base tone in the first syllable, which is also the rightmost tone in monosyllabic foot. Candidates (47a) and (47b) violate OPC-L for the reason that there are adjacent L tones in the output forms. Therefore, candidate (47c) is wrongly selected as the optimal output. Instead, the optimal output should be (47a).

To get rid of this problem, the OCP-L constraint needs to be modified a little bit. In (47a), the adjacent L tones belong to different feet. That is, for a foot structure like (L)(L.(LH.L)), the two adjacent L tones belong to different feet. Although the OCP-L constraint prohibits adjacent L tones, it does not explicitly regulate the circumstances at which adjacent L tones in the same foot are unacceptable. Therefore, the OCP-L(ft) constraint is proposed to substitute the OCP-L constraint.

(48) OCP-L(ft): adjacent L tones in the same foot are prohibited.

The specific OCP-LD constraint is less restricted than the general OCP-L constraint because the former allows adjacent L tones in different feet. By the restriction of tonal domain, candidate (49a) satisfies the OCP-L(ft) constraint, as shown in tableau (49).

(49) **guo** yao xiao bao ‘Dogs bite Small bao.’<sup>7</sup> Reference Output: (xiaoLH baoL)

guo yao xiao bao (L)(L(LL))	IDENT-T-R	OCP-L(ft)	IDENT-BOT	IO-IDENT
a. (L)(L (LH L))				*
b. (L)(LH (L L))		*!	*	*
c. (L)(LH (LH L))				**!
d. (LH)(LH (LH L))	*!			***

As shown above, candidate (49a) satisfies the OCP-L(ft) constraint due to the fact that the adjacent L tones belong to different feet. In contrast, candidate (49c) is ruled out because it violates the lower ranked constraint IO-IDENT. Therefore, candidate (49a) is successfully selected as the optimal output.

Finally, the markedness constraint OCP-L(ft) is unable to see the inner prosodic domain which is contained in a larger domain. For example, a trisyllabic foot like ((LH.L.)L) still violates the OCP-L(ft) constraint because the adjacent L tones are contained in the larger outer foot.

#### 4.7 A Comparison of Tonal Constraints for Non-focal and Focal Readings

The following tableaus illustrate the differences between the non-focal and focal readings in relation to tonal constraints.

<sup>7</sup> The focal phrasing pattern is the same as example (47) in Chapter 4.

(50) guo yao xiao bao ‘Dogs bite Small bao.’<sup>8</sup> (non-focal reading)

guo yao xiao bao (LL)(LL)	IDENT-T-R	OCP-L	IDENT-BOT	IO-IDENT
a. (LH L) (LH L)				**
b. (LH L) (L L)		*!		*
c. (L LH) (LH L)	*!			**

(51) guo yao xiao bao ‘Dogs bite Small bao.’<sup>9</sup> Reference Output: (xiaoLH baoL)

guo yao xiao bao (L)(L(LL))	IDENT-T-R	OCP-L(ft)	IDENT-BOT	IO-IDENT
a. (L)(L (LH L))				*
b. (L)(LH (L L))		*!	*	*
c. (L)(LH (LH L))				**!
d. (LH)(LH (LH L))	*!			***

Tableau (50) shows that in non-focal reading, the general OCP-L constraint successfully rules out candidate (50b) in that it contains adjacent L tones. However, when focus occurs in the marked reading of Type C, foot formation ends at the focused element and the focused element retains the base tone, as in tableau (51). Under such circumstances, the focused element may be followed by another L tone in different feet, as candidate (51a) shows. Hence, in focal reading, the OCP-L(ft)

<sup>8</sup> The phrasing pattern is based on example (9) in Chapter 4. In regular reading, a quatrasyllabic string is usually parsed into a couple of disyllabic foot.

<sup>9</sup> The focal phrasing pattern is the same as example (47) in Chapter 4.

constraint is needed to allow adjacent L tones in different feet; otherwise, the optimal output (51a) will be ruled out.

Tableaus (52) and (53) illustrate how IDENT-BOT operate in non-focal and focal readings in Type B.

(52) wu wu wu wu ‘5555’,<sup>10</sup> (non-focal reading)

wu wu wu wu (LL)(LL)	IDENT-T-R	OCP-L(ft)	IDENT-BOT	IO-IDENT
a. (LH L) (LH L)				**
b. (LH L) (L L)		*!		*
c. (L LH) (LH L)	*!			**

(53) **jui** wu wu wu ‘9555’,<sup>11</sup> Reference Output: (wuLH wuL)

jui wu wu wu (L)((LL)L)	IDENT-T-R	OCP-L(ft)	IDENT-BOT	IO-IDENT
a. ( <b>LH</b> )((LH LH) L)	*!		*	***
b. ( <b>L</b> )((LH L) L)		*!		*
c. ( <b>L</b> )((LH LH) L)			*	**
d. ( <b>L</b> )((L LH) L)			**!	*

<sup>10</sup> The phrasing pattern is based on example (50) in Chapter 4.

<sup>11</sup> The focal phrasing pattern is based on example (23) in Chapter 4. In Type B, foot formation ends at the focused element. The focused element **jui** is isolated as a monosyllabic foot while the non-focal syllables form a trisyllabic foot.

For non-focal reading in (52), the IDENT-BOT constraint is inactive because there is no trisyllabic foot. In other words, IDENT-BOT does not play a crucial role in the evaluation of the disyllabic foot. For focal reading in (53), the occurrence of focus results in prosodic restructuring so the focused subject *ju* is isolated as a monosyllabic foot while the rest of syllables form a trisyllabic foot. The IDENT-BOT constraint is needed to rule out candidate (53d). The base (wu wu) and its correspondence in the output ((wu wu) wu) is evaluated by IDENT-BOT. For candidate (53c), the second output tone (LH.LH) within ((LH.LH.)L) is not identical to the second tone in the base (LH.L). For candidate (53d), both output tones (L.LH) within ((L.LH.)L) are not identical to the base tones (LH.L). Candidate (53d) incurs one more violation than candidate (53c) in the IDENT-BOT constraint. As a consequence, the optimal output is (53c).

#### 4.8 Summary of Tonal Constraints

The overall tonal constraint ranking for non-focal and focal readings are given in (54) and (55), respectively.

(54) Tonal Constraint Ranking for Mandarin Tone Sandhi (in regular speech):

IDENT-T-R, OCP-L >> IDENT-BOT >> IO-IDENT

(55) Tonal Constraint Ranking for Mandarin Focal Tone Sandhi:

IDENT-T-R, OCP-L(ft) >> IDENT-BOT >> IO-IDENT

In sum, the occurrence of focus may result in prosodic restructuring, which yields different tone sandhi patterns. This section demonstrates that the focal tone sandhi pattern is determined by the interaction between tonal constraints.



## CHAPTER 5

### CONCLUSION

#### 5.1 Summary of the Thesis

This thesis examines Mandarin focal tone sandhi among Taiwan youngsters. Three types of sentences are under investigation in order to see whether youngsters' intuition for focal tone sandhi varies when compared with that of earlier generalization.

Three types of sentences are as follows: Type A includes the focused auxiliary verbs and adverbs in a simple sentence, Type B the flat structure, and Type C the others. For Type A, the focused element is at the left edge of the focal phrase and foot formation starts at the focused element. The focused element then undergoes tone sandhi. For Type B, the focused element is at the right edge of the focal phrase and foot formation ends at the focused element. The focused element retains the base tone. For Type C, two focal tone sandhi patterns are found. One is unmarked, and has the same grammar as Type A. The other is marked, and has the same grammar as Type B.

The generalizations in Chapter 3 show that the intuition of the informants in this study (i.e., people who were born in the 1990s) is different from that of older people observed in previous researches twenty years ago. The left-edge parameter proposed by Shih (1990) and Hsiao (1991, 1995) is unable to predict the occurrence of Type B

and the marked Type C. Instead, a right-edge parameter is needed to account for these two types of sentences, as governed by the ALIGN-R constraints in Optimality Theory.

In addition, the size of the focal phrase in Mandarin is bigger than the phonological phrase, but it pertains to a special kind of intonational phrase.

Under the framework of Optimality Theory, prosodic constraints and tonal constraints are posited, respectively, in order to account for Mandarin focal tone sandhi, as shown below:

(1) Prosodic Constraint Ranking for Mandarin Tone Sandhi (in regular speech):

PARSE- $\sigma$ , FtMIN >> FtMAX, ALIGN-L(IC, Ft), ALIGN-R(IC, Ft)

(2) Prosodic Constraint Ranking for Mandarin Focal Tone Sandhi:

a. Type A & unmarked Type C:

[FtMIN & NON-FINALITY] >> ALIGN-L(F, FP), ALIGN-L(FP, Ft), ALIGN-E(FP, IP)

>> PARSE- $\sigma$ , FtMIN >> FtMAX, ALIGN-L(IC, Ft), ALIGN-R(IC, Ft) >>

ALIGN-R(F, FP), ALIGN-R(FP, Ft)

b. Type B & marked Type C:

[FtMIN & NON-FINALITY] >> ALIGN-R(F, FP), ALIGN-R(FP, Ft), ALIGN-E(FP, IP)

>> PARSE- $\sigma$ , FtMIN >> FtMAX, ALIGN-L(IC, Ft), ALIGN-R(IC, Ft) >>



ALIGN-L(F, FP), ALIGN-L(FP, Ft)

Among the prosodic constraints, PARSE- $\sigma$ , FtMIN, FtMAX, ALIGN-L(IC, Ft), and ALIGN-R(IC, Ft) are proposed to account for regular prosodic phrasing. PARSE- $\sigma$  and FtMIN dominates FtMAX, ALIGN-L(IC, Ft), and ALIGN-R(IC, Ft) to ban unparsed syllables and monosyllabic feet, respectively. In focal phrasing, three kinds of alignment constraints are needed. The first kind, ALIGN-L(F, FP) and ALIGN-R(F, FP), is to align the edges of the focused element and the focal phrase. The second kind, ALIGN-L(FP, Ft) and ALIGN-R(FP, Ft), is to align the edges of the focal phrase and the foot. The third kind, ALIGN-E(IP, Ft), is to align the edges of the intonational phrase and the foot. The conjoined constraint, [FtMIN & NON-FINALITY], is undominated in order to prohibit a monosyllabic foot in sentence-final position in focal phrasing.

Following Cophonolgy, this thesis proposes two subgrammars to account for focal phrasing in different types of sentences. Subgrammar A (Align-L(F, FP), Align-L(FP, Ft) >> Align-R(F, FP), Align-R(FP, Ft)) accounts for focal tone sandhi of Type A and the unmarked Type C. Subgrammar B (Align-R(F, FP), Align-R(FP, FP) >> Align-L(F, FP), Align-L(FP, Ft)) deals with the focal tone sandhi of Type B and the marked Type C. Both subgrammars of the alignment constraints relating the focused elements interact with other foot form constraints so that various prosodic phrasing

phenomena will be included.

(3) Tonal Constraint Ranking for Mandarin Tone Sandhi (in regular speech):

IDENT-T-R, OCP-L >> IDENT-BOT >> IO-IDENT

(4) Tonal Constraint Ranking for Mandarin Focal Tone Sandhi:

IDENT-T-R, OCP-L(ft) >> IDENT-BOT >> IO-IDENT

As for tonal constraints, IDENT-BOT is adopted to deal with the tri-tonal strings such as  $(\sigma(\sigma\sigma))$  and  $((\sigma\sigma)\sigma)$  in non-focal and focal readings. This constraint requires that corresponding tones in the prosodically related bases and outputs remain identical. In addition, the general OCP-L constraint is modified as OCP-L(ft) in focal reading, which prohibits adjacent L tones in the same foot. In other words, OCP-L(ft) assures that adjacent L tones can appear in different feet.

In sum, the occurrence of focus results in prosodic restructuring, which yields different tone sandhi domains and tone sandhi patterns. This study shows that the phrasing of focal domain is determined by the interaction between alignment and foot form constraints, and the focal tone pattern is determined by the interaction between tonal constraints.

## 5.2 Further Issues

There are some issues which are not discussed in this thesis. The first issue is the case of multiple foci. Nagahara (1994) investigated the phonological phrasing in Japanese. One of Nagahara's findings is that when a sentence has multiple focused constituents, the focal phrasing starts at the first focused constituent and ends at the second focused constituent. There is no intermediate phrase boundary intervening between the second focused constituent and the end of the sentence. The following is a schematic representation of the phrasing pattern for multiple foci:

### (5) Multiple Foci

..... focus1 ..... focus2..... ]<sub>s</sub>  
 [i<sub>1</sub> [i<sub>2</sub> [i<sub>i</sub> No intervening [i between [i<sub>2</sub> and ]<sub>i</sub>

Hence, the issue of multiple foci could be taken into consideration and see how focal phrasing operates in Mandarin in the future study. The second issue is the correlation between Mandarin focal tone sandhi and the tempos in speech. Take the sentence *ma hen shao hou* 'Horses rarely roar.' for example. Two readings, (L)((LH.LH.)L) and (LH.LH.LH.L), are acceptable. In actual speech, the first reading occurs in unmarked

moderate speed, while the second reading occurs in marked presto speed. Hence, the investigation of the interaction between speed and focal phrasing can be incorporated with the framework of the present study in the future research. Finally, Taiwanese is a language that its tone sandhi pattern is not affected by the tempos in speech. Thus, a cross-dialectal comparison of the focal phrasing in Mandarin and Taiwanese can also be pursued in the future so as to reveal the specific and shared properties among the Chinese languages.



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