

Prosodic Phonology of the Ningbo Dialect

By

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*This dissertation is dedicated to
my parents*

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Abbreviations

A, AP	adjective, adjectival phrase
AdjR	adjective reduplication marker
Adv, AdvP	adverb, adverbial phrase
BT	base tone, base form
C	clitic
CG	clitic group
Cl, ClP	classifier, classifier phrase
Conj, ConjP	conjunction, conjunction phrase
CPW	combined-pronunciation words
CRS	currently relevant state
CT	citation tone, citation form
D, DP	determiner, determiner phrase
DTS	Diminutive tone sandhi
DUR	durative aspect marker
EBA	Edge/End-Based Approach
EXP	experiential aspect marker
F/Ft/Σ	foot
I/INFL, IP	inflection, inflectional phrase
IPh/t	intonational phrase
LOC	locative marker
LTS	lexical tone sandhi
M/σ	mora
MOD	modification marker
MW	measure word
N, NP	noun, noun phrase

ND	Ningbo dialect
NOM	nominalization marker
Num, NumP	numeral, number phrase
OT	Optimality Theory
P, PP	preposition, prepositional phrase
PASS	passive morpheme
PERF	perfective aspect marker
POSS	possessive marker
PPh/ φ	phonological phrase
PTS	post-lexical tone sandhi ru
PVP	post-verbal particle
PW/ ω	prosodic word/phonological word
Q, QP	quantifier, quantifier phrase
Qu	interrogative particle
RBA	Relation-Based Approach
S	sentence
SLH	Strict Layer Hypothesis
SPE	The Sound Pattern of English
t	trace of moved element
T, TP	tense, tense phrase
TS	phonological tone sandhi
Utt/ υ	utterance
V, VP	verb, verb phrase
WFR	word formation rule
X/X ₀ , XP	syntactic head of type X, full syntactic phrase of type X
X'	intermediate syntactic phrase of type X

Abstract

This dissertation will investigate the prosodic phonology of the Ningbo dialect under the framework of the theory of prosodic phonology. It consists of three parts. Chapter I presents a general background on the Ningbo dialect with a brief review on previous works as well as information about data collection in this study. Chapter II introduces the theoretical framework in prosodic phonology and then provides a background of the phonological system of the Ningbo dialect. Chapters I and II together constitute the first part of this dissertation. The second part consists of five chapters, Chapter III through Chapter VII, which are dedicated to discussing different domains in the prosodic hierarchy of the Ningbo dialect, including the syllable, the foot, the prosodic word, the clitic group, the phonological phrase and the intonational phrase. The last chapter of this dissertation will offer a final remark on this study.

This dissertation is devoted to answering some fundamental questions concerning the prosodic constituents in the Ningbo dialect such as how the phonological constituents at different levels are defined and organized in the prosodic hierarchy and to which constituents various phonological phenomena in this dialect make crucial reference. It will also examine whether a specific constituent should be established as a dispensable unit in this dialect. The first part of each chapter will provide some basic information of the constituent in question, including its basic formation rule(s) as well as evidence to support it as an independent constituent across languages. The second part of each chapter will discuss various phonological sandhi rules that make crucial reference to the certain prosodic domain in the Ningbo dialect. The last part of each chapter will offer a short

summary.

This dissertation, through the examination of different constituents in the Ningbo dialect, will advocate the Relation-Based Approach as a better solution to account for a variety of phonological phenomena in this dialect. On the one hand, it can provide solid evidence to support the existence of the prosodic hierarchy and the main prosodic constituents in the Ningbo dialect. On the other hand, this dissertation proves that a certain constituent in the hierarchy should be defined with respect to both phonological and non-phonological information. Therefore, whether a constituent exists or not in a language does not disqualify it as a constituent existing in the universal hierarchy. Third, based on the observation of the phonological phenomena relevant to each domain, it can be seen that (i) a certain phonological phenomenon in Ningbo dialect may apply within one domain while it is blocked in other domains, and (ii) one Ningbo phonological process could operate within more than one domain. Last, based on the previous insightful analyses of the Wu language/dialect, I also propose several hypotheses related to the Ningbo dialect, such as the minimal and maximal prosodic word requirements, the necessity of distinguishing proclitics and enclitics, as well as the obligatory upgrade within the morpho-syntactic-based hierarchy that was proposed by Zhang (2017).

This dissertation not only investigates the phonological system and the sandhi phenomena in the new Ningbo dialect which has not been adequately studied previously, but also makes contribution to the theory of the general prosodic phonology which deals with the interface between phonology and other components of the grammar. Therefore, it is my hope that this study can deepen our understanding of this dialect as well as the prosodic phonology in general.

Chapter 1. Introduction

1.1 General Background of the Ningbo Dialect

Ningbo, with a population of more than 7,600,000, is the second largest city in Zhejiang Province. To the north, Hangzhou Bay separates Ningbo from Shanghai while to the east lie the Zhoushan islands in the East China Sea. On the west and south, Ningbo borders Shaoxing City and Taizhou City respectively. The Ningbo dialect discussed here refers to the language spoken presently by the younger or middle-aged generation in the two central districts of Ningbo, namely the Haishu and Jiangbei districts. Historically, these two districts combined have constituted the main urban zone of Ningbo for more than a thousand years. According to the native speakers' perspectives and previous academic studies, the dialect spoken in these two districts is different from those spoken in the other areas of Ningbo. In these two central districts, the Ningbo dialect is for daily use at home, in the local community, and even on local radio and television broadcasts (although most of the programs use Standard Mandarin Chinese now). Under the influence of Standard Mandarin, which is the official language that Chinese government has been promoting throughout the whole country, along with the fast expansion of the city and massive immigration from other areas in China, the old Ningbo dialect has been dramatically impacted. Some tonal categories of Middle Chinese in Ningbo dialect have merged now. For instance, the citation tones of *yinping* and *yinqu* tonal categories have merged in the modern Ningbo dialect, the tonal value

of which is an HL tone now; and some nasal finals have lost the nasal feature compared with those in the old Ningbo dialect reported in previous studies.

According to Hou Jingyi's (2002) *Xiandai Hanyu Fangyan Gailun* [Survey on the Modern Chinese Dialects], the Ningbo dialect is considered a subdivision of the Yongjiang language branch in the Northern Wu language family. Its native speakers are able to understand Shanghai dialect easily, but not vice-versa. Like many other Wu dialects of Chinese, the Ningbo dialect is famous for the complexity of its tone sandhi phenomena. The complex interactions between phonology and other components of the grammar, such as morphology and syntax, make its phonological system even more obscure in the Ningbo dialect.

While there was no literature published on the phonological system of the Ningbo dialect until the Western missionaries came to China in the late 19th century, in the past more than one hundred years, a considerable amount of literature has been published on the dialect's phonology. However, most of it is descriptive research on the sound inventory or on the tone sandhi phenomena at word-size elements, and thus further research is needed in order to improve our understanding of the phonological system of the Ningbo dialect.

1.2 Previous Studies on the Ningbo Dialect

A number of research studies on the Ningbo dialect, especially on its phonological system, have been published in both Chinese and English since the late 19th century. The following review

of previous studies is arranged chronologically, and then by different aspects. Detailed discussion of certain aspects will be presented in relevant chapters later.

1.2.1 Early Works by Missionaries

Before the late 19th century, the Chinese linguistic tradition was almost entirely philological because its main purpose was to assist Chinese scholars to read classical texts or to write and read traditional poetry. By the late 19th and early 20th century, however, comparative linguistics in China had been inspired by the work of Western scholars who came to China, most of whom were missionaries, such as the consular official Edward Harper Parker (1849–1926) who was a pioneer in the collection of dialectological data in China. *The Ningbo Dialect* (1884, 1885) by Parker, published in *China Review* in Hong Kong, was one of the earliest descriptive analyses on the phonological system of the Ningbo dialect. Before him, William T. Morrison had spent 16 years compiling a dictionary named *An Anglo-Chinese Vocabulary of the Ningbo Dialect* (1884), which was intended to prepare missionaries to become familiar with the local language in Ningbo. In 1901, Paul Georg Von Möllendorff wrote a book titled *The Ningpo Syllabary*, which is still in manuscript form. Later, in 1910, the manuscript was revised and published as a handbook under the title of *The Ningbo Handbook* in Shanghai, in which von Möllendorff reported on the initial and final systems of the old Ningbo dialect. The afore-mentioned works all used romanized letters to transcribe the sounds of the Ningbo dialect. Although these books were all intended to help

western missionaries learn to speak the Ningbo dialect so that they could communicate with the local people and not intended primarily for linguistic usage, their works can still be considered as the starting point of the study of the Ningbo dialect in modern era.

1.2.2 Important Surveys in the Early and Mid 20th Century

Before the last decade of the 20th century, although there were no linguistic papers or books published specifically on the phonological system of the Ningbo dialect, there had been several linguistic surveys on Wu dialects conducted by Chinese scholars in which the Ningbo dialect was included and compared with other Wu dialects. The earliest works on the Ningbo dialect performed by a Chinese scholar under the framework of descriptive linguistic theory was Yuan Ren Chao's *The Studies of Modern Wu Dialects*. Returning to China in 1925, Chao taught Chinese phonology and music at Tsing Hua University, later known as the National Tsing Hua University, and began a survey of the Wu dialects in 1927. In 1928, as the result of the survey, he published the book in which he comprehensively compared various modern Wu dialects (including the Ningbo dialect), Mandarin Chinese and Middle Chinese from the perspectives of phonology, vocabulary and grammar. This book has been considered as a reliable source for the studies on the phonology in Wu dialects since then, and the theory and methodology adopted in these studies has influenced many subsequent analyses.

Since the establishment of the People's Republic of China, the provincial government of

Zhejiang has organized three language surveys across the province. The most important one was the third survey led by Guotong Fu in 1964-1965, which has done a thorough descriptive analysis on the phonology, vocabulary and grammar of the seventy-two dialects in Zhejiang Province. In the Ningbo area, they surveyed seven subdialects, including Ningbo dialect, Zhenhai dialect, Fenghua dialect, Xiangshan dialect and Ninghai dialect, etc. In 1985, the result of this survey was finally published in a book under the title of *Partition of Wu Dialects in Zhejiang* [浙江吴语分区], in which the basic characteristics of Mingzhou dialects (including Ningbo dialect) were reported, and the segmental and tonal inventory of the languages were illustrated in charts with glossary. It should be noted that the Ningbo dialect studied in the above-mentioned surveys was considered the old version of the dialect and the language has changed a lot since then in the sense that the sound inventory has become simpler and a great amount of new vocabulary from Mandarin has been absorbed into Ningbo dialect.

1.2.3 Research in the Recent Three Decades

The 1990s saw some progress in the studies on Ningbo dialect, the most important of which is the research on tone sandhi phenomena. Studies in different aspects of Ningbo dialect phonology will also be introduced in the following part.

1.2.3.1 Sound Inventory

In 1992, Guotong Fu published another book named *Vocabulary of Zhejiang Dialects* [浙江方言词], in which he compared the sound of 202 words in the 69 dialects in Zhejiang Province to show the internal similarities and differences of the Wu dialects in Zhejiang, including the seven Ningbo dialects spoken in different regions of Ningbo city. Following Fu, Nairong Qian (1990, 1992, 2003) has provided the sound inventory of the new Ningbo dialect. He discussed some of the tone sandhi phenomena of disyllabic and trisyllabic words and phrases in detail. However, the Ningbo dialect studied in his research is considered as old dialect nowadays because several citation tones have further merged. Other important works include Zhangnian Zhu's *Ala Ningbo hua* (Our Ningbo Dialect) in 1991 and *Ningbo Fangyan Cidian* (Dictionary of the Ningbo Dialect) in 1996. The introductory chapter of both books is concerned with the inventory of segmental elements and tones in the Ningbo dialect as well as the internal similarities and difference between various subdialects in Ningbo area. Other important works include Shifen Zhou's *Huoseshengxiang Ningbo Hua* (2000) (The Lively and Colorful Ningbo Dialect) and its revised and enlarged version in 2005, Zhifeng Zhou and Fang Hu's *Beilun fangyan* (Dialect of Beilun), in which a subdivision of Yongjiang language branch in Ningbo area, namely the Beilun dialect, is reported, as well as several articles by Hu (2005, 2007) who has analyzed the phonetic values of the segmental inventory of the Ningbo dialect.

1.2.3.2 Tone Sandhi

Chen Ningping (1985) was the first scholar that brought the General Linguistic theory to the study of Ningbo's tone sandhi phenomena. She provides a more in-depth analysis of tone sandhi in Ningbo dialect. Special emphasis is paid to the derivation relationship between the citation tones and their sandhi forms in Ningbo dialect under the framework of the rule-based general phonological theories, which serves as another important source for subsequent research. However, as I will discuss in Chapter III, a citation tone and its corresponding sandhi form, synchronically speaking, may not hold a derivational relationship in the Ningbo dialect. Instead, the two forms of a tone, namely the citation form and the sandhi form, are the realizations of a tone on different prosodic levels. Taking the Ningbo dialect as an example, the citation form of a tone makes reference to the syllable domain while the tone sandhi, particularly the lexical tone sandhi (LTS), can apply within prosodic word domain, clitic group that are formed by 'host+enclitic(s)' and phonological phrase domain, but never crosses the boundary between two phonological phrases.

In the early and mid 90s, Zhenzhu Tang, Rujie You and Zhongmin Chen (1990)'s *Ningbo Fangyan (Laopai) Danzidiao He Liangzizu Biandiao* (The monosyllabic and dissyllabic Tone Sandhi in the old Ningbo dialect), Ping Wang's (1990) *Ningbo Fangyan Liandiao de Tanta* (A Discussion on the Tone sandhi in Ningbo dialect) and Chen's (1993) *Ningbo Fangyan Shengdiao Bianyi* (The Tone Sandhi of the Ningbo Dialect) were three important papers, in which the disyllabic and tri-syllabic tone sandhi phenomena of the old Ningbo dialect were analyzed under the framework of descriptive linguistic theory.

The tone sandhi of diminutive words in Ningbo dialect has drawn a lot of attention since it is concerned with the interaction of phonology and morphology. Tongqiang Xu's (1985) *Ningbo fangyan de ε leici he 'erhua' de henji* (Discussion on the morphemes with the vowel ε and the trace of 'r'-coloring in Ningbo dialect) analyzes the residue of the 'r'-coloring feature in Ningbo dialect from the perspective of the interaction between phonology and morphology. He also accounted for the historical sound change of the vowel ε in Ningbo dialect. Other important works on tone sandhi include Chen's (1992) *Ningbo fangyan 'xia zhu ji' lei zi shengdiaobiandu ji yuanyin* (The Tone Sandhi of the Morphemes of 'shrimp, pig and chicken' and the analysis in Ningbo dialect) and Weihui Wang's (1991) *Qinshu chenweici de biandu' zaibu* (The Follow-up Report of the Kinsfolk Appellation).

Hu's (2003) *Ningbo fangyan gongnengci biandiao yu jufa de guanxi* (The Interaction between Tone Sandhi and Syntax of the Function words in Ningbo Dialect) is another important paper that deals with the tone sandhi in Ningbo at certain level of the prosodic hierarchy. In this article, Hu uses Selkirk's edge-based theory to analyze the tone sandhi regarding the function words in Ningbo dialect. However, as discussed in relevant chapter, while Hu's theory successfully explains some TS phenomena, precisely speaking, the TS within the host formed by 'host+enclitic(s)', yet he fails to account for TS within the clitic group formed by 'proclitic+host'. As a matter of fact, he is not even aware of the difference between the two types of the clitics. Moreover, the formula that Hu proposes for the formation of the clitic groups in Ningbo dialect, on the one hand, solely relies on

one single syntactic property, namely the left edge of of a lexical head. On the other hand, Hu's proposal includes a rule which claims that the personal pronoun following by a possessive marker will block LTS, which does not seem to fit in the single Edge/End-Based Approach (EBA). Thus, it undermines his analysis on the clitic group in Ningbo dialect on the basis of EBA. Furthermore, he does not seem to distinguish two the tone sandhi at two different levels in the hierarchy, namely, the clitic group and the phonological phrase. In other words, he mixes tone sandhi phenomena on different prosodic levels so that one cannot correctly account for a number of sandhi phenomena in this language.

Moreover, although the Ningbo dialect has not attracted enough attention in the literature, its neighboring language/dialect, the Shanghai dialect, has been a major focus of the studies on the interaction between phonology and syntax since the mid 1980s. Roughly speaking, the two dialects share similar TS phenomena on the word-size and phrase-size level. I will introduce the relevant studies and approaches in the following chapters.

1.2.3.3 Historical Phonology

Weihui Wang's (1988) Ningbo *Fangyan yinyang duizhuan kao* (The Internal Mutation between the sound of yin and yang categories in Ningbo dialect), following the theory of *yin-yang duizhuan* proposed by scholars in Qing dynasty, analyzes the historical change in Ningbo dialect. In 1991, Xu's *Bainian lai Ningbo yinxi de yanbian* (The historical change of the phonological

system of Ningbo dialect in the past one hundred years) discusses the historical sound change of Ningbo as well as summarizing three types of sound changes and their own characteristics in this language. Other important works in the historical phonology field of Ningbo dialect include but are not limited to Hu's (2001) *Shiyan bainianlai Ningbo fangyan shengmu xitong de yanbian* (A Discussion of the historical change of the consonants in Ningbo dialects in the past one hundred years) and Zhenzhu Tang's (2005) *Ningbohua de yi, er deng qunmu zi* (The Morphemes of the vowels in the first and second divisions with the consonant g in Ningbo dialect).

1.2.4 Reflection on the Previous Scholarship

Based on the brief review of the previous works in Ningbo dialect, we can find that one of the major problems of the previous scholarship is lack of modern linguistic theories when examining the phonological phenomena in the Ningbo dialect. There is a great deal of data and very detailed descriptions of certain phonological phenomena, most of which only focus on the basic sound inventory and the tone sandhi at the word-size units. However, an adequate linguistic analysis should be able to capture the deep nature of various complicated phonological phenomena and to provide general linguistic explanations. Thus, most of the previous scholarship mentioned above still linger at the stage of presenting data. Moreover, most of those scholars mentioned above just focused on the old Ningbo dialect, which now is only spoken by senior citizens in Ningbo area, most of whom are above 70 years old and the results of their researches were sometimes

contradictory. For example, the number of the tonal categories of Ningbo in these studies were all different, as will be discussed in Chapter II.

Although some scholars try to analyze Ningbo dialect under the framework of modern linguistic theories, such as Hu (2003), who adopts the Single Edge/End-Based Approach (EBA) to analyze the clitic group TS in Ningbo dialect, they cannot provide a complete satisfactory explanation to account for the overall data. More importantly, none of the previous studies have tried to analyze the data from the Relation-Based Approach (RBA), which is utilized in this dissertation and shows a stronger theoretical power to account for the phonological phenomena at different levels of the prosodic hierarchy in Ningbo dialect.

To conclude, the previous descriptive works, although contributing to our understanding of the Ningbo phonology, a more comprehensive work which is both descriptive and theoretical is necessary in order to deal with the actually more complex phonological phenomena in the new Ningbo dialect as well as its interactions with other components of the grammar.

1.3 The Purpose of this Dissertation

As concluded above, in order to deepen our understanding of the phonological system of Ningbo dialect, more comprehensive studies under the framework of modern phonological theories are needed, particularly the Relation-Based Approach (RBA) because it can better account for the complex phonological phenomena in the Ningbo dialect. The purpose of this dissertation

is to fill this vacuum.

On the one hand, this dissertation is an attempt to provide a detailed description and analysis of the phonological system of the new Ningbo dialect, which is spoken by native speakers who are normally younger than 50 year old. Because the previous scholarship mainly focuses on the old Ningbo dialect, the phonological phenomena discussed in this dissertation are based on my own data collections and few published materials. By capturing the phonological characteristics of the Ningbo dialect, I hope a comprehensive and clear picture of the phonological phenomena in this dialect can be provided.

On the other hand, the major framework employed in this dissertation is the theory of prosodic phonology, especially the RBA, which has been developed since 1980s. After the 1980s, a great amount of research studies have been conducted from many perspectives to refine the theory of prosodic phonology. It is my hope that, based on the analysis of the phonological phenomena of Ningbo dialect, our understanding of the prosodic phonology in general can also be improved. In this dissertation, I will define the domain of prosodic units in different levels within the hierarchy and discuss the role they play in application of phonological rules in Ningbo dialect as well as the interactions between phonology and other components of the grammar.

1.4 Data Collection

The data on the Ningbo dialect analyzed in this dissertation is mostly from my own original

data collection while little comes from published materials (e.g., Ningbo dictionaries, research papers or books).

1.4.1 Published Materials on the Ningbo Dialect

The data used in this research from the published materials are partially taken from the research papers and books, or Ningbo dialect textbooks by Fu (1992), Qian (1990, 2003), Zhu (1996), Tang (1997), Hu (2003), and Zhou (2005). It should be noted that the above-mentioned works usually do not provide the IPA transcription of the segmental elements. Moreover, these sources sometimes present the tone forms of old Ningbo dialect, which is quite different from the new version studied in this dissertation. There are many disagreements on the phonological system of Ningbo dialect between the old version and the new version of the Ningbo dialect, thus, lots of data presented in the previous research has been re-examined and been consulted with my informants.

1.4.2 Data Collection

It is the new Ningbo dialect which is examined in this study and mainly spoken by the native speaker normally under the age of 50. The main data used is collected from Lübo Ding, Xiaosi Zhou, and Qi Zhang, three native speakers of Ningbo dialect, all of whom were born and raised in Haishu and Jiangbei Districts in Ningbo. Lübo Ding is a female accountant. Mrs. Zhou is an editor

in a local newspaper company now. Mr. Qi Zhang works as a security guard in the local area. All of these three speakers are younger than 50 years old and can speak standard Mandarin Chinese, but the Ningbo dialect is their everyday language. In other words, these three informants mainly speak Ningbo dialect at home and their speech is similar.

1.5 Organization of this Dissertation

This dissertation consists of eight parts. As presented above, the first chapter provides the general background on the Ningbo dialect, a brief review on the previous works as well as the information about data collection in this study.

Chapter II is divided into two parts. A critical review of the theoretical frameworks in the prosodic phonology will be presented first. I will present the historical development of prosodic phonological theory as well as some fundamental tenets, such as the organization of the prosodic hierarchy, Strict Layer Hypothesis and its weakened version, and the prosodic constituents at different levels as well as their definitions. The second part will offer a descriptive background on the segmental and tonal inventory of Ningbo dialect. Some phonological phenomena will be demonstrated with examples, such as the lexical tone sandhi rule, the post-lexical tone sandhi rule, etc.

The Chapter III to Chapter VII are dedicated to discussing different prosodic constituents in Ningbo dialect from the lowest one to the constituent on the top of the hierarchy. The definition of

each prosodic domain as well as the relevant phonological phenomena will be discussed.

Chapter III will examine the lowest domains in the prosodic hierarchy, namely the syllable and the foot, in Ningbo dialect. I will demonstrate that the foot is not a necessary prosodic domain in Ningbo dialect due to lack of the independent phonological evidence to make a 'strong-weak' binary contrast between syllables so the foot cannot be considered as a dispensable domain for application of any phonological phenomena in Ningbo dialect.

Chapter IV will deal with the prosodic word. Major morpho-syntactic words in Ningbo dialect are provided and will be examined with respect to application of lexical tone sandhi rules. Based on the survey of the phonological phenomena within the domain formed by morpho-syntactic words in Ningbo dialect, the definition of the prosodic word will be proposed. I will further show that the disyllabic minimal word requirement is necessary for the formation of the restructuring of the prosodic word.

Chapter V focuses on the two types of clitic groups, namely, the clitic group type A formed by 'host+enclitic(s)' and clitic group type B formed by 'proclitic+host'. A detailed analysis of the morpho-syntactic properties and phonological behavior of the two types of the clitic groups will be provided. I will demonstrate that the clitic group type A exhibits different phonological behavior from the clitic group type B. In the previous studies on Ningbo dialect or even Wu dialect family, few scholars have noticed the differences between the two. Moreover, a traditionally accepted claim, in which the clitic group is seen as a prosodic domain in Wu dialect is formed by a lexical

head plus the following function words, will be challenged.

Chapter VI is a formal analysis of the phonological phrase. The major phonological phenomena in Ningbo dialect discussed in this chapter is application of the lexical tone sandhi (LTS) and the post-lexical tone sandhi (PTS). I will demonstrate the classification of the tone sandhi rules at the phrasal level in Ningbo dialect can be accounted for on the basis of the Relation-Based Approach (RBA).

Chapter VII will explore the intonational phrase. I will present the definition and the reconstructing of the intonational phrase as well as the phonological phenomena that are characteristic of this domain.

Chapter VIII will provide a complete model of the prosodic hierarchy in Ningbo dialect which have been discussed in the previous chapters. I will summarize my research on Ningbo dialect at the end.

Chapter II. Background

This dissertation is an investigation of the phonological system of the Ningbo dialect under the framework of the prosodic phonology theory. This chapter will provide the theoretical and descriptive background before moving to talk about the complex tone sandhi phenomena in the Ningbo dialect as well as the interactions between phonology and other components of the grammar in this language. Section 2.1 introduces the theoretical framework under which this research is conducted. The development and the basic tenets of the prosodic phonology theory, as well as some of the most discussed topics in the literature, are briefly reviewed in this section. Section 2.2 provides a basic introduction to the Ningbo dialect phonological system. Segmental inventory and tonal inventory in Ningbo dialect are discussed in detail in this part.

2.1. Theoretical Background

2.1.1 Introduction

The objective of section 2.1 is to provide a survey and critical review of the phonological theories assumed in this dissertation, which deal with phenomena whose domains of application are indirectly determined by syntactic structure. In Section 2.1.2, the development of previous theoretical frameworks is presented. And the most relevant theoretical approaches are presented in Section 2.1.3.

2.1.2 The Development of the Prosodic Phonology Theory

Many modern phonological theories have either been inspired by, or been proposed in reaction to, the work of Chomsky and Halle's (1968) *The Sound Pattern of English* (or the *SPE* model). In the *SPE* model, a variety of phonological 'adjustment' rules are introduced to describe the process by which the surface syntactic structure is partitioned into the phonological representation. As a result, the partition of a spoken structure may differ from the phrasing in the syntactic bracketing. However, in the *SPE* model, phonology is considered linearly, namely, a linear organization of segments and a variety of phonological rules, and thus the domains of phonological rules are simply defined by the boundaries of the syntactic structure. Therefore, this model of phonology has been shown to be inadequate, which has led to the proposals of substituting theories such as Lexical Phonology, Metrical Phonology, Auto-segmental Phonology, and Prosodic Phonology, which provide evidence for rich phonological representations.

Despite the challenges, since there has no other substituted systematic theory of the interaction between phonology and the other components of the grammar, so far, the prosodic phonology is still a robust theory of the interface and related studies. A number of researchers have been dedicated to the proposal of various prosodic constituents and the way to express them as well as providing evidence to support them. In the late 70s, Liberman (1975) and Liberman & Prince (1977) propose a phonological hierarchical tree, in which the relative prominence between

syllables in a sentence can be accounted for by the branching below the level of words. They argue that, in addition to the hierarchical syntactic tree, a hierarchical phonological tree whose constituents are not identical to those in the syntactic tree is needed. Following their idea, Selkirk (1981) develops a phonological hierarchical tree that contains six units of different levels, including the syllable, the foot, the prosodic word, the phonological phrase, the intonational phrase and the phonological utterance. However, influenced by Prince (1983), Selkirk (1984) adopts the grid-only approach and claims that it can obviate the necessity of defining various prosodic constituents separately. She also proposes the Strict Layer Hypothesis, which governs the relations between prosodic constituents at different levels. In 1986, Selkirk changes her mind again, arguing that there can be a 'peaceful coexistence' for the prosodic constituency and the metrical grid. According to Selkirk, the metrical grid is defined by the syntactic information but is referred to prosodic structure, which is required in the analysis of ChiMwiini stress (Selkirk 1986: 376). Therefore, the system allows two distinct mapping mechanisms that are serially ordered: (1) prosodic constituency is the output of regular mapping rules with morphosyntactic structure as its input, and (2) the metrical grid construction is performed on prosodic structure domains by another set of mapping rules. Following Chen (1985, 1987), Selkirk proposes that phrasing is operated with respect to the ends of X' representations, namely a single-edge-based approach (Edge/End-Based Approach or EBA). In this EBA model, she sets two parameters, each of which has two possibilities, as given in (1):

- (1) a. $\#[X^{\max}] \#$ b. $X^{\max} \#$
 c. $\#[X^{\text{head}}] \#$ d. $X^{\text{head}} \#$

As can be seen in (1), the first parameter determines when it is at the left or right edge of a syntactic constituent, which is related to construction rules. The second parameter indicates the nature of the syntactic constituent, which is marked as X^{\max} or X^{head} , and thus there are four logical possibilities that all languages may fall into. The evidence that found to agree with (1a) are tone sandhi in Ewe (Selkirk 1986) and tone sandhi in Shanghai (Selkirk & Shen 1986). The cases found to conform to (1b) are tone sandhi in Xiamen (Chen 1985, 1987, 1990; Selkirk 1986), vowel shortening in ChiMwiini (Selkirk 1986), and the tone sandhi phrasing in Pingyao (Hale & Selkirk 1987). As for (1c), the cases come from the tone sandhi of clitic groups in Wenzhou (Chen 1990). As for (1d), Selkirk provides the example of the liaison in French, on which Chen holds a different idea.

Similarly, Nespor and Vogel (1983) propose a hierarchy which includes the levels of phonological word, phonological phrase and intonational phrase. Pierrehumbert (1986) suggests a possible accentual phrase level between the intermediate phrase and word levels. Later that year, Nespor and Vogel's (1986) *Prosodic Phonology* comes out which provides the impetus for a great amount of research in a variety of areas, in particular, the inventory of prosodic constituents and their definitions as well as the geometry of the hierarchical phonological tree. In that book, seven

prosodic constituents are proposed: syllable, foot, phonological word, clitic group, phonological phrase, intonational phrase and phonological utterance. Distinct from Selkirk's EBA approach, Nespor and Vogel's approach makes reference to X-Bar theory, which is able to interface with the fundamental principles of syntax, such as head-complement, modifier-head and specifier-head relations, as well as syntactic branchingness.

Other important contributions made to the studies of prosodic phonology include but are not limited to Booij (1983, 1985a & b, 1986), Hayes (1984/1989), Chen (1985, 1987, 1990, 2000), Neijt (1985), Ito (1986), Zec (1988), Zhang (1992, 2014, 2017), and others.

The naissance of the Optimality Theory (OT hereafter) in 1990s (McCarthy & Prince 1993, Prince & Smolensky 1993) jettisons the notion of derivation in phonology but claims that the underlying and the surface forms are related formally by an algorithm that selects a surface representation from a wide set of candidates on the basis of constraints which the selected candidate best satisfies. While the constraints are considered to be universal, languages may vary by the ranking of the constraints. Since then, prosodic phonology has been embracing the constraint-based approach. Within the OT framework, the mapping between phonology and syntax is operated by ranking different constraints. Different rankings of constraints result in different prosodic units in particular languages. In the spirit of the generalized alignment theory proposed by McCarthy and Prince (1993), Selkirk (1996) defines two distinct phrase-level alignment constraints, namely Align-R (XP, φ) and Align-L (XP, φ), which calls for the right or the left edge

of the syntactic constituents to match up with the edges of corresponding prosodic constituents. The hypothesis is in the sense that languages can differ in which type of Align XP is responsible for prosodic phrasing patterns. Alignment theory is actually derived from the edge-based theory of Selkirk (1986). In addition, Selkirk (1995) proposes four general constraints deduced by the Strict Layer Hypothesis (Selkirk 1984). Truckenbrodt (1995, 1999) proposes that a theory on the interface between phonology and syntax within the OT framework, besides the alignment constraints, the Wrapping constraint, which requires each syntactic phrase to be wrapped within the same phonological phrase, and $A_{\text{ALIGN-FOC}}$, which calls for each focused constituent to be right-aligned with a phonological phrase boundary, should also be included.

Another theory that is concerned with universal constraints on the correspondence between syntactic and prosodic constituency in grammar is the Match Theory (Selkirk 2006, 2009, 2011, Werle 2009), as posited in (2).

(2) Match Theory syntactic-prosodic constituency correspondence.

a. Match (α, π) [= S-P faithfulness]

The left and right edges of a constituent of type α in the input syntactic representation must correspond to the left and right edges of a constituent of type π in the output phonological representation.

b. Match (π, α) [= P-S faithfulness]

The left and right edges of a constituent of type π in the output phonological

representation must correspond to the left and right edges of a constituent of type α in the input syntactic representation.

Selkirk (2000) proposes the prosodic markedness constraint formulated as BinMin (φ, ω) , which requires a phonological phrase minimally contains two phonological words, and the constraint BinMax (φ, ω) , demanding that there should be no more than two phonological words in one phonological phrase.

Within the OT framework, other constraints have also been proposed for the prosodic phonology, such as U_{NIFORMITY}, which demands that a string is ideally partitioned into units of the same length (Ghini 1993, Sandalo & Truckenbrodt 2002, Prieto 2005, 2006), and I_{NCREASING} U_{NIT}, which means phonological phrases on the recursive side are heavier than those in the non-recursive side (Ghini 1993).

To sum up, in the past thirty years or so, there has been great progress in the prosodic theory. In the meanwhile, debate has persisted in every area of the field. There is no easy answer to the questions concerned with the prosodic phonology. For instance, the assumption of the universal prosodic hierarchy has been revised several times. What is sure is that there is much more complexity in the prosodic phonology than the theories make people to believe. However, since there has no other systematic theory of the interface between phonology and other components of the grammar, the prosodic phonology still robustly stands, and the fundamental claims of the theory,

such as the prosodic constituents as domains for phonological rule application, as well as the basic model of the prosodic hierarchy, have not been changed.

2.1.3 Basic Tenets in the Prosodic Phonology Theory

2.1.3.1 Direct Reference Approach vs. Indirect Reference Approach

In response to some fundamental questions, such as how the phonological components are organized, which specific syntactic properties will affect application of phonological rules, and how these syntactic properties should be incorporated into phonology, two major theories have been developed separately. On the one hand, one model, which is called Direct Reference Approach (hereafter DRA), argues that phonological rules are directly sensitive to syntactic relations (Manzini 1983, Kaisse 1985, Odden 1987, 1990, 1996, Rizzi & Savoia 1993); on the other hand, the theory proposed by Selkirk (1984, 1986), Nespor and Vogel (1986), and Hayes (1984/1989), among others, which is named Indirect Reference Approach (hereafter IRA), claims that the phonology can only access syntax indirectly, namely, as the surface syntactic structure first has to be mapped onto a prosodic hierarchical structure consisting of different prosodic constituents which are the domains of phonological rule application.

However, one should not think that the DRT advocates for an isomorphism between syntactic and phonological constituents, or that it allows phonological operations to be able to access all sorts of syntactic information. It is necessary to clarify that the amount and type of information

that the DRT allows phonological rules to access is also limited, being constrained to the c-command/m-command relationships, edge conditions, etc (cf. Manzini 1983, Lobeck and Kaisse 1984, among others).

Kaisse (1985) provides the definition of domain c-command as in (3).

(3) Domain c-command

In the structure [Xmax... α ...], Xmax is defined as the domain of α . Then α c-commands any β in its domain.

Based on (3), Kaisse proposes that the domain of a tone sandhi rule application is a c-command domain as in (4).

(4) C-command relation

For a rule to apply to a sequence of two words α and β

(i) α must domain-c-command β or

(ii) β must domain-c-command α .

Based on the principles proposed in (4), Kaisse reanalyzes Kimatuumbi vowel shortening, French liaison, Mandarin tone sandhi, and Ewe tone sandhi. Although, his analyses have been challenged, I will show that c-command relation is indeed one of the crucial parameters for phonological phenomena in certain domain of rule application in the Ningbo dialect, i.e., LTS

within phonological phrase.

There are more recent developments which advocate for a direct mapping between syntax and phonology. Chomsky (2001a) proposes, based on the minimalist notion of a phase, that phases delimit phonological domains or constituents. Seidl's (2001) Minimal Indirect Reference Theory claims that other syntactic relationships such as theta-domains or domains where theta-roles are assigned determine phonological constituency at the phrasal level. Another important view is the one that maintains the spell-out domains (that is, all the constituents included in a syntactic phase except for the head of the phase and elements in the specifier of that phase) are interpreted as phonological constituents in PF (cf. Dobashy 2003, Ishihara 2003, 2007, Kahnemuyipour 2004, Kratzer and Selkirk 2007, Pak 2007, 2008, among others).

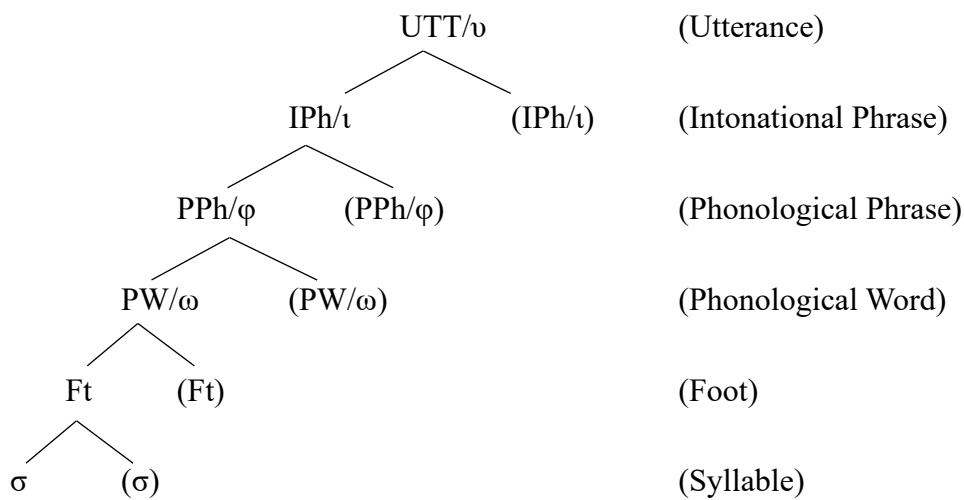
However, balance has certainly been in favor of the Indirect Reference Approach (IRA), which is represented by the prosodic phonology, claiming that phonology accesses syntax only indirectly (cf. 1986, 2007, Selkirk 1978/1981, 1980a, b, 1984, 1986, Nespor & Vogel, Hayes 1984/1989, Chen 1987, Zhang 1992, 2017, among others). Prosodic structure is not isomorphic to syntactic structure although it makes reference to syntactic information. A mapping procedure only allows restricted syntactic information (as well as the prosodic principles) to define various prosodic constituents. Mismatches between syntax and phonology are common, and there is a hierarchically arranged organization mediating in between, which is called Prosodic Hierarchy, consisting of a set of hierarchically arranged prosodic constituents, which are the domains of application of

phonological rules and phonetic operations.

2.1.3.2 Prosodic Hierarchy Theory

As mentioned earlier, prosodic constituents, which is the domain of application of phonological rules, are arranged hierarchically instead of in a flat way. Since it was first proposed by Selkirk (1978/1981), up to the recent studies, the basic inventory of the Prosodic Hierarchy has been surprisingly stable. Selkirk's initial inventory of the Prosodic Hierarchy is given in Figure 1.

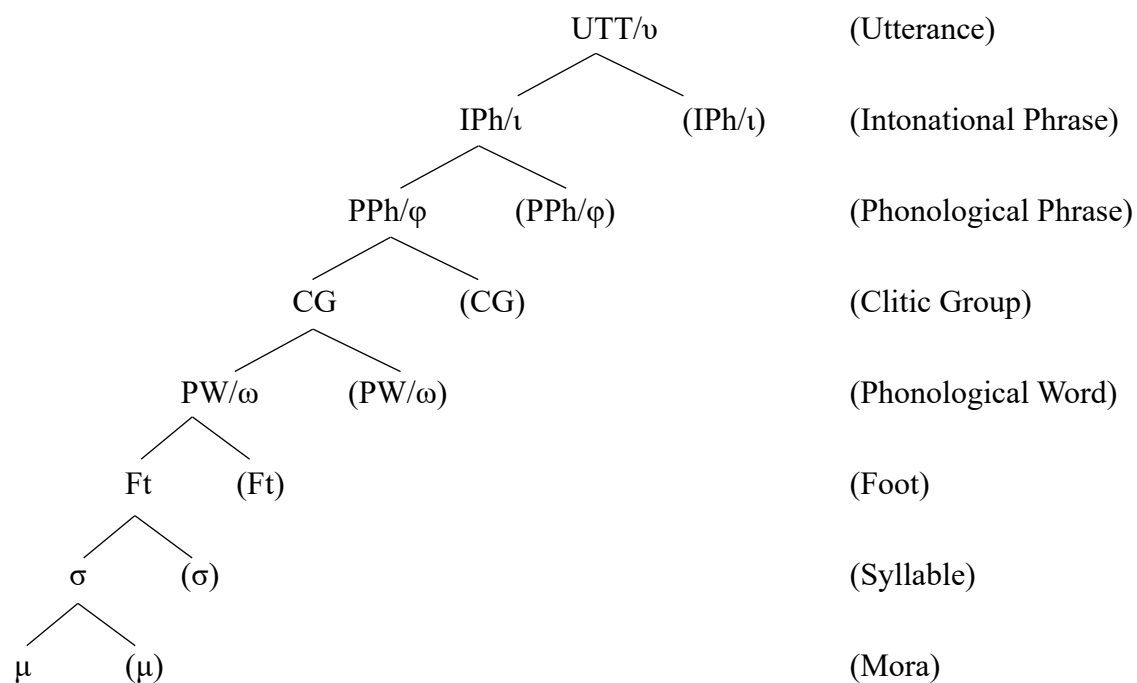
Figure 1. Prosodic Hierarchy (Selkirk 1978/1981)



Although most of researchers agree on the main body of the prosodic hierarchy in Figure 1, there are a variety of concerns about the inventory of the types of prosodic constituents. For instance, the phonological word is labeled as the prosodic word in some instances. Hayes (1984/1989), Nespor & Vogel (1986), and McHugh (1990) propose that there is a constituent called the Clitic

Group between the phonological word and the phonological phrase. Zec (1988) proposes the domain of the mora (μ), which is located at the lowest level in the prosodic hierarchy. A more elaborate version of a universal prosodic hierarchy including eight layers proposed so far can be seen in Figure 2.

Figure 2. Prosodic Hierarchy (elaborate version)



In addition, other constituents of prosodic hierarchy have been proposed. For instance, Condavdi (1990) and Kanerva (1990) claim that further prosodic domains such as minimal phrase and focal phrase are needed. Rice (1993) proposes a constituent called Small Word. However, these claims have not received universal agreement.

The eight levels in the Figure 2 provide the theoretical framework for the analysis of prosodic

domains: the mora (μ), the syllable (σ), the foot (φ), the prosodic word (PW/ ω), the clitic group (CG), the phonological phrase (PPh/ φ), the intonational phrase (IPh/ i) and the utterance (UTT/ v).

The lower constituents in this hierarchy are defined purely phonologically, all constituents above the prosodic word level are mapped onto morphological, morphosyntactic or syntactic structures.

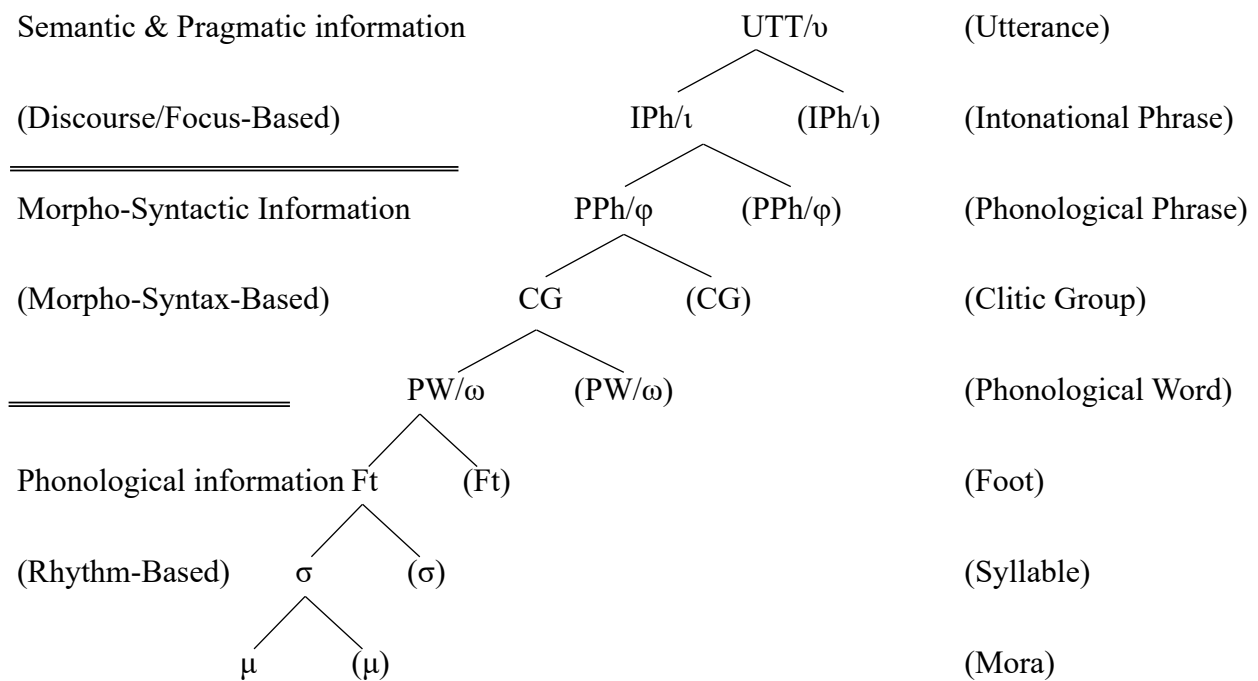
Therefore, the hierarchy can be divided into two groups accordingly, and the separating line is drawn between the foot and the phonological word. The mora and the syllable refer to the domains of stress and other internal phonotactic generalizations like the Sonority Sequencing Principle (Blevins 1995), the foot defines the domain for rhythm generalizations (Hayes 1995). The prosodic word refers to morphological structure, e.g. a stem and its affixes, and is characterized by minimality constraints, phonotactic generalizations, application of phonological processes and other diagnostics (Peperkamp 1997, Hall and Kleinhenz 1999, among others). The clitic group has been proposed to account for phonological patterns which are restricted to combinations of a host word and a clitic, for example, the Latin clitic stress rule (Nespor and Vogel 1986). The phonological phrase and the intonational phrase are mapped to syntactic phrases or clauses and provide constituents for postlexical processes and intonation contours, respectively. Finally, the utterance, as the largest domain in the hierarchy, accounts for phonological processes such as utterance-final lengthening, which applies across constituents and spans sentences.

Zhang (1992, 2007) proposes that the hierarchy can be further divided into a trisected model.

The first separating line can be drawn between the phonological word and the foot as the part

below is the rhythm-based hierarchy since the mora, the syllable and the foot all deal with sonority features as strong and weak. The second splitting line can be laid between the intonational phrase and the phonological phrase as the part above is mainly sensitive to information structure, discourse, pragmatics, etc., so that it can be considered as focus-based hierarchy or the speech-rate-based hierarchy. As for the part in the middle of the prosodic hierarchy, the components in this group are mainly sensitive to various types of morpho-syntactic information, such as the c-command/m-command relations, functional relations, syntactic units, empty categories, and directing of branching, etc. Zhang (1992, 2017)'s tri-division model for the prosodic hierarchy can be shown in Figure 3.

Figure 3. Prosodic Hierarchy (Zhang 1992, 2007)



Nespor and Vogel consider that the phonology of a given language must include the constituents of all the levels. However, such strong assumption is problematic in a way that it thinks prosodic domains as existing independently of given rules or constraints. On the other hand, as discussed earlier, many proposed levels of prosodic structure have been disputed on the basis of both theoretical considerations and language-particular evidence. Nespor and Vogel (1986) discard the mora in their proposal of the hierarchy. Hyman (1982) and Auer (1994) report Gokana and !Xóõ, respectively, in which the syllable does not exist. Hayes (1980) argues that word stress plays no role in some languages, such as West Greenlandic. Kleinhenz (1996) notes that lacking the phonological phrase is characteristic of stress-timed languages. Moreover, the universal existence of Clitic Group has been seriously challenged. This domain is proposed by Nespor and Vogel (1986) and is supported by some analyses (Kabak and Vogel 2001, among others). But there are a number of arguments against the concept (Zec 1988; Inkelas 1989; Zec and Inkelas 1991; Zec 1993; Selkirk 1995; Booij 1996; Peperkamp 1997; Inkelas and Orgun 2003; Zec 2005).

2.1.3.3 Strict Layer Hypothesis

The Strict Layer Hypothesis (SLH) is the well-formedness condition for the geometry of prosodic hierarchy. Selkirk (1984) proposes the SLH to the effect that a category of level n in the prosodic hierarchy immediately dominates only (a sequence of) the categories of level $n-1$, and is exclusively contained in the category of higher level $n+1$. Below shows the reformulation of SLH

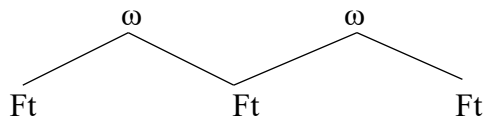
by Nespov and Vogel (1986) in (5).

(5) Strict Layer Hypothesis

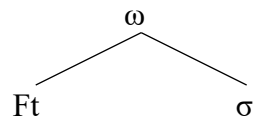
- a. A given nonterminal unit of the prosodic hierarchy, X^P , is composed of one or more units of the immediately lower category, X^{P-1} .
- b. A unit of a given level of the hierarchy is exhaustively contained in the superordinate unit of which it is a part.

If this hypothesis is correct, as Ladd (1996:239) argues, the following types of hierarchies in (6) is not legible in the prosodic hierarchy theory, whereas a structure as in (7) will conform to the Strict Layer Hypothesis.

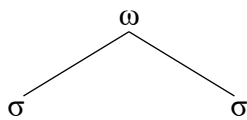
(6) a. Multiple domination



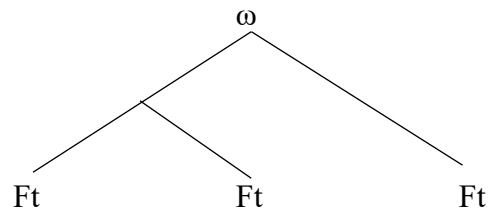
b. Heterogeneous sisters



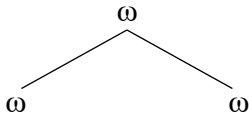
c. Skipping of levels



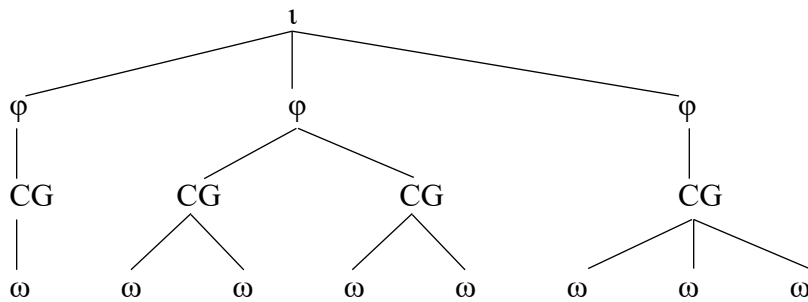
d. Unlabeled nodes



e. Recursion



(7)



As presented above, (6a) violates (5b), and (6b), (6c), (6d), and (6e) violate (5a).

The above representations show that, although the prosodic phonology that deals with mapping between phonology and syntax in early studies is based on X' Theory, phonology has formal properties distinct from that of syntactic structure since recursivity is prohibited by SLH but is commonly seen in syntactic trees. In recent research, a certain amount of evidence has shown that the SLH has been challenged in many languages (e.g. Ladd 1986, 1990; Hyman et al. 1987; Oden 1987; Inkelas 1989; Ito & Mester 2003, 2015; Vogel 2015; Zhang 1992, 2017; Truckenboldt 1995, 1999, among others). Particularly, it seems that recursion of prosodic constituents is allowed.

Within the OT framework, Selkirk (1996) decomposes the Strict Layer hypothesis into four basic constraints as shown in (8).

(8) Constraints on Prosodic Domination

(where C_n = some prosodic category)

(i) Layeredness. No C_i dominates a C_j , $j > i$, e.g. "No syllable dominates a foot."

(ii) Headedness. Any C_i must dominate a C_{i-1} (except if $C_i = \sigma$), e.g. "A prosodic word must dominate a foot."

(iii) Exhaustivity. No C_i immediately dominates a constituent C_j , $j < i-1$, e.g. "No prosodic word immediately dominates a syllable."

(iv) Nonrecursivity. No C_i dominates C_j , $j = i$, e.g. "No foot dominates a foot."

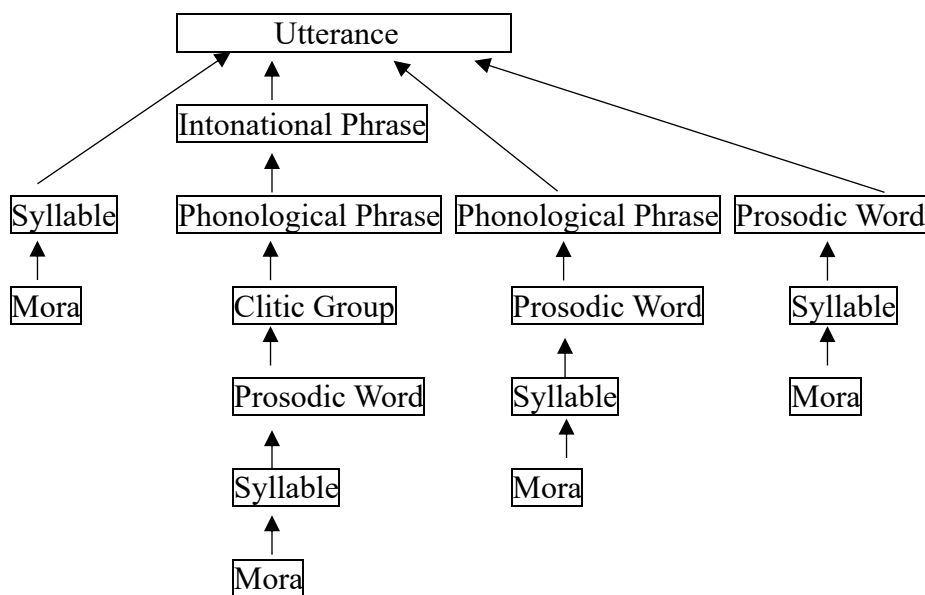
Selkirk argues that, on the one hand, Layeredness and Headedness which together embody the essence of the Strict Layer Hypothesis are the properties that are universal and are not undominated in the constraint ranking in any language, while on the other hand, Exhaustivity and Nonrecursivity appear to be violable on the language-particular base.

However, many examples of the violations of the all four constraints in SLH have been reported across languages (cf. Ladd 1986, 1990; Hyman et al. 1987; Oden 1987; Inkelas 1989; Kanerva 1989; Ito & Mester 1992/2003, 2015; Prince & Smolensky 1993; Mester 1994; Hayes 1995; Vogel 2009, 2015; Zhang 1989, 2014, 2017, among others).

One of such challenges to the SLH comes from the Chinese dialects. Zhang (1989) reports that in old Chongming dialect, while quite a lot of data conform to the SLH, and the prosodic

domain is hierarchically arranged, i.e., ... $\varphi > CG > \omega > \dots$, the CG may dominate both ω (... $CG > \omega > \dots$) and CG (... $CG > CG \dots$), which shows that prosodic recursivity is allowed in old Chongming dialect. Another violation case is found in Pingyao by Zhang (1992), in which the PW may dominate the prosodic domain, such as PPh, thus it violates the Layeredness principle. Zhang further points out that some prosodic constituents can be recursive in Pingyao as well. As for the violation of Exhaustivity, based on the evidence from Mandarin Chinese, Zhang (2014, 2017) proposes a complete prosodic hierarchy as in Figure 4, in which level-skipping or the violation of Exhaustivity principle is allowed.

Figure 4. Prosodic Hierarchy in Mandarin Chinese



Zhang (2014, 2017) points out that it does not make much sense to argue about whether a particular prosodic constituent, such as clitic group, does or does not exist in the prosodic hierarchy

of human languages, because if a particular constituent is not found in one language, it does not undermine its existence in the prosodic hierarchy in general.

Different from Vogel's (1986) proposal, Zhang (1992, 2017) argues that prosodic recursivity is in fact a mirror image of the syntactic recursivity and it only occurs in the morpho-syntax-based hierarchy in Figure 3. Hence Zhang proposes a supplementary principle to the SLH, as provided in (9).

(9) Stipulation of prosodic recursivity

Prosodic recursivity is prohibited between the units of different hierarchies (language-universal), but optionally in the units of the same hierarchy (language-specific).

The principle in (9), on the one hand, solves the theoretical problem caused by the violations of SLH, thus the SLH can still serve as an important theory in the Prosodic Phonology, i.e., a foot cannot dominate a phonological phrase not only because the latter one is at the higher level in the complete hierarchy, but also because they belong to different sub-hierarchies in Zhang's model, namely, the Rhythm-Based Hierarchy and the Morpho-Syntax-Based Hierarchy, respectively. On the other hand, it re-divides the hierarchy into the trisected model as shown in Figure 3.

To sum it up, although the Strict Layer Hypothesis was originally conceived as an inviolable constraint, recent developments have showed that the initial universal assumption regarding the nature of the Strict Layer Hypothesis needed to be relaxed. In this dissertation, a flexible version

of the SLH is adopted.

2.1.3.4 The Relation-Based Approach vs. the Edge/End-Based Approach

Two different approaches can be differentiated within the framework of the prosodic phonology, namely, the Relation-Based Approach (RBA), developed mainly by Nespor and Vogel (1982, 1986) and Hayes (1989), and the Edge/End-Based Approach (EBA), proposed by Selkirk (1986) and Chen (1987). The two main approaches differ in the kind and amount of syntactic information they require access to in the construction of prosodic domains, particularly at the phrasal level. I will start by introducing the main claims of the RBA.

2.1.3.4.1 The Relation-Based Approach

The RBA makes reference to X' theoretic notions of phrase structure, such as head-complement, modifier-head, and specifier-head relations as well as syntactic branching. The RBA recurs only to the edges of syntactic heads or maximal projections, i.e., X^0 and X^{\max} .

Nespor and Vogel's (1986) principles that establish the geometry of the hierarchical structures of prosodic constituents according to the RBA are presented in (10). It should be noted that (10a) and (10b) are subsumed under Selkirk's (1984) Strict Layer Hypothesis.

(10) Principle 1.

A given non-terminal unit of the prosodic hierarchy, X^p , is composed of one or more units

of the immediately lower category, X^{P-1} .

Principle 2.

A unit of a given level of the hierarchy is exhaustively contained in the superordinate unit of which it is a part.

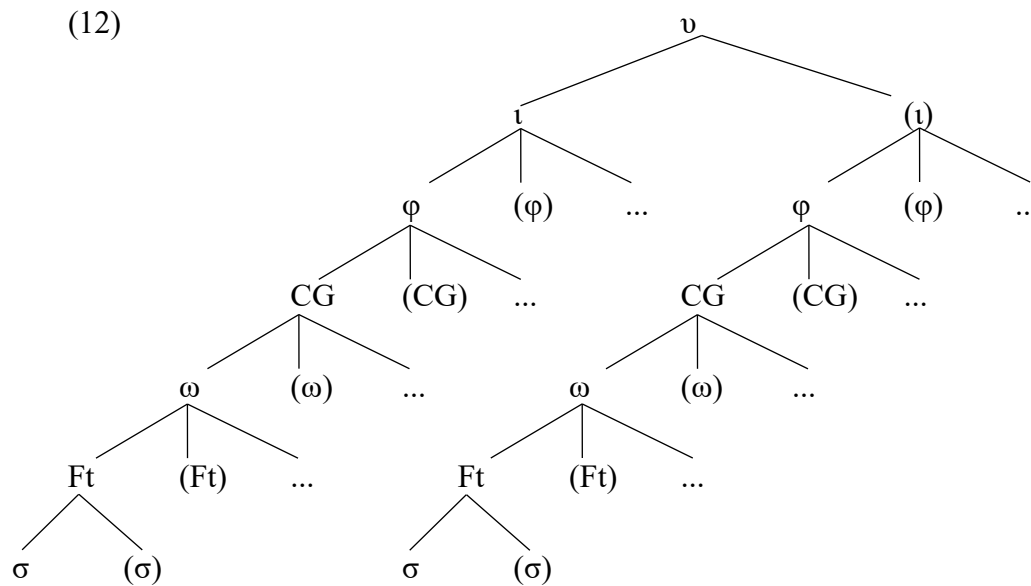
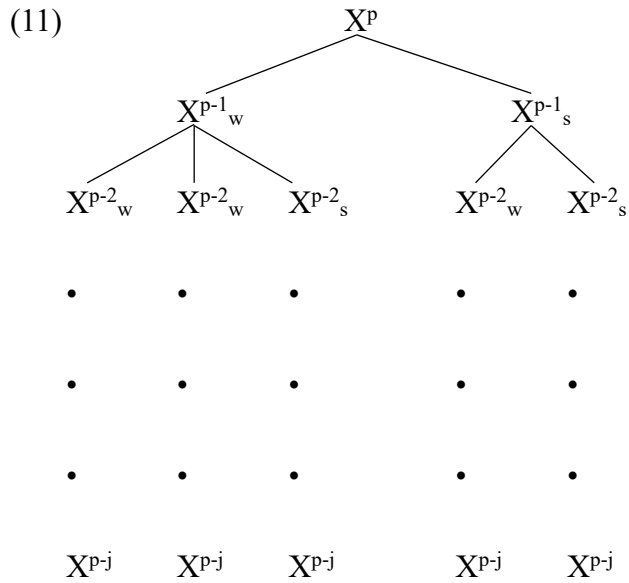
Principle 3.

The hierarchical structures of prosodic phonology are n-ary branching.

Principle 4.

The relative prominence relation defined for sister nodes is such that one node is assigned the value 'strong' (s) and all the other nodes are assigned the value weak' (w).

(11) could be a good example of the phonological representation of the form constructed by the found principles, whereas a structure like (12) would be a good example of a a schematic prosodic tree. At each level, there may be more than one constituent, which are marked by parentheses and dotted lines.



We should be aware that the principles stated in (11) reveal some important differences between syntactic structure and prosodic structure. On the one hand, although prosodic structure has immediate constituent analysis like syntactic structure, namely, each prosodic constituent must

directly dominate its immediate lower-level constituent, one of the fundamental tenets in prosodic phonology is that, unlike syntactic structure, prosodic structure does not allow for recursion or non-layeredness, which is governed by the original version of the Strict Layer Hypothesis.

Nespor and Vogel (1986) propose the algorithms for the formation of the phonological word, as presented in (13).

(13) Phonological word (ω) formation

A. The domain of ω is Q. (Q = terminal element of a syntactic tree) or

B. I. The domain of ω consists of

- a. a stem;
- b. any element identified by specific phonological and/or morphological criteria;
- c. any element marked with the diacritic [+W].

II. Any unattached elements within Q form part of the adjacent ω closest to the stem; if no such ω exists, they form a ω on their own.

Phonological words may thus be the same size as or smaller than the terminal node in a syntactic tree (i.e., Q), as presented in (13A) and (13B), respectively. the Type A refers to the prosodic word that is the same size of the terminal node of the syntactic tree. (e.g., Greek, Latin; cf. N&V: 110-116, Nespor and Ralli 1996).

Type BIa is exemplified by those cases in which each member of a compound word forming

its own phonological word (e.g., Sanskrit, Turkish, Italian; cf. N&V: 117-122, Nespor and Ralli 1996). Type BIb refers to the cases in languages such as Hungarian, where prefixes can form independent prosodic word, as well as Italian, where only certain prefixes can form their own prosodic word domain (cf. Nespor & Vogel 1986: 122-134). Type BIb is also exemplified by the cases in languages such as Yidiñ, in which affixes satisfying minimal word requirements form their own prosodic words (cf. Nespor & Vogel 1986: 134-136). Type Ic refers to affixes which are idiosyncratically specified to form independent words, as in Dutch (cf. N&V: 136-140), hence the diacritic [+w].

Regarding Type BII, with respect to the necessity of obeying the Strict Layer Hypothesis, elements that do not qualify as stems, such as conjunctions, complementizers and clitics, also form a ω , either by attaching to a ω within Q or by themselves.

The clitic group is defined as follows in (14) by Nespor and Vogel (1986: 154). The existence of the clitic group as a prosodic constituent is proposed based on the observation that there are phonological rules that make reference to the sequence formed by a lexical word and the clitic that attaches to it (cf. Cohn 1989, Hayes 1984/1989, Nespor & Vogel 1986, among others).

(14) Clitic Group Formation

The domain of C consists of a ω containing an independent (i.e. nonclitic) word plus any adjacent ω s containing

- a. a DCL, or

- b. a CL such that there is no possible host with which it shares more category memberships.

Following Klavans (1982), this definition assumes that there are elements lexically specified as clitics, with the mark [+CL]. DCL and CL stand for directional and nondirectional clitics, respectively. DCLs are idiosyncratically specified for directionality of attachment, i.e., as proclitics or enclitics. CLs would be those that only require an adjacent host. The clitic group is located between the prosodic word and the prosodic phrase in the prosodic hierarchy.

However, there are a number of criticisms against the notion of the clitic group as a prosodic constituent. Inkelas (1990) points out that these rules can be reanalyzed as applying either in the phonological word or in the phonological phrase. Therefore, adding the clitic group as a prosodic constituent in the hierarchy may undermine the Strict Layer Hypothesis. However, Zhang (1992, 2017) proposes a supplementary principle to SLH, as presented in (9), which allows recursivity to happen in the morpho-syntax-based hierarchy. The same position is adopted by Zec (1988, 1993), Selkirk (1995), and Booij (1996), among others. Moreover, it has been reported in the literature that, if the clitic group is treated as an independent prosodic constituent, the distinction between proclitics and enclitics cannot be accounted for since the former one usually shows a strong tendency to connect with the host while the latter does not.

The formation for the phonological phrase is stated in (15) (taken from Bickmore 1990).

Reference is made to the recursive and the non-recursive side of a head. The recursive side is the direction of branching (i.e., of complementation) in a language, whereas the non-recursive side is the opposite side, that is, the side where specifiers are located.

(15) Phonological phrases formation

Phonological phrase contains: a head X and all elements on the non-recursive side of the head which are still within X_{max}.

Parameters:

- a. obligatory, optional, or prohibited inclusion of the first complement on the recursive side of X.
- b. this complement may branch or may not.

Most, if not all, proponents of this definition assume the syntactic model of Chomsky (1981), in which functional categories are considered specifiers or modifiers located on the non-recursive side of heads. This is illustrated in Nespor & Vogel (1986) by the rule of Raddoppiamento Sintattico (RS hereafter) in Italian, which is analyzed as applying across two words located in a phonological phrase. By RS, the initial consonant of a word is lengthened when it is following a word ending in a stressed vowel. The consonant to be transformed into a geminate must be followed by a sonorant, specifically a vowel or other non-nasal sonorant. Examples of the contexts in which RS applies are marked with '=', and those in which it does not are marked with '/', as

given in (16).

- (16) a. Avrá = trovato il pescecane. (s)he-will-have found the shark
 '(S)he must have found the shark'
- b. Devi comprare delle mappe di città // molto vecchie. you-must buy some maps of
 city very old
 'You must buy some very old city maps'

The sentences in (16) are structured in phonological phrases as indicated in (17) following the phonological-phrase-formation algorithm expressed in (15), where φ stands for phonological phrase.

- (17) a. [Avrá_trovato] $_{\varphi}$ [il pescecane] $_{\varphi}$
- b. [Devi comprare] $_{\varphi}$ [delle mappe] $_{\varphi}$ [di città] $_{\varphi}$ # [molto vecchie] $_{\varphi}$

Apart from Nespor & Vogel, this paper refers the reader to Cho (1990), Condoravdi (1990), Kidima (1990), McHugh (1990), Rice (1991), Hayes and Lahiri (1991), Zsiga (1992) and Frota (2000), among others, for discussion on prosodic phrase levels of the Prosodic Hierarchy. The relevance of different aspects of syntactic structure in the formation of phonological phrase as rule application domain, such as branching, head-complement relation, are well examined. It should be noted, however, due to the new developments in syntactic theory since the late 1980s, the definition

of phonological phrase in the Relation-Based Approach should be reformulated.

The intonational phrase (I) and the utterance (U) are the higher levels in the prosodic hierarchy.

Nespor & Vogel (1986) propose the following rule of Intonational Phrase Formation, as provided in (18)

(18) Intonational Phrase Formation

An ι domain may consist of

- a. all the φ s in a string that is not structurally attached to the sentence tree at the level of s-structure, or
- b. any remaining sequence of adjacent φ s in a root sentence.

Is may be reconstructed, like φ s. In the examples above from Italian, a non-branching complement may restructure and form part of one φ with the verb. Nespor & Vogel point out that a sentence such as (19) can be pronounced as one ι (20a), or as smaller *is* (20b, 20c):

(19) My friend's baby hamster always looks for food in the corners of its cage.

(20) a. [My friend's baby hamster always looks for food in the corners of its cage] ι

b. [My friend's baby hamster] ι [always looks for food in the corners of its cage] ι

c. [My friend's baby hamster] ι [always looks for food] ι [in the corners of its cage] ι

Length or syntactic branching is only one of the factors that can play a role in restructuring

operation. Nespor & Vogel also point out that rate of speech, style and contrastive prominence (i.e., focus) may affect the partition of sentences optionally.

The Utterance (U) is the highest constituent in the Prosodic Hierarchy. It is mostly isomorphic with the syntactic constituent that could be called a sentence, a CP (X^n , in Nespor and Vogel's terminology) dominating all other nodes in the syntactic structure. Nespor & Vogel propose the formation of U as in (21) below:

(21) Phonological Utterance Formation

The domain of U consists of all the I s corresponding to X_n in the syntactic tree.

More discussion on I s and U s as levels of the Prosodic Hierarchy can be found in Hayes (1989), Nespor (1990), Vogel and Kenesei (1990) and Frota (2000), among others.

2.1.3.4.2 The Edge/End-Based Approach

The proposal in the Edge/End-Based Approach (EBA) is that the mapping between syntactic structure and prosodic structure above the foot and below the intonational phrase refers to the left or right edge of syntactic heads or maximal projections. This claim is a generalization of Chen's (1985, 1987) proposal for the domain of tone sandhi in Xiamen Chinese, in which, Chen argues that the domain of tone sandhi in Xiamen is blocked by the right edges of X_{\max} . Following Chen, Selkirk (1986) proposes parameters for the mapping between syntactic structure and prosodic

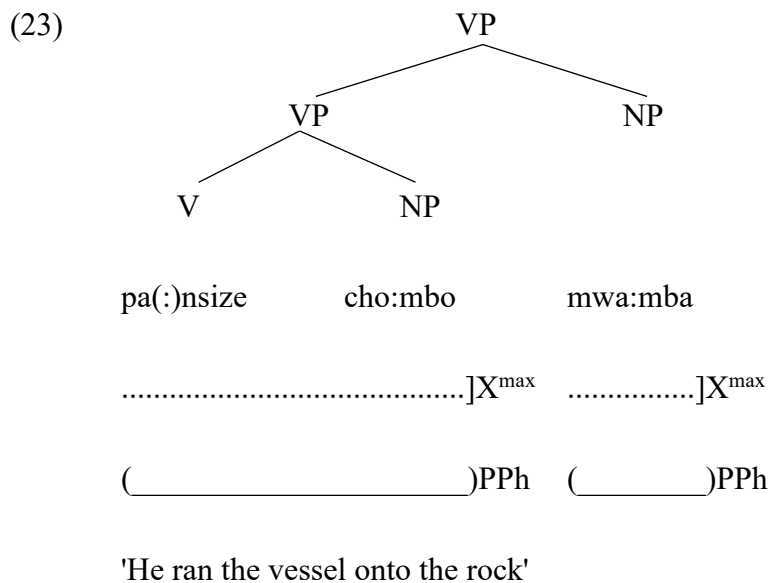
structure, as posited in (22):

(22) End parameter settings:

(i) a.]_{Word} b. Word[

(ii) a.]_{X_{max}} b. X_{max}[

Thus, two prosodic constituents are recognized: the string falling between two word-boundaries is a prosodic word, as in (22i), and the string contained between two boundaries of maximal projections is a major phonological phrase, as in (22ii). In ChiMwiini (Selkirk 1986), for example, the domain of application of stress assignment is assigned at the phrasal level, which is delimited by the right edge boundaries of the maximal projection]_{X_{max}}, as exemplified in (23).



As shown above in (23), in ChiMwiini, the verb *pa(:)nsize* and its complement *cho:mbo* form

one domain of phonological phrase, and the adjunct NP forms its own phonological phrase domain. The two phonological phrase domains are separated by the right-edge boundary of the complement NP, which is identified as the right edge of maximal projection.

It should be noted that as stated in Selkirk's (1984) Principle of the Categorical Invisibility of Function Words (PCI), in the Edge/End-Based Approach, function words' boundaries do not count for the mapping between syntactic and prosodic structure, and are included in larger prosodic domains. Selkirk (1984, 1986) and Shen (1990) claim that, in Chinese, the combination of function words with an adjacent lexical item is determined by the edge of X^0 or X^{\max} . However, Zhang (1992, 2017) argues that the TS of function words is not simple enough to be accounted for by one lone principle, i.e., EBA. In this dissertation, I will show evidence that the syntactic relationship holding between functional words and lexical items acts as a constraining force in the interface between syntax and phonology.

2.1.3.4.3 The Edge/End-Based Approach within Optimality Theory

With the naissance of Optimality Theory, Selkirk (1995, 2000), Truckenbrodt (1995, 1999, 2002), Sandalo and Truckenbrodt (2002) and Prieto (2006), among others, view the interactions between syntax and phonology as the result of evaluating candidates of prosodic phrasings of the input syntactic structure by a ranked set of violable constraints which it best satisfies.

As mentioned earlier, Selkirk (1996) defines two distinct phrase-level alignment constraints,

which later is discussed by Truckenbrodt (1995, 1999), namely $A_{\text{ALIGN-R}}(XP, \varphi)$ and $A_{\text{ALIGN-L}}(XP, \varphi)$, calling for the right or the left edges of the syntactic constituents to match up with edges of corresponding prosodic constituents. The hypothesis is in the sense that languages can differ in which type of Align XP is responsible for prosodic phrasing patterns.

Selkirk (1996) breaks down the Strict Layer Hypothesis into four basic constraints within the framework of OT, as previously given in (8) and represented in (24).

(24) Constraints on Prosodic Domination

(where C_n = some prosodic category)

(i) Layeredness. No C_i dominates a C_j , $j > i$, e.g. "No syllable dominates a foot."

(ii) Headedness. Any C_i must dominate a C_{i-1} (except if $C_i = \sigma$), e.g. "A prosodic word must dominate a foot."

(iii) Exhaustivity. No C_i immediately dominates a constituent C_j , $j < i-1$, e.g. "No prosodic word immediately dominates a syllable."

(iv) Nonrecursivity. No C_i dominates C_j , $j = i$, e.g. "No foot dominates a foot."

Truckenbrodt (1995, 1999) analyzes the asymmetry between Kimatuumbi-ChiMwiini and Chicheŵa as the effect of two other constraints, $W_{\text{RAP-XP}}$ and N_{ONREC} . $W_{\text{RAP-XP}}$ demands that each lexically headed XP must be contained in the same phonological phrase, i.e., without having the words in the XP in separate phonological phrases. $W_{\text{RAP-XP}}$ is compatible with $A_{\text{ALIGN-XP}}$ when

a bigger or more inclusive XP containing two or more XPs projecting right edges of phonological phrases is still wrapped together in one phonological phrase. This would be the case where a XP wrapped as a phonological phrase but containing two or more XPs whose edges are aligned with the right edge of phonological phrases as well. Whether to ban or to allow such recursivity of phonological phrases is the role of NONREC. In Kimatuumbi such recursive structures are allowed, which conforms to ALIGN-XP and WRAP-XP but violates NONREC. In Chicheŵa, however, a VP forms a single phonological phrase, respecting WRAP-XP and NONREC but violating ALIGN-XP. Thus, in Kimatuumbi, the constraints of ALIGN-XP and WRAP-XP is higher than NONREC while in Chicheŵa WRAP-XP and NONREC are higher than ALIGN-XP.

Moreover, in Chicheŵa, narrow focus plays a role as a constituent bearing narrow focus is phrased separately. Truckenbrodt (1995, 1999) introduces another constraint ALIGN-FOC (ALIGN (FOC, R; φ , R)), which demands that each focused constituent is right-aligned with a phonological phrase boundary. Truckenbrodt (1999) argues that ALIGN-FOC has to be ranked above WRAP-XP in order to enforce violations of WRAP-XP.

In addition to constraints such as ALIGN and WRAP-XP that refer to syntactic information, other purely prosodic constraints imposing conditions on size and balancing of phonological phrases have been introduced in the literature. For instance, Uniformity (phonological phrases must be of equal length, i.e., containing the same number of prosodic words; cf. Ghini 1993, Sandalo and Tuckenbrodt 2002, Prieto 2005, 2006), Symmetry (a string is divided into phonological phrases

displaying a symmetrical distribution of length, i.e., $(ww)\varphi (w)\varphi (ww)\varphi$ is better than $(w)\varphi (ww)\varphi (ww)\varphi$; cf. Ghini 1993), Increasing Units (phonological phrases on the recursive side are heavier, i.e., contain more prosodic words than those in the nonrecursive side; cf. Ghini 1993), Binary-MaP (a major phrase/phonological phrase must contain minimally and/or maximally two minor phrases, i.e., prosodic words; cf. Selkirk 2000, Prieto 2005, 2006), or Maximum-MaP (a major phrase/phonological phrase must not contain more than a language-specific maximum number of syllables or of levels of prosodic branchingness; cf. Elordieta, Frota and Vigário 2005).

2.1.3.4.4 Summary

In the section 2.1.3.4, two different approach developed in the prosodic phonology theory, namely, the RBA and EBA, have been reviewed. It is not easy to show the superiority of the EBA over the RBA or vice versa, as most of phonological phenomena could receive a satisfactory analysis under both approaches. Bickmore (1990) and Cho (1990) compare both models and reach opposite conclusions. Also, Chen (1987, 1990) suggests the possibility that phonological domains in one language may be constructed following the EBA but that certain relation-based considerations may also play a role.

2.1.3.5 The Metrical Approach

The metrical approach is first developed as a theory concerned with stress phenomena in

natural languages (Lieberman & Prince 1977, Hayes 1981), as a response to Chomsky & Halle's (1968) proposal of a linear analysis that stress is segmental. The metrical approach is a theory dealing with the hierarchical organization of segments into syllables, syllables into feet, and so on into higher-level structure. The concept of the foot as an accentual domain stems from the pioneering work on phrasal and word stress by Lieberman (1975) and Lieberman & Prince (1977). Early research assumes that stress is an individual property/feature of a given segment (or syllable) (cf. [\pm stress] in Chomsky & Halle's 1968), but later developments leads to the complete abandonment of the feature [\pm stress], and instead, to the proposal of a relational category in between the syllable and the prosodic word: the metrical foot (Selkirk 1978b, 1980: 570; Prince 1980 and Hayes 1980). Each foot contains no more than one head (the metrically strong constituent, generally realized with greater relative prominence) and a non-head (the metrically weak constituent). The recognition of this constituent between the syllable and the prosodic word has brought about quite a lot of discussions (e.g. Kiparsky 1979; Yip 1980; van der Hulst and Smith 1982; Leer 1985; McCarthy 1982; Hammond 1984; Hyman 1985; McCarthy & Prince 1986/1996; Nespor & Vogel 1986; Halle & Vergnaud 1987; Kager 1989; Itô & Mester 1992/2003; Rice 1992; Kenstowicz 1993; Hayes 1995; Bennett 2012; Harris 2013 among many others). By assuming that syllables are grouped into feet rather than directly linked to the prosodic word, a wide range of phonological and morphophonological phenomena can be accounted for.

In Halle and Vergnaud (1987), the construction of stress template in a language is determined

by setting a limited number of parameters, such as headedness, directionality and boundaries, the purpose of which is to add constituent boundaries at particular position in a sound string, such as the left of the right edge of a syllable.

The earliest works on Chinese phonology that assumes the metrical approach include Chen's (1979, 1980, 1984, 2000) studies on Chinese poetry as well as Wright's (1983) research on the Fuzhou tone sandhi phenomena. Following them, there were Duanmu (1991, 1992, 2000a, 2007) and Hsiao (1991) with their emphasis on Taiwan folksongs and Mandarin Chinese, respectively.

Duanmu (1991, 1992, 2000a, 2007) argues that Chinese syllables can be divided into two kinds, full (or heavy) and weak (or light). They differ in rime duration, rime reduction, the ability to carry (or hold on to) a lexical tone, and whether they can be stressed. He claims that full syllables hold on a lexical tone while weak syllables don't, and the former ones can be stressed but the latter one cannot, i.e., *maa-ma* 'mother'. He argues that the stress difference between heavy and light syllables can also be explained by the Weight-Stress Principle (WSP), stated in (25).

(25) The Weight-Stress Principle (WSP):

A syllable is stressed if and only if it is heavy.

Duanmu (1999, 2000) then proposes that the basic metrical structure in Chinese includes both the moraic trochee (left-headed moraic feet) and the syllabic trochee (left-headed syllabic feet), which can be called the dual-trochee. A minimal dual-trochee is made of either a full syllable and

a weak syllable (heavy-light) or two full syllables (heavy-heavy), as shown in (26).

(26)	heavy-light	heavy-heavy
	x	x
Syllabic trochee:	(σ σ)	(σ σ)
Moraic trochee:	(MM) . M	(MM) . (MM)
	x	x x

As for the stress assignment issue, Duanmu (2000) proposes that in compounds and phrases stress is assigned to the syntactic non-head. The rule is called Non-head Stress Principle, shown in (27).

(27) Non-Head Stress Principle

In the syntactic structure [X XP] (or [XP X]), where X is the syntactic head and XP is the syntactic non-head, XP should be stressed.

He then argues that this principle can be predicted by the Information-Stress Principle, as stated in (28).

(28) The Information-Stress Principle:

A syntactic constituent that carries more information than its neighbor(s) should be stressed.

According to Duanmu, in standard X-bar syntax, the head is an element at the word or affix level, and a nonhead is an element at the phrase level. Since there are more possible phrases than possible words or affixes, the occurrence of a nonhead (phrase) is less predictable than the occurrence of a head (word or affix)

In light of his stress theory of Mandarin Chinese, Duanmu argues that the word length variation in Chinese is motivated by the metrical need that phrase stress must fall on a disyllabic foot when discussing the well-known word length asymmetry between [M N] compounds (*[1 2]) and [V O] phrases (*[2 1]) in Mandarin Chinese. He further extends his theory to the third tone sandhi in Mandarin Chinese by arguing that variability is accounted for by whether two syllables are ‘adjacent’, as defined by the foot structure and syntactic constituency, and whether the following syllable is a T2 that came from T3.

2.1.4 Summary

In this section I provide a general review of the Prosodic Phonology Theory which argues for an indirect mapping between phonology and morpho-syntax by introducing a hierarchically arranged structure that intermediates in between and serves as the domains of phonological rule application and phenetic processes. I outline the development of the theory as well as some basic tenets within the framework including the prosodic structure, prosodic hierarchy, the early version

and the weakened version of Strict Layer Hypothesis, the comparison of the Relation-Based Approach and the Edge-End Based Approach, the new development of the prosodic phonology under OT as well the metrical approach.

To account for the phonological phenomena in the Ningbo dialect discussed in this study, I assume the basic claims and tenets in the prosodic phonology theory and tentatively adopt the universal prosodic hierarchy as presented in Figure (2) and Figure (3).

Since there is no phonological evidence reported to support the idea that mora plays an important role in application of any phonological phenomena in Ningbo dialect, and Chinese has been considered as a non-quantifier-sensitive language (cf. Chan 1985, Zhang 2014, 2017, among others), I will not talk about the mora as a prosodic constituent in this dissertation. Although there are some previous studies which claim that, in Chinese dialects, the mora is the tone-bearing unit (cf. Duanmu 1990, Chan 1998). Such claim has been proved to be problematic (cf. Nespor & Vogel 1986, 2017, Zhang 2017, among others). As pointed by Zhang (2018), the tone bearing unit of the Ningbo dialect is word or higher level unit, while the tone bearing unit of Mandarin is syllable.

Moreover, by adopting the Strict Layer Hypothesis (SLH) in my study in Ningbo dialect, I will adopt its weakened version, in which, the violation of Nonrecursivity, Layeredness, Headedness and Exhaustivity may be allowed as suggested by Zhang's (2017) stipulation as in (9).

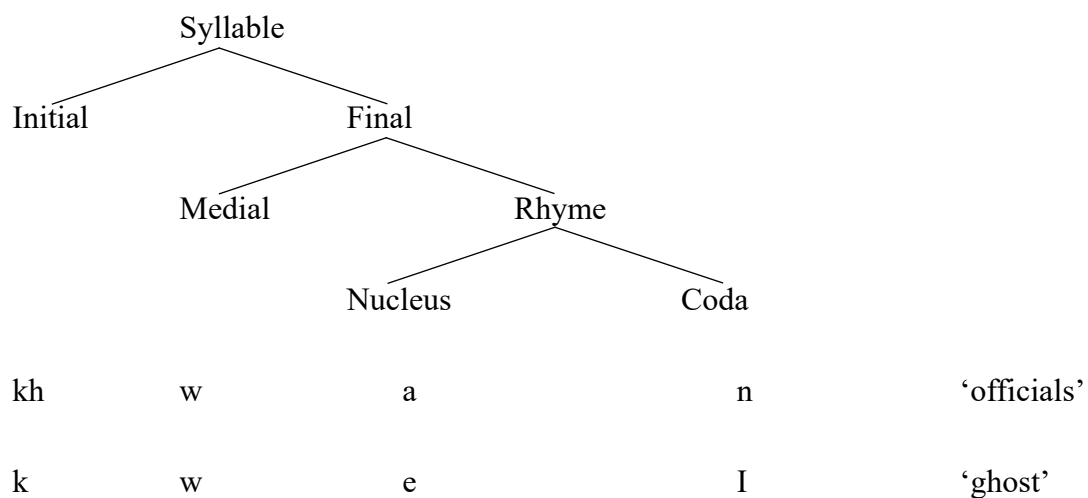
2.2 Descriptive Background

Before moving to discuss the prosodic phonology in the Ningbo dialect, I would like to briefly present a description of the Ningbo dialect's phonological system including its segmental inventory and tonal inventory as well as some tone sandh phenomena. This section consists of three parts. The first part is an overview of the segmental inventory of the Ningbo dialect, and the second part provides the tonal inventory, while the third part will introduce a special phonological phenomenon called *heyinci* 合音词 (combined-pronunciation word).

2.2.1 Syllable Structure of the Ningbo Dialect

In Chinese philological literature, a Mandarin syllable is divided into five components. They are consonantal initial, medial, nucleus, coda and tone. The hierarchical structure of the syllable in Mandarin is shown in (29):

(29) Syllable structure in mandarin Chinese



The ‘initial’ is the onset. The ‘final’ includes the medial (onglide, like [w] or [y]) and the rhyme. The rhyme consists of a nucleus and an optional coda, which can be either an offglide, such as [i], or a consonantal ending, such as [n] in Mandarin, which can also be a glottal stop coda [ʔ] in Ningbo dialect. The nucleus is the only obligatory segmental element in a Chinese syllable.

A simpler formula can be used to represent these elements of a Mandarin syllable, i.e. ‘(C)(M)V(E)’ (Hsueh 1980). In this formula, ‘C’ stands for the initial, ‘M’ for the medial, ‘V’ for the nucleus, and the ‘E’ for the coda. The elements put in parenthesis are optional. In other words, all of the segmental elements can be omitted except the nucleus. A syllable with a nuclear vowel but without coda is called an open syllable, such as [ma] 'horse' in Standard mandarin. A syllable with a nucleus and a consonant or vowel coda ([i] or [u]) is called a closed syllable.

The aforementioned formula and the description of syllable structure in (29) can also be used to represent a syllable of Ningbo dialect. In Ningbo dialect, only V is the mandatory segmental element, C, M and E are optional.

2.2.2 Initial Consonants of the Ningbo Dialect

Based on the analysis of the data that I collect, there are altogether 27 initial consonants plus one zero initial found in Ningbo dialect, which are presented in the following Table 1:

Table 1. Ningbo Dialect Initials

Labials	p	ph	b	m	f	v
---------	---	----	---	---	---	---

Alveolars	t	th	d	n		l
Dental Sibilants	ts	tsh	dz		s	z
Palatals	tɕ	tɕh	dʒ		ɕ	ʒ
Velars	k	kh	g	ŋ	h	ɦ
Zero Initial	∅					

It is noteworthy that the palatal initials [tɕ, tɕh, dʒ, ŋ, ɕ, ʒ] can only combine with the finals that have the [j] or [y] medial or the [i] nucleus, but neither can the velar initials [k, kh, g, ŋ, h, ɦ] nor can the dental sibilant initials [ts, tsh, dz, s, z]. Therefore, the palatal initials are in the complementary distribution with the velar and the dental sibilant initials. The palatals can be considered as the variants of the velars through the palatalization process, i.e., [tɕjã] ‘general’ vs. [kã] ‘hole’, [tɕhyoʔ] ‘lack’ vs. [khoʔ] ‘shell’, [ɕyoʔ] ‘blood’ vs. [hoʔ] ‘to give away’. A similar phenomenon can be found in the Standard Mandarin (Chao 1968), i.e., [tɕia] ‘family’ vs. [ka] ‘card’, or [tɕhyoŋ] ‘poor’ vs. [khoŋ] ‘hole’.

It suffices to note that in old Ningbo dialect (Tang, You & Chen, 1990), there were 28 consonant initials plus a zero initial, i.e. [ŋiŋ] 宁 ‘peaceful’, [ɲy] 女 ‘female’, while in modern ND, the initial [ŋ] has merged with [n], i.e., [niŋ] 宁 ‘peaceful’, [ny] 女 ‘female’. However, the syllables with the [n] initial in modern ND actually falls into two sub classes: (i) with the glide [j] or [y] or with the nucleus [i]; (ii) without the glide [j] or [y] nor the nucleus [i]. If we trace it back,

historically speaking, the former class, obviously, used to be [ŋ] in old ND. Examples are listed below in (30):

(30)	Class (i)	vs.	Class (ii)
	[ny] 'female'		[naʔ] 'to accept'
	[niŋ] 'peace'		[nɲŋ] 'be able to'

In Tang, You and Chen's (1990) study on the old Ningbo, the morphemes [ŋy] 'female' and [niŋ] 'peace' have the [ŋ] initial, while now, no matter in phonetic experiment or according to native speaker's instinct, it does not have any difference from the initial [n]. In the old Ningbo, the initial [n] never combines with a final starting with the glide [j] or [y] or with the nucleus [i]. Therefore, while in the old Ningbo the initials [ŋ] and [n] are in a complementary distribution relationship, in modern Ningbo dialect, they merge together.

It should be pointed out that the zero initial is normally transcribed as \emptyset in previous studies, and it can only be combined with the *yin* tonal category (e.g., Tang, You & Chen 1990, among others). It has been reported that a syllable begins with the zero initial [\emptyset] phonetically is optionally pronounced with a glottal stop initial [ʔ] in old Ningbo dialect (e.g., Tang, You & Chen 1990, among others).

Moreover, there are some variants of certain initials when they combine with certain finals. For example, when the labial initial [f] combines with the monophthong final [u], it may change

to [ɸ] optionally, i.e., [ɸu], 'rich'. The velar initial [ŋ] may change to [β] when it goes with the final [u], i.e., [βu] 'lake'.

Examples of the Ningbo dialect initials are listed as below in (31).

(31)	[p]	布	pu ⁵¹	'cloth'	[ph]	胖	pɔ̃ ⁵¹	'fat'
	[b]	旁	bɔ̃ ¹³	'side'	[m]	忙	mɔ̃ ¹³	'busy'
	[f]	飞	fi ⁵¹	'to fly'	[v]	文	veŋ ¹³	'article'
	[t]	多	tɕu ⁵¹	'many'	[th]	汤	thɔ̃ ⁵¹	'soup'
	[d]	达	daʔ ¹³	'to reach'				
	[n]	女	ny ¹³	'female'	[l]	辣	laʔ ¹³	'spicy'
	[ts]	作	tsɔʔ ⁵	'to do'	[tsh]	草	tshɕu ⁴⁵	'grass'
	[dʒ]	瓷	dʒɿ ¹³	'porcelain'				
	[s]	四	sɿ ⁵¹	'four'	[z]	市	zɿ ¹³	'city'
	[tɕ]	九	tɕɛy ⁴⁵	'nine'	[tɕh]	秋	tɕhy ⁵¹	'autumn'
	[dʒ]	近	dʒiŋ ¹³	'close'				
	[ɕ]	休	ɕy ⁵¹	'to rest'	[z]	寻	ziŋ ¹³	'to look for'
	[k]	高	kɕu ⁵¹	'high'	[kh]	客	khaʔ ⁵	'guest'
	[g]	共	goŋ ¹³	'together'	[ŋ]	咬	ŋɕu ¹³	'to bite'
	[h]	好	hɕu ⁴⁵	'good'	[ɦ]	鞋	ɦa ¹³	'shoe'
	[∅]	衣	i ⁵¹	'clothes'				

2.2.3 Syllable Finals of the Ningbo Dialect

There is a total of 43 finals in the ND, which are listed below in (33). Finals occurring with entering tone are marked by glottal stop [ʔ]. The nasalized finals are all marked with a wave symbol above them. In Tang, You and Chen's (1990) study, there were 50 finals in old ND. However, as shown above, many finals have merged.

(33) Ningbo Dialect Finals

Monophthong: Apicals: ɿ, ʉ

High: i, y, u

Mid: e, ø, ε, o, ɔ, ə, ɐ

Low: a

Diphthong: ja, je, jo, ua, ue, uo, ɤi, ɤu, əy

Triphthong: uɤi

Nasalized: ã, jã, uã, õ, uõ

With [ŋ] coda: ɤŋ, iŋ, uɤŋ, əŋ, oŋ, yoŋ

With glottal stop [ʔ] coda: aʔ, jaʔ, uaʔ, oʔ, yoʔ, jeʔ

Syllabic consonant: [ṁ], [ṅ], [ŋ]

There are 12 monophthongs in modern ND. The first two are apical [ɿ, ʉ], which only appear

after the dental sibilant initials [ts, tsh, dz, s, z]. Look at the following pairs as examples: [dzɿ] 'porcelain' and [dzɿ] 'pig', [sɿ] 'four' and [sɿ] 'water'.

2.2.3.1 High vowels

[i], [u], and [y] are ordinary high vowels, similar to those in Standard Mandarin. Some examples are shown below in (34):

(34)[phi] 'to lie/cheat' [ɬzu] 'ancestor' [ny] 'female'

Moreover, all the three high vowels can serve as the second part of a rhyme, namely the coda.

For example:

(35)[pɛi] 'cup' [dɛu] 'many' [lɔy] 'building'

All three high vowels can occur before a non-high vowel, in which case they are written as offglides here, as shown in (36).

(36)[tja] 'dad' [kua] 'strange' [nyoʔ] 'meat'

2.2.3.2 Mid Vowels

The Ningbo dialect has seven high-mid vowels: [e], [ø], [ɛ], [o] [ɔ], [ə] and [ɐ]. They can either appear independently or together with other elements or form a final.

Let's compare [e]/[o] with [ɛ]/[ɔ]. Both [e] and [o] can appear after a palatal medial [j], but neither can [ɛ] nor [ɔ]. [ɛ] can go after [u] to form a diphthong [uɛ] while [e] cannot. Moreover, [ɔ] can be nasalized while [o] cannot, but [o] can precede a nasal coda [ŋ] or a glottal coda [ʔ] while [ɔ] cannot. Apparently, when forming a non-monophthong final, [e] vs. [ɛ], [o] vs. [ɔ] have a complementary distribution relationship. Examples are listed as below in (37).

- | | | | | | |
|------|-------|--------------------|-----|---------|------------|
| (37) | [ɛje] | 'release; let out' | vs. | [kuɛ] | 'to close' |
| | [pjo] | 'to mark' | vs. | [nyoʔ] | 'meat' |
| | [huo] | 'flower' | vs. | [khuɔ̃] | 'mine' |
| | [soŋ] | 'pine' | vs. | [khɔ̃] | 'healthy' |

However, when they form a monophthong final, respectively, they are not in complementary relationship, as presented in (38).

- | | | | | | |
|------|-------|-----------|-----|-------|---------|
| (38) | [fiɛ] | 'to harm' | vs. | [fiɛ] | 'salty' |
| | [tso] | 'car' | vs. | [tso] | 'grass' |

The mid-high front rounded vowel [ø] only appears in a monophthong final, such as [sø] 'sour'.

The central vowel [ə] only appears in few characters, such as [ə] 'son.' These syllables all only have the nucleus [ə]. In other words, they do not have initial, glide or coda. It is in complementary distribution relationship with the mid front vowel [e] and [ɛ], which never show up in the same

situation.

For [ɐ], although it could be transcribed as a mid-low vowel, apparently, it is in complementary distribution with the low vowel [a].

2.2.3.3 Low Vowels

There is only one low vowel in the Ningbo Dialect, [a]. It can form a monophthong final or show up together with the offglides [i] or [u]. As mentioned above, [a] is in a complementary distribution relationship with mid-low vowel [ɐ]. [a] can only combine with the glottal stop or be nasalized, but cannot combine with the [ŋ] coda, while the case of [ɐ] is exactly the opposite. Moreover, in a diphthong, [a] only appear together with the glide [j] or [u] while [ɐ] only appears with [i] or [u] coda. The last, only [ɐ] can form the triphthong [uɐi], as in (39)

- (39) [tia] 'dad' vs. [pɛi] 'cup'
 [kua] 'strange' vs. [tɛu] 'many'
 [lã] 'cold' vs. [fɛŋ] 'minute'

In other words, except the glottal stop syllables, [ɐ] can only show up in a closed syllable while [a] have to be in an open syllable. This should be sufficient to prove that [ɐ] is actually a variant of the phoneme [a].

2.2.3.4 System of Vowel Phonemes

Based on the analysis above, it can be seen that there are 15 vowels in the modern ND, as shown in (40):

(40)	Apical	Front	Central	Back
High	ɿ, ʮ	i/y		u
Hi-mid		e/ø		o
Mid			ə	
Mid-low		ɛ	ɐ	ɔ/õ
Low		a/ã		

Because the apical vowels [ɿ, ʮ] only appear after the dental sibilants, they can be considered as the variants of the front high vowel [i, y]. This phonemicization reflects the native speakers' rhyming practice on the zhi-xi rhyme, that is, the rhyming syllables share the same nucleus.

Because [a] and [ɔ] are in complementary distribution relationship with their nasalized variants, along with the complementary distribution relationship of [ə] and [ɐ], the 15 vowels in (40) can be re-analyzed into 9 vowel phonemes as in (41).

(41)	Front	Back
High	i/y	u
Hi-mid	e/ø	o

Mid-low	ɛ	ɔ
Low	a	

Comparing the vowel system of the new Ningbo and that of the old version proposed by Tang, You and Chen (1990), which contains 50 vowels, it should be noted there has been a decrease in the number of vowels. Such change indicates that the sound system of the Ningbo dialect is simpler now, which is in accordance with the change in many other Wu dialects.

It is also very possible that the mid-high and mid-low phonemes may merge in future because, except in the monophthong finals, [e] and [ɛ], [o] and [ɔ] are already in complementary relationship, respectively.

2.2.3.5 Syllabic Consonant

In the Ningbo dialect, the consonants [m], [n], and [ŋ] have their nasalized variants [m̃], [ñ] and [ŋ̃], which form a syllable, respectively. For example, the syllable [ŋ̃] with the *yangping* tone means ‘fish’, and the [m̃] with the *yinshang* tone means ‘mother.’ It should be noted, however, that there are very few words of these three nasalized consonants.

2.2.4 Tones

2.2.4.1 The Citation Tones in the Ningbo Dialect

Although no conclusion has been reached on the nature of the exact phonetic values of the four Middle Chinese (hereafter MC) tones, scholars usually follow the custom of referring to them by their traditional terms, namely, 平 *ping*, 上 *shang*, 去 *qu* and 入 *ru*, which can be roughly translated as level, ascending, departing, and entering tones, respectively. Each MC tone can be further divided into two register-categories corresponding to the voiced/unvoiced contrast of the initial consonants. Syllables with voiced initial consonants falls into the low register category, which is named 阳 *yang* categories traditionally, while those with unvoiced initial consonants are grouped into the high register category, which is called 阴 *yin* category. For the sake of convenience, I here use A, B, C & D to refer to the four MC tones, *ping*, *shang*, *qu* & *ru*, respectively, and use 1 & 2 to refer to the high register (*yin*) and low register (*yang*) categories, respectively. Therefore, the eight MC tonal categories can simply be referred to by employing a combination of an English letter and a number, as shown in (42).

(42) MC tonal categories

<i>MC Tonal Categories</i>	<i>ping</i> (A)	<i>shang</i> (B)	<i>qu</i> (C)	<i>ru</i> (D)
1 high register (<i>yin</i>)	A1	B1	C1	D1
2 low register (<i>yang</i>)	A2	B2	C2	D2

In the new Ningbo dialect, based on the data collected from my informants, the eight MC tonal categories have evolved into a five-citation-tone system, as presented in (43).

(43) The citation tones in ND

<i>Middle Chinese Tonal Categories</i>		<i>ping</i> (A)	<i>qu</i> (C)	<i>shang</i> (B)	<i>ru</i> (D)
<i>ND tones</i>	1 high register (<i>yin</i>)	51 (HL)		45 (H)	5 (Hq)
	2 low register (<i>yang</i>)	13 (LH)			13 (LHq)

As can be seen in (43), the tonal value of *yinping* tone and *yinqu* tone is a high falling tone, which is presented as 51 or 42 in some works (cf. Chao 1928, Rose 1975, Shi 1979, among others). According to the data from my informant, this tone sounds similar to the falling tone in Mandarin Chinese that usually is marked as 51. I mark the new Ningbo *yinping* tone as 51 so it is a high-low tone (as HL).

The tone value of *yinshang* tone is quite controversial in the literature. It is recorded as a high rising tone as 34 or 45 in some works (cf. Chao 1928, Rose 1975, Hu 2003, among others) or as a high-level tone with the tonal value 44 (cf. Tang 1997, among others), but is presented as a high dipping tone in others (cf. Shi 1979). It should be noted that a syllable with *yinshang* tone, when it stands alone, always carries a characteristic of glottal [ʔ] at the end of the syllable. However, it is different from the glottal coda [ʔ] with the *rusheng* 'entering tone' in a way that, in *yingshang* tone, it is just slightly tighten the glottal vocal and this glottal stop only appears when the syllable stands alone. In the sandhi form of a string starting with *yinshang* tone, the glottal feature will simply disappear, while in the syllable with *rusheng*, the glottal coda consistently emerges. Dell

(1977), by analyzing Chinese dialects, points out that the glottal feature may co-occur with a rising pitch, which is exactly the case in *yingshang* tone in Ningbo dialect. When a syllable with *yinshang* tone stands alone, a glottal stop will be added at the end, and the high tone will become a high tone, while the tone appears as a simple high tone when no glottal stop is added in a sandhi form. Therefore, I will treat the rising part of the citation tone as caused by the glottal stop, and marker *yinshng* tone simply as a H tone.

The tonal value of *yangping*, *yangshang* and *yangqu* have merged, according to my informant, the tonal value of which is a low rising tone 13, while in other data it may be presented as a low dipping tone as 313 or 323 (cf. Rose 1975, Shi 1979, among others). Base on my data collection, I shall mark the three tones as LH.

There are two *rusheng* in Ningbo dialect, namely *yinru* and *yangru* tones, both of which are accompanied by a glottal consonant stop coda [ʔ] in the syllable. The glottal stop is a residue that evolved from the Middle Chinese stop codas [p, t, k], making the sound short and abrupt. *Yinru* tone is usually recorded as a short high tone 5 (cf. Chao 1928, Rose 1975, Shi 1979, Tang 1997, Hu 2003, among others). *Yangru* tone is a rising tone but is short in duration comparing with the long rising tone and is marked as 13/23 in many works (cf. Chao 1928, Rose 1975, Shi 1979, Tang 1997, Hu 2003, among others). Because phonologically speaking, LM and LH do not make a difference, hereby, I will mark the *yangru* tone as a short LH.

A comparison of transcription for the citation tones of Ningbo dialect in the published source

consulted in this dissertation is provided in (44) below, arranged chronologically, most of which are published after 1975. It should be noted that the data before Tang's (1997) studies are considered to be the old Ningbo dialect, which now is only spoken by senior citizens.

(44) A comparison of transcription for the citation tones of Ningbo dialect

MC	Chao 1928	Rose 1975	Shi 1979	Tang 1997	Hu 2003
A1	42	42	42	513	51
C1	434		55	44	44
B1	45	334	424	44	34
A2	242	243	213	13	13
B2	13	323	313		
C2					
D1	5	5	4	5	5
D2	23	23	2	2	23

Examples of the citation tones in Ningbo dialect are provided in (45).

(45)yinping	高	kəu ⁵¹	'high'
yangping	寻	ziŋ ¹³	'to look for'
yinshang	九	tey ⁴⁵	'nine'

yangshang	咬	ŋeu ¹³	'to bite'
yinqu	布	pu ⁵¹	'cloth'
yangqu	共	goŋ ¹³	'together'
yinru	客	khaʔ ⁵	'guest'
yangru	达	daʔ ¹³	'to reach'

Because ND has 5 citation tones, for disyllabic compounds, there can be 25 (=5×5) possible tonal sequences, and 125 (=5×5×5) possibilities for tri-syllabic tonal sequence. However, when I survey the TS phenomena in the Ningbo dialect, on the one hand, the combinatorial possibilities of tonal strings are reduced when TS operates in a spreading mode. On the other hand, the morphosyntax information that accesses phonology as well as the mismatch between citation tones and the base tones make the whole picture quite complicated.

2.2.4.2 Two Types of Tone Sandhi in Wu

In the Wu language/dialect family, it is well known that there are two types of tone sandhi which can be referred to by their widely-used terms: *guangyong shi biandiao* 广用式变调 ‘TS in broad used form’ (hereafter TS-G), and *zhaiyong shi biandiao* 窄用式变调 ‘TS in narrow used form’ (hereafter TS-Z). Phonological speaking, as Zhang (2017) points out, TS-G’s mode of rule application is tonal spreading. That is, in a given TS domain, all but the leftmost syllable lose their

tones, and the base tone of the leftmost syllable is associated in one-to-one fashion from left to right across the whole TS domain (Sherard 1972; Yip 1980; Zee & Maddieson 1980; Wright 1983; Shen 1985; Jin 1986; Zee 1988; Selkirk & Shen 1990; Duanmu 1992; Zhang 2017). The process of TS-G rule application can roughly be stated as in (46):

(46) Process of TS-G rule application

a) Tone deletion (TD)

In a certain TS domain, delete the underlying tones of all but the leftmost syllable.

b) Associate convention (AC)

Associate the leftmost syllable's base tone to syllables in the same domain in a one-to-one fashion from left to right.

c) Assign default tone (ADT)

Assign default low tone (L) to the remaining unassociated syllables.

It should be noted that, in the process of TS-G of Ningbo dialect, what should be associated to the syllables in the domain is the base melody of the leftmost syllable's sandhi form instead of its citation form. Zhang (2016, personal communication) argues that the base tone and the sandhi melody should be treated as the realization of tones at different prosodic domains. For example, in majority of the Wu dialects, the citation tone applies to the syllables, while the sandhi forms are used in higher domains.

Moreover, it is commonly seen that there may be mismatched number of the available tonal features and syllables. If the number of the available syllables is more than that of the tonal features, after the process of tone-syllable association convention (AC), the default low tone will be assigned to all the unassociated syllables; if the number of the tonal features are more than those of the syllables, the unassociated floating tonal features will all be assigned to the last syllable in the domain to form a pitch contour.

Take Shanghai dialect for example, as Shen (1980), Jin (1986) and Zhang (2017) propose, at the underlying level, Shanghai dialect has only three base tones and their corresponding relationship to the five citation tones is given in (47).

(47)	CT	a. HL	b. MH	c. LM	d. Hq	e. LMq
	BT	a. HL	b. MH	c. LH	d. MH	e. LH

Zhang (2017) gives an example on how the rules in (46) apply to the base tones in (47) in the TS-G process of Shanghai dialect, as shown in (48).

(48) Example for TS-G application in Shanghai dialect

a. Underlying form (DF)

‘purple color flowers’

purple face color flower

紫 颜 色 花

tsɿ	ŋɛ	səʔ	ho
M H	L H	H H	H L

b. Tone deletion (TD)

tsɿ	ŋɛ	səʔ	ho
M H			

c. Association line deletion

tsɿ	ŋɛ	səʔ	ho
M H			

d. Association convention (AC)

tsɿ	ŋɛ	səʔ	ho
M	H		

e. Assign default tone (ADT)

tsɿ	ŋɛ	səʔ	ho
M	H	L	L

f. Surface form (DF)

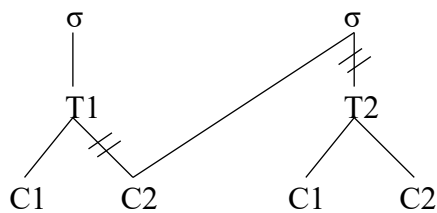
tsɿ	ŋɛ	səʔ	ho
M	H	L	L

As for TS-Z process, Selkirk and Shen (1988) take it as a non-TS case, while some others,

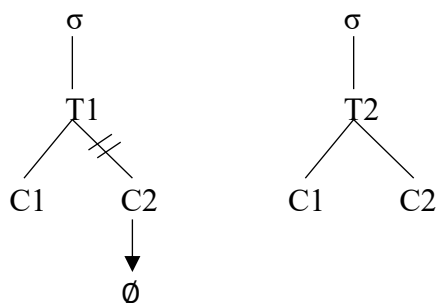
such as Duanmu (1992) consider that TS is blocked as the sequence is divided into two tonal domains. Zhang (2017) argues that TS-Z, as a matter of fact, is a direct mapping case. For instance, in a disyllabic TS-Z process in Shanghai dialect, the second syllable keeps its underlying tone, while the first syllable drops the latter half of its base tone. As a result, the original contour tone of the first syllable changes to an even tone while the second syllable remains its base tone.

Zhang concludes that the TS-G is a tonal spreading case while the TS-Z mode can be considered as direct mapping. The tonal representations of these two different cases that he provides are cited in (49).

(49)a. TS-G case (spreading)



b. TS-Z (direct mapping)



Given in (50a) and (50b) are the examples from Shanghai dialect that Zhang provides for (49a)

and (49b), respectively.

(50)a.		商	品		
		sã	phiŋ		
		trade	article		
		‘commodity’			
	BT	HL	MH		
	ok	TS-G	H	L	by (49a)
	*	TS-Z	H	mH	by (49b)

b.		打	狗		
		tã	kɤ		
		beat	dog		
		‘to beat dog’			
	BT	MH	MH		
	*	TS-G	M	H	by (49a)
	ok	TS-Z	M	MH	by (49b)

2.2.4.3 Disyllabic TS Patterns in the Ningbo Dialect

Now let us turn back to the disyllabic TS in ND. The following tables in (51) summarizes the

two types of correspondences between the citation tones and their sandhi forms applying to a disyllabic compound in ND. The citation tones of the first and the second syllables of a disyllabic compound are indicated in the left column and in the top row, respectively. The sandhi tones of such combinations are given in the cells where two citation tones intersect. The symbol ‘-’ indicates a syllable boundary between the two syllables in the disyllabic sandhi form.

(51)a. The disyllabic TS-G in ND

		2nd		1st		
		A1, C1	B1	A2, B2, C2	D1	D2
		HL	H	LH	Hq	LHq
A1	HL	M-HL			M-Hq	
C1		H-L			H-Lq	
B1	H					
A2	LH	L-HL			L-Hq	
C2						
B2		LH-L			LH-Lq	
D1	Hq	Hq-L			Hq-Lq	
D2	LHq	Lq-HL	Lq-H	Lq-LH	Lq-Hq	Lq-LHq

b. The disyllabic TS-Z in ND

2nd 1st		A1, C1	B1	A2, B2, C2	D1	D2
		HL	H	LH	Hq	LHq
A1	HL	M-HL	M-H	M-LH	M-Hq	M-LHq
C1		H-HL	H-H	H-LH	H-Hq	H-LHq
B1	H					
A2, B2, C2	LH	L-HL	L-H	L-LH	L-Hq	L-LHq
D1	Hq	Hq-HL	Hq-H	Hq-LH	Hq-Hq	Hq-LHq
D2	LHq	Lq-HL	Lq-H	Lq-LH	Lq-Hq	Lq-LHq

Generally speaking, in ND, the disyllabic combinations with internal structures such as SP, as seen in (52), VO, as seen in (53), and adverbial MH, as seen in (54) may undergo the TS-Z as shown in (51b) or undergo the TS-G as shown in (51a); while the adnominal MH structures, as seen in (55), verb-complement structure (VC), as seen in (56), and CC, as seen in (57), structures formed by affixation or reduplication, as seen in (58) and (59) respectively, all belong to the TS-G as in (51a). For the sake of convenience, I will not mark the glottal stop symbol with tones.

(52) SP Structure

a.	夏	至		
	fɔ	tsɿ		
	'summer'	'arrive'		
	'June solstice'			
CT	LH	HL		
ok	L	HL		by (51a)
(?)	L	HL		by (51b)
b.	夜	到		
	ja	tɔ		
	'night'	'arrive'		
	'night'			
CT	LH	HL		
ok	L	HL		by (51a)
(?)	L	HL		by (51b)

c.	手	长	
	ɛy	dzɛŋ	
	'hand'	'long'	
	'the hands are long'		
CT	H	LH	
*	H	L	by (51a)
ok	H	LH	by (51b)
d.	天	冷	
	thi	lɛŋ	
	'sky'	'cold'	
	'the weather is cold'		
CT	HL	LH	
*	M	HL	by (51a)
ok	M	LH	by (51b)

(53) VO Structure

a.	回	头	
	uəi	dəy	
	'return'	'head'	
	'to refuse'		
CT	LH	LH	
ok	L	HL	by (51a)
*	L	LH	by (51b)
b.	领	径	
	liŋ	tɛiŋ	
	'to get'	'path, road'	
	'convenient'		
CT	LH	HL	
ok	LH	L	by (51a)
*	L	HL	by (51b)

c.	回	头	
	uəi	dəy	
	'return'	'head'	
	'to turn back one's head'		
CT	LH	LH	
*	L	HL	by (51a)
d.	补	桶	
	wɛ	dʒio	
	'to mend'	'bucket'	
	'to mend a bucket'		
CT	H	LH	
*	H	L	by (51a)
ok	H	LH	by (51b)

(54) Adverbial MH Structure

a.	滚	壮	
	kā	zǒ	
	'to roll'	'strong'	
	'strong; fat'		
CT	HL	HL	
ok	H	L	by (51a)
*	H	HL	by (51b)
b.	难	熬	
	nε	ŋo	
	'hard'	'suffer'	
	'suffering'		
CT	LH	LH	
ok	L	HL	by (51a)
*	L	LH	by (51b)

c.	蛮	大	
	mɛ	dɛu	
	'quite'	'big'	
	'quite big'		
CT	HL	LH	
*	H	L	by (51a)
ok	H	LH	by (51b)
c.	快	跑	
	khua	pho	
	'run'	'fast'	
	'run fast' (VP)		
CT	HL	LH	
*	H	L	by (51a)
ok	H	LH	by (51b)

(55) Adnominal MH Structure

a.	快	跑	
	khua	pho	
	'run'	'fast'	
	'fast-running'		
CT	HL	LH	
ok	H	L	by (51a)
*	H	LH	by (51b)
b.	带	豆	
	ta	døy	
	'belt'	'bean'	
	'cowpea'		
CT	HL	LH	
ok	H	L	by (51a)
*	H	LH	by (51b)

(56) VC Structure

a.	吃	煞	
	ɛioʔ	saʔ	
	'eat'	'die'	
	'to cloy'		
CT	H	H	
ok	H	L	by (51a)
*	H	H	by (51b)
b.	爬	起	
	bo	tei	
	'crawl'	'up'	
	'to get up'		
CT	LH	H	
ok	L	HL	by (51a)
*	L	H	by (51b)

(57)CC structure

a.	细	小	
	ɛi	ɛio	
	'narrow'	'small'	
	'tiny'		
CT	HL	H	
ok	H	L	by (51a)
*	H	H	by (51b)
b.	长	大	
	dziã	dau	
	'long'	'big'	
	'tall and big (person)'		
CT	LH	LH	
ok	L	HL	by (51a)
*	L	LH	by (51b)

(58) Affixation structure

a.	阿	嫂		
	aʔ	sə		
	prefix	'elder brother's wife'		
		'elder brother's wife'		
CT	H	H		
ok	H	L		by (51a)
*	H	H		by (51b)
b.	纸	头		
	tsɿ	dəy		
	'paper'	'suffix'		
	'paper'			
CT	H	LH		
ok	H	L		by (51a)
*	H	LH		by (51b)

(59) Reduplication structure

a.	爸	爸	
	pa	pa	
	'father'	'father'	
	'father'		
CT	HL	HL	
ok	H	L	by (51a)
*	H	HL	by (51b)
b.	呆	呆	
	ŋe	ŋe	
	'stupid'	'stupid'	
	'dull, stupid'		
CT	LH	LH	
ok	L	HL	by (51a)
*	L	LH	by (51b)

c.	看	看		
	khi	khi		
	'to look'	'to look'		
	'try to look'			
CT	HL	HL		
ok	H	L		by (51a)
*	H	HL		by (51b)

Comparing the examples (a, b) with (c, d) in (52) to (54), for SP, VO and adverbial MH, cases like (a, b) are in tonal spreading (TS-G) mode while those in (c, d) are direct mapping (TS-Z). However, the TS behavior of adnominal MH, VC, CC and the structures formed by affixation and reduplication is always tonal spreading (TS-G) regardless of their positions in the syntactic tree, namely syntactic word or syntactic phrase. As a matter of fact, the syntactic status of (a, b) and (c, d) in (52) to (54) are distinct in a way that the former ones are morpho-syntactic words, while the later ones are phrases. Thus, it seems that the difference between TS-G and TS-Z is that the latter only applies to phrases, while the former may apply to both words and phrases.

In Wu dialects, according to Zhang (2017), TS can be divided into three types: a) lexical TS (LTS), b) clitic TS (hereafter CTS), and c) phrasal TS (hereafter PTS). Roughly speaking, LTS is applied to lexical items, where one content word plus a functional element forms a clitic group

(hereafter CG) belongs to CTS, and a phrase belongs to PTS. PTS is much more complicated than the other two types of TS because not all of the syntactic phrases will undergo PTS. For example, in Wu dialects, phrases as SP, VO and adverbial MH will undergo PTS, while phrases of adnominal MH and VC seem to be subject to LTS. In Chapter VI and Chapter VII, I will show that LTS can not only apply within the prosodic word but can also apply within clitic groups formed by 'host+enclitic' and some phonological phrases, while the PTS only applies between two phonological phrases within the same intonational phrase.

More examples from Wu dialects can show that phrases as SP, VO and adverbial MH will undergo PTS, while phrases of adnominal MH and VC will be subject to LTS. as shown in (60) and (61), provided by Zhang (2017).

(60) Chongming dialect (Zhang 1988)

a. TS-Z Case

SP	树	大
	tree	big
	‘The tree is big.’	
BT	MLM	MLM
* by TS-G	MLM	H
ok by TS-Z	L	MLM

VO	杀	狗
	kill	dog
	'to kill a dog'	
BT	Hq	HMH
* by TS-G	H	M
ok by TS-Z	H	MHM
Adverbial MH	真	忙
	really	busy
	'really busy'	
BT	H	LM
* by TS-G	H	H
ok by TS-Z	H	LM

b. TS-Z Case

Adnominal MH	小	牛
	small	ox
	‘calf’	
BT	HMH	LM
ok by TS-G	HMH	H
* by TS-Z	M	LM

(61) Huinan dialect (Z. Zhang 1987)

a. TS-G case

SP	天	晴
	sky	clear; sunny
	‘The sky is clear.’	
BT	HM	HM
* by TS-G	H	HM
ok by TS-Z	H	MLM

VO	补	桶
	mend	bucket
	'to mend the bucket'	

BT	H	MLM
----	---	-----

* by TS-G	MH	HM
-----------	----	----

ok by TS-Z	H	MLM
------------	---	-----

Adverbial MH	快	放
	quickly	set off
	'to quickly set off'	

BT	MH	MH
----	----	----

* by TS-G	H	H
-----------	---	---

ok by TS-Z	M	MH
------------	---	----

b. TS-G Case

Adnominal MH	小	米
	small	rice
	'millet'	
BT	H	MLM
ok by TS-G	MH	ML
* by TS-Z	H	MLM

In the examples of the aforementioned Wu dialects, phrases of SP, VO and adverbial MH share the same TS behavior, namely PTS, while other types of structures belong to LTS.

2.2.4.4. Base Tones of the Ningbo Dialect

Now let us discuss the base tones of the sandhi forms in ND. Despite the ad hoc case of D2, the spreading LTS patterns of ND are given in (62).

(62) Spreading LTS patterns in ND

	BT	Disyllable	Tri-syllable	Quadri-syllable
A1	MHL	M-HL	M-H-L	M-H-L-L
B1, C1 & D1	H	H-L	H-L-L	H-L-L-L
A2 & C2	LHL	L-HL	L-H-L	L-H-L-L
B2	LH	LH-L	LH-L-L	LH-L-L-L

As discussed earlier, the sandhi form and citation form of a tone belongs to different domains in a way that the citation form only appears to monosyllables while the sandhi form is for polysyllables when tone sandhi applies. Therefore, the base tone or base melody of each tone can be deduced based on tone sandhi form, given as follows:

(63) Base tone/Base melody of sandhi forms in Ningbo dialect

MC tones	A1	C1	B1	A2&C2	B2	D1	D2
CT	HL	HL	MH	LH	LM	H	LH
BT	MHL	H	H	LHL	LH	H	LH

First, the base melody of B1, C1 and D1 are very easy to deduce based on their sandhi form, which is H. The low tone that is assigned to the rest of the syllables in the spreading domain can be considered as introducing by the default low tone rule.

As for A1, I consider its base tone as MHL, instead of MH. As shown in (64), the LTS melody of a disyllabic compound starting with a syllable of tone A1 is MHL, which means that only when the low tonal feature is included in the base melody of A1 instead of assigned by default low tone rule, then can the second syllable is assigned a HL tone.

(64) Disyllabic LTS application of tone A1 in ND

	商	品	
	sǔ	phiŋ	
	'trade'	'article'	
	'commodity'		
BT	MHL	H	
Tone deletion	MHL		
Association convention	M	HL	
Default low tone			(doesn't apply)
Surface form	M	HL	correct

Follow the same logic, I consider the base tone of A2 & C2 should be LHL instead of LH, as shown in (65).

(65) Disyllabic LTS application of tone A2&C2 in ND

	大	米	
	dau	mi	
	'big'	'rice'	
	'a kind of rice'		
BT1	LHL	LHL	
Tone deletion	LHL		
Association convention	L	HL	
Default low tone			(doesn't apply)
Surface form	L	HL	correct

As for B2, I consider its base tone as LHL as well even though its sandhi form is different from A2 and C2. As can be seen in (66), in the sandhi form of B2, the falling tone HL will be bound together to the first syllable. Logically speaking, the L feature assigned to the second syllable may also go by the default low tone rule. The reason why B2 differs from A2 and C2 may be due to the historical fact that they used to belong to different tonal categories in Middle Chinese. However, this dissertation is mainly focus on the interface between syntax and phonology. Thus, for the simplicity of the model, here I consider all the three tones to have the same base melody of LHL, and the first two tonal features, LH, are bound to assign to B2, as a special case.

(66) Disyllabic LTS application of tone B2 in ND

	雨	衣
	y	i
	'rain'	'coat'
	'raincoat'	
BT	LHL	MHL
Tone deletion	LHL	
Association convention	LH	L
Surface form	LH	L

Finally, let us take a look at D2. As shown in (51a), in the LTS process of D2, the first syllable changes by dropping all but the first tonal feature of its base, while the second one keeps its citation tone. In other words, LTS of D2 is not a spreading case, instead, it is a direct mapping. Clearly, the internal morphosyntactic structure is invisible here, so the motivation for replace LTS with PTS of D2 must be phonological. As for the cases of D2, LTS somehow is blocked, the rest of the syllable in the same domain will start a new domain, as shown in (67). Otherwise, all the tones in the domain will get low tone. If there is only one syllable remaining in the domain, then it keeps its citation form, if there are two or more syllables the right side of D2, then the sandhi form of the first one of the remaining syllables will spread from left to right.

(67)	蜜	蜂	
	mle?	foŋ	
	'honey'	'bee'	
	'honeybee'		
BT	LH	MHL	
Tone deletion	LH		
Association convention	L #		TS is blocked by glottal coda
2st syllable remains CT	L #	HL	correct outcome
*Surface form	L	L	wrong outcome

In other words, D2 never spreads its base tone within the domain. For the sake of simplicity, I will simply take its citation form as its base form, namely, LH.

2.2.4.5. Tri-syllabic TS Patterns in the Ningbo Dialect

Now let us quickly take a look at tri-syllabic TS in ND, starting with the examples given in (68).

- (68) a. 搬 铺 盖
 pø phu ke
 'move' 'bed-roll'
 'to move bed-roll'
- BT MHL MHL H
- i. iterative [M H L] *by PTS
- ii. cyclic [M HL] by LTS
- [M] by PTS
- M M HL outcome
- b. 爸 爸 笑
 pa pa eio
 'father' 'smile'
 'The father smiles.'
- BT H H H
- i. iterative [H L L] *by LTS
- ii. cyclic [H L] by LTS
- [HL] by PTS
- H L HL outcome

c.	怕	结	婚	
	pho	tɛlɛ?	huəŋ	
	'afraid'	'get married'		
	'be afraid of getting married'			
BT	H	H	H	
i. iterative	[H	L	L]	*by LTS
ii. cyclic		[H	HL]	by PTS
	[H]	by PTS
	H	H	HL	outcome
d.	结	婚	难	
	tɛlɛ?	huəŋ	nɛ	
		'get married'	'hard'	
	'Getting married is difficult.'			
BT	H	H	LHL	
i. iterative	[H	L	L]	*by LTS
ii. cyclic	[H	HL]		by PTS
		[LH]	by PTS
	H	H	HL	outcome

As seen in (68a) to (68d), only cyclic mode will bring about the correct output forms. In other words, the inner/outer syntactic structures are visible for tone sandhi rule application since TS rules apply cyclically, and the rule selection (LTS or PTS) depends on the syntactic relation that holds for each cycle. For example, in (68c), the inner cycle is a CC structure, it applies the LTS, while the outer cycle is a VO structure, so the PTS is applied.

Some other cases, however, suggest a non-cyclical mode, namely an iterative mode, as seen in (69).

(69)a.	太	阳	帽
	ta	yā	mǎo
	'sun'		'hat'
	'sun hat'		
BT	HL	LHL	LHL
Tone deletion	HL		
Association convention	H	L	
Default low tone	H	L	L
Surface form	H	L	L

b.	大	太	阳
	dau	ta	yã
	'big'		'sun'
	'big sun'		
BT	LHL	HL	LHL
Tone deletion	LHL		
Association convention	L	H	L
Surface form	L	H	L
c.	大	出	血
	dau	tsho?	cio?
	'big'		'bleed'
	'massive hemorrhage'		
BT	LHL	H	H
Tone deletion	LHL		
Association convention	L	H	L
Surface form	L	H	L

d.	饮	水	机
	iŋ	sø	tei
	drink	water	machine
	‘water fountain’		
BT	H	H	MHL
Tone deletion	H		
Association convention	H		
Default low tone	H	L	L
Surface form	H	L	L

As shown in (69) above, the syntactic information of the structures is ignored. Regardless of the left/right branching or inner/outer syntactic structures, LTS applies in a spreading mode left-to-right iteratively. Such kind of tri-syllabic LTS rules of the Ningbo dialect can be viewed as being derived from the corresponding base melodies by left-to-right association and the spreading of the base tone of the leftmost syllable. For instance, the base tone of the first syllable in (69a), i.e. H, is applied left to right iteratively.

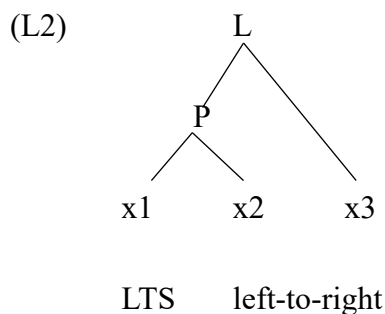
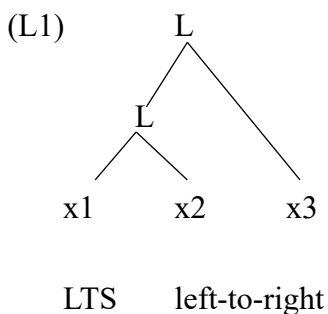
If we compare the examples given in (68a~d) and (69a~d), it seems that, in tri-syllabic TS domain in Ningbo dialect, whether TS rules apply cyclically or iteratively is determined merely by the syntactic structure of the outer cycle. In other words, if the outer cycle is a SP, VO or

adverbial MH, then TS rules apply cyclically, otherwise, LTS is applied iteratively.

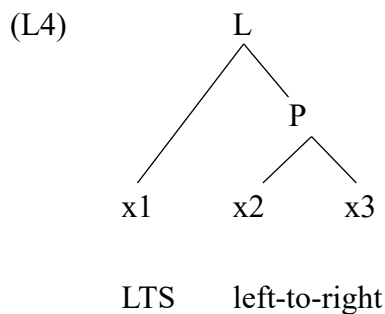
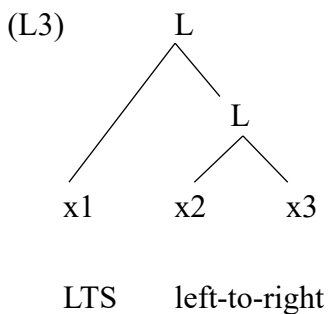
The figures in (70) below exhaust all logical possibilities: right/left branching structures, and the syntactic structures corresponding to LTS and PTS on the inner/outer cycle. The trees represent the IC hierarchy in the usual manner, with node labels L/P indicating the syntactic structures that corresponds to LTS and PTS, and x's standing for the syllables. -LTS-, -PTS- and -default tone- indicate which TS applies to which pair of adjacent syllables. The rare cases as in (31) are considered as exceptions and therefore are not included.

(70)a. Outer structure is type L

Left-brunching



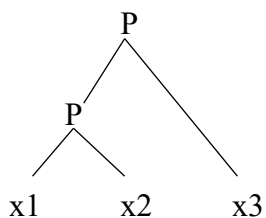
Right-brunching



b. Outer structure is type P

Left-brunching

(P1)



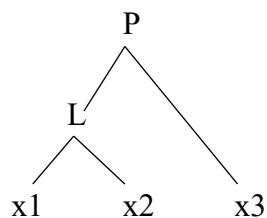
PTS

level 1

PTS

level 2

(P2)



LTS

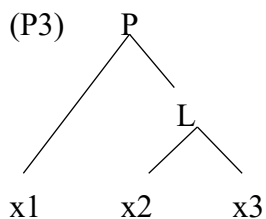
level 1

PTS

level 2

Right-brunching

(P3)



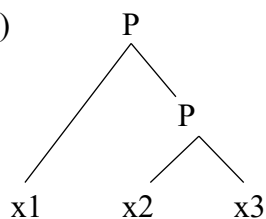
LTS

level 1

PTS

level 2

(P4)



PTS

level 1

PTS

level 2

However, few examples show that, in the structure (L2), as illustrated in (70), the syntactic information of the inner cycle may still be visible for TS rule application, as shown in (71).

(71) a.

还	魂	酒
vɛ	vən	tɛio
'return'	'soul'	'wine'

'soul catcher wine'

BT

LHL	LHL	MH
-----	-----	----

i. iterative

[L	H	L]	*by LTS
----	---	----	---------

ii. cyclic1

[L	LH]		by PTS
----	-----	--	--------

	[L	H]	by LTS
--	----	----	--------

L	L	H	*outcome
---	---	---	----------

iii. cyclic2

[L	LH]		by PTS
----	-----	--	--------

		L	by ADT
--	--	---	--------

L	LH	L	outcome
---	----	---	---------

b.	杀	人	犯	
	saʔ	niŋ	vɛ	
	'kill'	'human'	'criminal'	
		'murderer'		
BT	H	LHL	LHL	
i. iterative	[H	L	L]	*by LTS
ii. cyclic	[H	LH]		by PTS
		[L	H]	by LTS
	H	L	H	*outcome
iii. cyclic	[H	LH]		by PTS
			L	by ADT
	H	LH	L	outcome

In the examples given in (71a) and (71b), both of which are left-branching structures, the morphosyntactic relation holding on to the inner structures is verb-object (VO), while the relation on the outer structures is adnominal MH. Although their syntactic structures are exactly the same as that of (68d), neither the iterative or cyclic mode can bring about the correct output forms. In fact, the correct output can be derived only if, firstly, PTS applies to the inner cycle, then the third syllable gets a default low tone by ADT instead of applying LTS between the second and the third

syllables.

The reason that causes such alternative TS patterns of type (L2), as shown in (68d) and (71), may be caused by its left-branching structure and the difference between the morphosyntactic structures that hold on the inner/outer cycles. As a matter of fact, in all the eight types of tri-syllabic structures in (70), the sandhi form of the first syllable is always determined by the TS which corresponds to the syntactic structure that directly holds on the first syllable, except (L2). In other words, the type (L2) is the only case where the sandhi form of the first syllable is not determined by syntactic structure that directly holds it. Instead, it is determined by the outer cycle.

There are four types of right-branching tri-syllabic structures as shown in (70), namely (L3), (L4), (P3), and (P4). If the outer cycle corresponds to LTS, the syntactic information of inner cycle is ignored, LTS is applied iteratively left-to-right. If the outer cycle should apply PTS, since PTS is blocked after the first syllable, the tone of the rest syllables can be determined by the syntactic structure that directly holds on them. As for the left-branching type (L1), although it is the outer, not the inner cycle, that determines its final sandhi form, since they are both LTS, which is a spreading mode, there won't be any confliction to generate the output forms. As for the left-branching type (P2), which applies LTS in the inner cycle and PTS in the outer cycle, because PTS does not have any influence on the final syllable, TS is applied in the inner cycle and simply stops before the third syllable. As for type (P1), both inner/outer cycles apply PTS, TS is blocked before the 2nd and 3rd syllables. To sum up, in the seven aforementioned types, the sandhi tone of the

first syllable can be determined the moment when the syntactic structure holding on the first syllable and the second one is scanned.

However, following this logic, the output of type (L2) will not be an iterative case. Take (71a) for an example. In such a left-branching structure, the inner cycle that holds on the first syllable corresponds to PTS, so a [L-LH] combination is generated. When the output of the inner cycle comes to the outer cycle, because it is the combination of first two syllables, not just the second syllable, that is directly dominated by the syntactic node that holds on the outer cycle even though the tone of the second syllable is associated with two tonal features. Namely [LH], the [H] feature of the [LH] will not be separated and re-associated with the third one. Since there is no floating tone available either, the third syllable can only be assigned a default low tone. Thus, the odd output [L-LH-L] is generated. On the other hand, if type (L2) is interpreted as a spreading case by its outer cycle's syntactic information at the very first moment, LTS rule is applied iteratively. Therefore, the left-branching structure and the syntactic contrast between the inner/outer cycles causes such TS classification of the tri-syllabic type (L2).

2.2.5 Combined-pronunciation Words

In the Ningbo dialect, there is a very interesting phenomenon, which is called 'combined-pronunciation words', or 合音词 *heyinci* in Chinese. It seems that, when two monosyllabic function words are highly frequently used together, they may merge as one syllable by taking the

initial of the first syllable and final of the second syllable but keeping the meaning of the original combination of the two words.

Most of the 'combined-pronunciation words' are the combination of a monosyllabic function word and monosyllabic pronoun. For example, in the Ningbo dialect, the singular pronouns, [ŋo] 'I', [nəu] 'you' and [dzi] 'he/she/it', are all monosyllabic morphemes. The expression 'by him/her/it' normally consists of two syllables [paʔ] 'by', and [dzi] 'he/she/it', but in real pronunciation, it usually is pronounced as one syllable bearing the tone of [paʔ], as shown in (72).

(72)	[paʔ ^H]	+	[dzi ^{LH}]	→	[pi ^H]
word gloss	'passive voice marker'		'third person singular pron.'		
phrase gloss			'by him/her/it'		'by him/her/it'

Or for the expression 'for me', originally it consists of two syllables, [taʔ] 'by' and [ŋo] 'I', but it usually is combined into one syllable [do] 'for me' bearing the tone of [taʔ] 'for', as in (73).

(73)	[taʔ ^H]	+	[ŋo ^{LH}]	→	[to ^H]
word gloss	'for'		'first person singular pron.'		
phrase gloss			'for me'		'for me'

In the Ningbo dialect, the phrase 'don't want' can also form a 'combined-pronunciation word' with the third person singular pronoun [dzi], meaning 'don't want him/her/it', as in (74).

(74)	[fje ^{HL}]	+	[dzɪ ^{LH}]	→	[fɪ ^H]
word gloss	'don't want'		'he/she/it'		
phrase gloss	'don't want him/her/it'				'don't want him/her/it'

So far, the 'combined-pronunciation words' reported in the Ningbo dialect only happens between a singular pronoun and a monosyllabic function word. Although they are normally called 'combined-pronunciation words' by Chinese scholars, as a matter of fact, they should be treated as clitic groups rather than words. The 'combined-pronunciation word' will be discussed in detail in Chapter V.

2.2.6 Summary

In the second section of this chapter, I have provided a general introduction to the segmental and tonal inventory of Ningbo dialect as well as a survey of a few phonological phenomena, such as lexical tone sandhi and post-lexical tone sandhi, and the so-called 'combined-pronunciation words'. It can clearly be seen that different phonological phenomena may be sensitive to different-sized groups of sound, namely, different prosodic domains. For instance, PTS only occurs in phrases while LTS may apply to both words and phrases.

In the following chapters, I will further investigate application of different phonological phenomena, particularly the tone sandhi phenomena, as well as the different domain where these

sandhi operations may apply. I will show, as inspired by Zhang (2017) and You (2017), that (i) a certain phonological phenomenon in Ningbo dialect may apply within one domain while is blocked in other domains; (ii) one Ningbo phonological operation could apply within more than one domain. Each following chapter will start with an introduction to a certain prosodic domain, followed by a detailed examination of application of various phonological phenomena within the domain in question.

Chapter III. The Syllable and the Foot in the Ningbo Dialect

While the syllable and the foot are not new notions in the theories of phonology, each of which is afforded to be discussed in more than an entire chapter, the reason why these two constituents are put together in one chapter here is because I decide to restrict my focus only to the investigation of the role the syllable and the foot play in the theory of prosodic phonology. Section 3.1 will provide an introduction to the syllable as the prosodic domains of phonological rule application. I will demonstrate that the application of citation tone makes crucial reference to the domain of syllable rather than others. I will also discuss the relationship between the citation tone and the sandhi form in Ningbo dialect. Section 3.2 will discuss the next level above the syllable, namely the foot, in Ningbo dialect. I will start with a short discussion on the notion of the foot as well as its definition established on the basis of several phonological rules across languages. Then based on the review of Duanmu's metrical approach, I will argue that the foot is not a prosodic unit that exists in Ningbo dialect.

3.1 The Syllable in the Ningbo Dialect

3.1.1 The Domain of the Syllable across Languages

There have been a great amount of works dealing with various aspects of the notion of syllable in phonology. In mid 1970s, the study of the phonology starts to accept syllable to be included

within the theory of prosodic phonology (cf. Hooper 1972, 1976; Kahn 1976; Kiparsky 1979; Booij 1981; ver der Hulst 1984; Nespor & Vogel 1986; Jensen 1992, among others). I will start with several phonological rules that makes crucial reference to the domain of the syllable in this section.

The first language in which an interaction between phonology and morphology at the syllable level can be seen is Spanish. According to Harris, in certain dialects of Spanish, there is a Velarization rule, which changes a nasal *n* to [ŋ] when it is in the rhyme of a syllable, as shown in (1).

- (1) a. cantan → ca[ŋ]ta[ŋ] 'they sing'
 b. instituto → i[ŋ]stituto 'institute'
 c. constante → co[ŋ]sta[ŋ]te 'constant'

On the basis of the above examples, the Velarization rule is formulated by by Nespor & Vogel (1986) as in (2).

- (2) $n \rightarrow \eta / _ Co]_{\sigma}$

Another rules that operates within the syllable is the Aspiration rule in Spanish, where a fricative /s/ is realized as [h] in syllable coda after [+sonorant] consonants, as illustrated in (3).

- (3) a. tienes → tiene[h] '(you) have'
 b. después → de[h]-pué[h] 'after'

Nespor and Vogel (1986) reformulated the rule as in (4).

- (4) s → h / [+son] __]_σ

The third rule that examined in this section is the Glottalization rule in English, in which a voiceless stop *t* is glottalized following a [-cons] segment when the *t* is (a) in an absolute final position, as in (5a-c), (b) preceding a consonant other than *r* within a phonological word, as in (5d-f), or (c) followed by a consonant or a glide in an adjacent word, as in (5g-i) (cf. Kahn 1976, 1980; Nespor & Vogel 1986. among others), in which Glottalization is represented by the voiceless alveolar stop *t* in bold.

- (5) a. cat → [kæ**t**^ʔ]_σ
 b. wait → [we**i**^ʔ]_σ
 c. seat → [si:**t**^ʔ]_σ
 d. cutler → [cʌ**t**^ʔ]_σ [lɚ]_σ
 e. fitness → [fi**t**^ʔ]_σ [nis]_σ
 f. bootless → [bu:**t**^ʔ]_σ [lis]_σ
 g. wait patiently → [we**i**^ʔ]_σ [phei]_σ ...

- h. wait reluctantly → [weɪtʰ]_σ [rə]_σ ...
 i. wait wearily → [weɪtʰ]_σ [wiə]_σ ...

However, when a word-final *t* is followed by a vowel in an adjacent word in a compound or a phrase, Glottalization does not happen, as illustrated below.

- (6) a. night owl → *[naɪtʰ] owl
 b. wait a minute → *[weɪtʰ] a minute

In the cases above, we can find a flap instead of a glottalized *t*. The solution Nespors and Vogel (1986) provides is to allow the Flapping rule to apply before the Glottalization rule, thus, the flapped *ts* in (6) will not be subject to the application of Glottalization since they have already been voiced.

On the basis of the above discussion, we can formulate the Glottalization as a rule that makes crucial reference to the syllable domain, as in (7), provided by Nespors and Vogel (1986).

(7) Glottalization rule in English

$$t \rightarrow t^h / \dots [-\text{cons}] __\]_\sigma$$

The Alveopalatalization in English is another rule that applies within syllable domain. This rule changes the point of articulation of *t* from alveolar to alveopalatal before *r*, as shown in (8),

comparing with the cases where Alveopalatalization rule does not apply, as in (9). The *t* in question is marked in bold. It should be noted that the alveopalatal *t* will further be aspirated or unaspirated based on the context.

- (8) a. street [street]_σ → s[c]reet
 b. citrus [ci]_σ [trus]_σ → ci[c]rus
 c. destroy [de]_σ [stroy]_σ → des[c]roy
- (9) a. rat race [rat]_σ [race]_σ → *ra[c] race
 b. cut rate [cut]_σ [rate]_σ → *cu[c] rate
 c. tight rope [tight]_σ [rope]_σ → *tigh[c] rope

Another rule, discussed by Nespor and Vogel (1986), that has syllable as its domain of application is the Schwa Insertion rule in certain varieties of Dutch (Booij 1981, Trommelen 1983, van der Hulst, 1984, Nespor and Vogel 1986, among others). This rule inserts a schwa between a liquid that precedes a noncoronal obstruent, but only if the liquid and the obstruent are in the same syllable, as exemplified in (10), and those do not apply the rule, as in (11). Nespor and Vogel (1986) formulate the rule as in (12), where L represents a liquid.

- (10)a. [park]_σ → par[ə]k 'park'
 b. [helft]_σ → hel[ə]ft 'half'
 c. [melk]_σ [au]_σ [to]_σ → mel[ə]kauto 'milk van'

Based on the fact that the Strengthening rule applies in relation to the right edge of a syllable, Nespor and Vogel (1986) propose the formulation of the rule as follows.

(15) The Strengthening rule in Tamazight Berber

$$\begin{bmatrix} +\text{con} \\ +\text{ant} \\ +\text{cor} \\ -\text{strid} \end{bmatrix} \rightarrow [-\text{cont}] / [\dots \begin{bmatrix} +\text{con} \\ +\text{ant} \\ +\text{cor} \\ +\text{strid} \end{bmatrix} _]_{\sigma}$$

The last rule that should be considered is the Emphasis rule in Arabic. This rule assigns all segments in a syllable receives emphasis if there is an emphatic consonant within the syllable (cf. van der Hulst and Smith 1982, Nespor and Vogel 1986), as illustrated below.

- (16) a. [rab]_σ → [raːb] 'little hand'
 b. [raa]_σ [gil]_σ → [raːgil]_σ 'little mortar'
 c. [buk]_σ [ra]_σ → [bukraː]_σ 'your stretched'

As illustrated in (16), Emphasis is an autosegmental spreading rule operates within the syllable domain, which is somehow different from the segmental rules as discussed above.

On the basis of the various phonological rules demonstrated above, it should be without any doubt that the syllable should be established as a dispensable domain for application of phonological phenomena across languages.

3.1.2 The Syllable as a Prosodic Domain in the Ningbo Dialect

As mentioned in Chapter II, each of the tones in Ningbo dialect has two forms of phonetic realizations: the citation form and the corresponding sandhi form, as listed as follow. The glottal stop indicates it is a *rusheng* 入声 'entering tone', which only occurs with a syllable containing glottal stop coda [ʔ].

(17) Citation forms and LTS sandhi forms of tones in Ningbo dialect

tone name	citation form	disyllabic sandhi form	trisyllabic sandhi form
yinping	HL	M-HL	M-H-L
yinshang	H	H-L	H-L-L
yinqu	HL	H-L	H-L-L
yangping & yangqu	LH	L-HL	L-H-L
yangshang	LH	LH-L	LH-L-L
yinru	Hʔ	Hʔ-L	Hʔ-L-L
yangru	LHʔ	LHʔ-ʔ	LHʔ-ʔ-ʔ

As shown above, there exist some mismatches between the citation tones and their corresponding sandhi forms in the Ningbo dialect. First of all, as for the tones that do not combine with short syllables (containing the glottal coda), on one hand, the citation tones of *yingping* and

yinqu merge to a HL tone, while they differ from each other in terms of the sandhi form. By contrast, the sandhi forms of *yingshang* and *yinqu* are same, but their citation forms are different.

On the other hand, the citation forms of all the three *yang* tones merge to a LH tone. Their sandhi forms seem same on the surface, namely, a LHL sandhi melody. However, in the sandhi form of the *yangshang* tone, the first two tonal feature, namely LH, are obligatorily bound to assign to the first syllable within the sandhi domain, while in the sandhi form of *yangping* and *yangqu*, the three tonal features of are assigned from left to right in a one-to-one fashion.

As for the two *rusheng* 'entering tones', *yinru* tone is the same as *yinqu* tone, except for its short duration due to the glottal stop coda in the syllables. *Yangru* tone is a special case, since in its sandhi form, the tone sandhi is a direct mapping case as TS-Z. The tones of the following syllable(s) in the same domain depend on the number of the remaining syllables. If there is only one syllable following the syllable with *rusheng*, then this syllable keeps its citation tone, if there are more than one syllable, then the rest of the syllables will form one TS domain, and the first syllable of the remaining ones will spread its sandhi form from left to right.

In the literature of Ningbo dialect, few scholars have discussed the relationship between the citation tones and their sandhi forms. Chen (1985) discusses the derivational relationship between the citation tone and sandhi form in the old Ningbo dialect. According to Chen's analysis, there exists an underlying form of each tone, which can derive both the citation form and sandhi form depending on the context, i.e., citation tone for a monosyllabic syllable, and sandhi form for

polysyllable.

Traditionally, the citation form of a tone is usually considered as the base form which will derive sandhi form under certain circumstances, i.e., combination of two morphemes (cf. Lü 1980, among others). By contrast, other scholars claim that, in some Chinese dialect, the sandhi form sometimes could be more conservative than its citation tone, which means that the underlying form may maintain unchanged in tone sandhi form while its citation form changes through time (cf. Ding 1984, among others). For instance, in the Lingao 临高 dialect in Hainan Province, there are two subdivisions, each of which has six tones. While five tones of each dialect are the same in terms of both the citation form and the sandhi form, the sixth tone varies: 35 (or MH) in dialect A which will change to 11 (L) in its disyllabic sandhi form, while 11 in dialect B which does not have any variation. Since the linguists know the historical relationship between these two dialects, it is natural to set a L tone as the underlying form for both of these two dialects, which, thus, will make the sandhi form as the underlying form for the sixth tone in both dialects.

However, if we take a look at the data in the new Ningbo dialect examined in this dissertation, as in (17), we will find it is really difficult to find such an underlying form for both the citation form and the sandhi form of each tone because, based on pure phonological information, we cannot find a satisfactory answer to account for the odd mismatch between them in Ningbo dialect. The problems are, how to group several tones together in terms of citation form while separating them in the sandhi form? Or, how to find a derivational rule to bind the first two tonal feature of LHL to

the first syllable in the sandhi form of *yangshang*, while separate the three tonal features in the sandhi form of *yangping* and *yangqu*, if we assume all the three tones share the same underlying form, namely LHL?

Other scholars, by contrast, argue that sandhi tones, on the one hand, certainly have historical relationship with the citation forms. However, once the sandhi tones were formed at certain point in history, they started to develop independently (cf. Wutai 1986; Qian 1988; Chen 1993, among others). As Zhang (2016, personal communication) points out, synchronically speaking, the relationship between the citation form and the sandhi form of a tone in a Chinese dialect may not be derivational. Particularly, in the cases in the Ningbo dialect, the difference between the two forms of a tone actually could reflect applications of a tone at different levels in prosodic hierarchy. That is, the citation tones in Ningbo dialect are only assigned to the syllable-level constituent, while the sandhi forms are applied to the constituents at higher levels. Therefore, following his insight, the syllable should be treated as a prosodic constituent in the prosodic phonology of this dialect since it constitutes the domain of the application of the citation tones.

Another phonological rule that makes reference to the syllable constituent in Ningbo dialect is the Glottalization rule, which adds a glottal stop [ʔ] at the end of the syllables with *yinshang* tone (the citation form of which contains a single H feature) regardless of their part of speech or semantic meanings, as exemplified in (18), while this rule is blocked in other cases, as exemplified in (19). The syllables that bear H tone are marked in bold with a H tonal feature on the top-right

corner.

- (18)a. 草 [tseu]^H_σ → [tseu^ʔ]^H 'grass'
- b. 土 [thu]^H_σ → [thu^ʔ]^H 'earth'
- c. 请 [teiŋ]^H_σ → [teiŋ^ʔ]^H 'to invite'
- d. 拐 [kua]^H_σ → [kua^ʔ]^H 'to shake'
-
- (19)a. 草地 [tseu]^H_σ [di]^{LH}_σ → [tseu]^H [di]^L 'lawn; meadow'
 *[tseu^ʔ]^H [di]^L
- b. 救火车 [tey]^{HL}_σ [hœu]^H_σ [hœu]^H_σ → [tey]^H [hœu]^L [hœu]^L 'ambulance'
 *[tey^ʔ]^H [hœu]^L [hœu]^L
- b. 请你 [teiŋ]^H_σ [nœu]^{LH}_σ → [teiŋ]^H [nœu]^{LH} 'to invite you'
 *[teiŋ^ʔ]^H [nœu]^{LH}
- c. 做谜子 [tseu]^{HL}_σ [mi]^{LH}_σ [tsɿ]^H_σ → [tseu]^H [mi]^L [tsɿ]^{HL} 'to make riddle'
 *[tseu^ʔ]^H [mi]^L [tsɿ]^{HL}

As shown in (18), the syllable bearing H tone in each example all undergoes glottalization while those in (19) remain unchanged. The examples in (19a-b) are two compounds and the two in (19c-d) are two phrases, in which the lexical tone sandhi rule applies in the first two while PTS applies to the latter two. Particularly, compare (18a, c) and (19a, c), while 草 'grass' and 请 'to

invite' undergo Glottalization as a single syllable, respectively, the rule is blocked when they are included within larger domains and undergo TS. Therefore, I will formulate the tone sandhi rule as below.

(20) Glottalization rule in Ningbo dialect

$$\emptyset \rightarrow ? / [\dots _]_{\sigma}$$

It should be noted that result of the application of this rule is different from the syllables bearing *rusheng* 'entering tone' since the latter ones will carry the glottal stop coda [ʔ] in any case.

3.2 The Foot as a Prosodic Domain

In the model that proposed for the universal prosodic hierarchy (cf. Nespor & Vogel 1986, among others), syllables are not immediately dominated by prosodic word, but have to be grouped into feet first. Most of the arguments that include foot within the prosodic hierarchy, particularly the metrical theory, are based on the stress assignment. In other words, the foot has been seen as the basic notion in determining the positions of stressed vs. unstressed syllables within prosodic word or larger strings (cf. Liberman and Prince 1977, Halle and Vergnaud 1978, Kiparsky 1979, Selkirk 1980b, Hayes 1981, among others), although Selkirk (1984b) later claims that the notion of the foot can be eliminated from the prosodic phonology since it can be accounted for in terms of metrical grid. In 1986, Selkirk changes her mind again, arguing that there can be a 'peaceful

coexistence' for the prosodic constituency and the metrical grid. According to Selkirk, the metrical grid is defined by the syntactic information but is referred to prosodic structure, which is required in the analysis of ChiMwiini stress. Therefore, the system allows two distinct mapping mechanisms that are serially ordered: (1) prosodic constituency is the output of regular mapping rules, with morphosyntactic structure as its input, while (2) the metrical grid construction is performed on prosodic structure domains by a another set of mapping rules. In Section 3.2.1, I will examine several phonological rules that make crucial reference to the domain of foot. In Section 3.2.2, I will examine some phonological phenomena in the Ningbo dialect, and argue that, although foot should be treated as a prosodic constituent in the universal prosodic hierarchy, it does not mean that the foot is an indispensable prosodic constituent in the prosodic phonology of a particular language, i.e, the Ningbo dialect.

3.2.1 The Foot as a Prosodic Domain across Languages

It has long been noticed in the literature that the structure of a foot can be described as a string containing a relative strong syllable and any number of relatively weak syllables under the same node (Lieberman and Prince 1977, Kiparsky 1979, among others). However, stress is not the only phonological phenomena that associate with the foot. As shown in the examples below, there exist certain rules that cannot be formulated in terms of stress.

Let us first consider the Aspiration rule in English. This rule applies and changes the voiceless

stop *t* if and only if it is at the beginning position of a foot (cf. Nespors and Vogel 1986, Jensen 1993, among others), as exemplified in (21), but does apply to the stop *t* in other positions, as in (22). The rule can be formulated as in (23), where the stop *t* in question is marked in bold.

- (21)a. [time]_Σ → [th]ime
 b. [ty]_Σ [phoon]_Σ → [th]yphoon
 c. [de]_Σ [tention]_Σ → de[th]ention
 d. [en]_Σ [tire]_Σ → en[th]ire
 e. [tree]_Σ [toad]_Σ → [th]ee [th]oad
 f. [tree]_Σ [toad]_Σ → sweet [th]ooth
- (22)a. [sting]_Σ → *s[th]ing
 b. [alter]_Σ → *al[th]er
 c. [ab]_Σ [stain]_Σ → *abs[th]ain
 d. [au]_Σ [stere]_Σ → *aus[th]ere
 e. [night]_Σ [owl]_Σ → *nigh[th] owl
 f. [falt]_Σ [iron]_Σ → *fla[th] iron

(23) The Aspiration rule in English

$$t \rightarrow [+asp] / [_ \dots]_{\Sigma}$$

According to Nespors and Vogel (1986), by referring to the foot, the phonological phenomenon

can be accounted for in a simpler way, instead of being explained in terms of stress which may require more complicated rules.

Another rule that works by referring to the foot domain in English is *l*-deletion (LD) rule, which applies to an *l* that is preceded by a voiceless consonant, only when the two segments are grouped within the same foot. This rule applies to the examples in (24a-b), but not to those in (25c) (cf. Kiparsky 1979, Nespors and Vogel 1986, among others). The consonants in question are marked in bold. The formulation of *l*-deletion (LD) is provided in (25).

- (24)a. [Islip]_Σ → Is[**l**]ip
 b. [eye]_Σ [slip]_Σ → eye s[**l**]ip
 c. [ice]_Σ [lip]_Σ → *ice [**l**]ip

(25) The *l*-deletion rule in English

$$l \rightarrow [-\text{voice}] / [\dots [\text{voice}] _ \dots]_{\Sigma}$$

Another case that operates within the domain of foot comes from the Amoy, a tonal language. In Amoy, when the suffix *a*⁵³ is added to a morpheme, the two form a single foot, with the marked w-s prominence pattern, while other tone bearing units form separate feet on their own, as exemplified as in (26) (cf. Yip 1980, Nespors and Vogel 1986).

- (26)a. tshin²¹ + a⁵³: [[tshin²¹]_{σ_w} [a⁵³]_{σ_s}]_Σ 'small scale'
 b. tshin²¹ + a²¹: [[tshin²¹]_{σ_w} [[a²¹]_{σ_s}]_Σ 'scale box'

There is a segmental rule of Gemination in Amoy which applies to the final consonant of a syllable when it precedes a vowel-initial syllable within the same foot, as in (27a), but not applies to the items in different syllables, as in (27b). The rule of Gemination can be formulated as in (28), provided by Nespov and Vogel (1986).

- (27)a. tshin²¹ + a⁵³ → [tshin⁵⁵ na⁵³]_Σ 'small box'
- b. tshin²¹ + a²¹ → [tshin⁵³]_Σ [a²¹]_Σ 'scale box'
- *[tshin⁵³]_Σ [na²¹]

(28) The Gemination rule in English

$$C \rightarrow [+long] / [\dots [\dots _]_{\sigma} [V \dots]_{\sigma} \dots]_{\Sigma}$$

Moreover, the foot has also been reported as the domain of application of certain autosegmental phonological rules, one of which is the Nasalization in Applecross Gaelic (cf. Ternes 1972, van der Hulst and Smith 1982, Nespov and Vogel 1986, among others). This rule spreads nasal feature from a stressed nasal vowel until the end of the word and also goes backward to the consonantal onset of the stressed syllable, as in (29a). This rule cannot be blocked are: (a) a stop within the domain, as in (29b-c), or (b) one of the vowels /e/, /o/, or /ə/, as in (29d). Furthermore, this rule does not cross the boundary of the foot, as exemplified in (29e).

- (29)a. /ʃɛ̃nɛ. var/ → [ʃɛ̃ñɛ. ṽãr̃]_Σ 'grandmother'

- b. /strāi. γ/ → [střāí. ỹ]Σ ‘string’
- c. /khǫ̃ispaxk/ → [khǫ̃ispaxk]Σ ‘wasp’
- d. /mǎ. riçən/ → [mǎ. řičən]Σ ‘mothers’
- e. /khǫ + vía. t/ → [khǫ]Σ [vǐǎ. t]Σ ‘how much’
- *[khǫ̃]Σ [vǐǎ. t]Σ

The next phonological phenomenon that makes reference to the domain of foot is the phonotactic restrictions in Žul’hōasi, a Namibian tonal language (cf. Snyman 1975, Smith 1986, Nespor and Vogel 1986, among others). In this language, although any single syllable may bear one of the four basic tones, however, the number of the possible tonal combination are reduced within the domain of the foot. The restriction requires that the intervocalic consonant within the foot may only be one of the following four: *b, m, r, n*, within the domain of foot, as exemplified as in (30).

- (30)a. lōarà ‘complete’
- b. n#òanà ‘tell’

The restriction on intervocalic consonants as shown above only applies to those within the same foot. However, when a consonant is at the position of juncture of two feet, the consonants other than the four above-mentioned can be found, as illustrated in (31). Consonants in question

are underlined.

- (30)a. [kx'ù]_Σ [kx'ùni]_Σ 'move'
 b. [ʃ'ää]_Σ [ʃ'àmà]_Σ 'gather'

In this section, I have illustrated that the foot as the domain of application for segmental and autosegmental rules in various languages. Therefore, the foot should be established as an indispensable constituent in the universal prosodic hierarchy. However, it does not mean that in every language there exists such kind of binary contrast.

3.2.2 Metrical Approach in Wu

Although there is no published book or articles particularly discussing the domain of foot in Ningbo dialect, a few scholars have discussed the foot as the domain of application for TS rules in some of its neighboring languages under the framework of the metrical theory, such as Shanghai dialect (Chen 2000:307, Duanmu 1993, 1997, 1999, among others).

The first to apply the metrical approach to Chinese phonology were Chen (1979, 1980, 1984, 2000) and Wright (1983) with their emphasis on Fuzhou dialect. Following their works, Duanmu applies the metrical approach to the studies on Shanghai dialect (1991, 1992, 1993, 1999, 2000, 2007). Within the metrical approach, Duanmu (1993, 1997) first claims that Chinese is both mora-counting and syllable-counting. In particular, a heavy syllable always forms a moraic trochee (M-

FOOT), but a minimal word must be a syllabic trochee (S-FOOT), which he calls as Dual-Trochee. Since a stressed syllable must be heavy, an S-FOOT always contains at least one M-FOOT.

Duanmu considers Shanghai syllable as light inherently based on his observation that Shanghai dialect does not have diphthong or contrastive nasal coda. Since within a TS domain, all the syllables but the leftmost one deletes their tones, only the initial syllable gets stress. Moreover, since a stressed syllable must be heavy, the Shanghai S-foot must be heavy-light. In other words, according to Duanmu, all the syllables in Shanghai dialect are light, but the initial syllable in a tone sandhi domain is heavy because it remains its tone.

According to Duanmu, the syllable tones in Shanghai are H and L, instead of HL and LH. A tonal polarity constraint proposed by Duanmu (1993, 1999) requires an initial tone to be followed by an opposite tone. Thus, H leads to HL, and L leads to LH. A further constraint imposed by Duanmu (1993, 1999) requires a syllable to carry a simple tone. This forces the polarity tone to occur on the second syllable, even though the initial syllable has two tone-bearing units. Finally, both the polarity constraint and the simple tone constraint can be overridden by the requirement for tonal categories to remain distinct, to be seen below. The relevant metrical constraints tonal constraints are proposed by Duanmu are cited in (31) and (32), respectively, in which “A >> B” means “A is ranked higher than B.”

(31) Metrical constraints

- a. S-FOOT: heavy-heavy or heavy-light.

b. KEEP WEIGHT: Syllables must preserve their underlying weight.

S-FOOT >> KEEP WEIGHT

(32) Tonal constraints

a. T-DISTINCTION: A stressed syllable must maintain its tonal distinction.

b. POLARITY: An initial tone is followed by an opposite tone at surface in an S-foot.

c. SIMPLE TONE: Avoid contour tones.

T-DISTINCTION >> POLARITY >> SIMPLE TONE

By employing these constraints, Duanmu tries to account for the TS at word and phraseal levels in Shanghai dialect, which, I will not go into details but refer the readers to Duanmu (1999, 2000). As a matter of fact, there are several problems in Duanmu's analysis.

First of all, he claims that Shanghai dialect is inherent light since all syllables have simple rimes, namely, no diphthongs or contrastive codas. However, such claim is not correct. The syllable weight is determined according to the number and/or duration of segments in the rime. A heavy syllable is a syllable with a branching nucleus or a branching rime. A branching nucleus generally means the syllable has a long vowel or a diphthong, which is usually abbreviated as CVV. A syllable with a branching rime is a closed syllable, that is, one with a coda (one or more consonants at the end of the syllable), which is abbreviated as CVC. In Shanghai dialect, there are a great number of syllables with a branching rime, such as 真 [tsəŋ] 'real', 姐 [tɕia] 'sister', 欢 [huə]

'happy', etc. Therefore, by the definition of the weight of the syllables, Duanmu's observation does not hold the water.

Secondly, as pointed out by Zhang (2017), whether the foot as a prosodic domain exists in a language or not is determined by the existence of metrical binary contrast. The contrast is frequently represented by the stress, as in English, duration, pitch or strength of syllables. However, in Shanghai dialect, there does not exist such kind of binary contrast, nor does it exist in the Ningbo dialect. Take Ningbo dialect as example, while there are a great number of disyllabic words, there also exist a lot of trisyllabic words or longer ones, as illustrated in (33a-b) and (33c-d). One may claim that the domain of foot does exist in this language since in disyllabic compounds, the left syllable always remains its base tone while the right one loses the tone. However, quadrisyllabic monomorphemic words would serve as the counterevidence since the third and the fourth syllable both lose their tones and get assigned default low tone, thus, they do not form binary contrast in any way. Moreover, in the disyllabic sandhi forms of Ningbo dialect, on the one hand, in LTS, only the first syllable remains its tone which seems to form a contrast between the two members of a disyllabic combination, on the other hand, in PTS, the second syllable keeps its tone while the first syllable only remains the first part of its sandhi melody/base tone. This sandhi pattern is similar to that in Shanghai dialect, thus, Duanmu's claim that the foot of Shanghai dialect is heavy-light does not hold water. The above arguments are illustrated in the examples below. The transcription on the left side of the arrow are the underlying forms/base tones while those on the right of the arrow

are sandhi forms.

- (33)a. 开心 ke^{MHL} tɕhiŋ^{MHL} → ke^M tɕiŋ^{HL} 'happy'
- b. 手机 ɕy^H tɕi^{MHL} → ɕy^H tɕi^L 'cellphone'
- c. 维多利亚 vi^{LHL} tɕu^{MHL} li^H ja^H → vi^L tɕu^H li^L ja^L 'Victoria'
- d. 避暑山庄 bi^{LHL} sɕ^H sɕ^{MHL} zɕ^{MHL} → bi^L sɕ^H sɕ^L zɕ^L 'Summer Villa'

In a stress language, a foot often consists of a strong syllable and a weak syllable, with the strong syllable carrying the primary stress. The universal rules restrict that only one syllable in a foot is the metrical prominent. Duanmu's proposal on Shanghai dialect is merely based on the spreading of the tone of the leftmost tone. In other words, the foot domain that established by Duanmu is based on the contrast between tones. If his proposal holds water, then the output of the sandhi form within the domain of foot can only allow one syllable to have high tone, which is wrong in reality as seen in (33d-f).

Moreover, another main problem of Duanmu is that he uses the notion of the foot to account for application of sandhi rules at both lexical level and phrasal level. As will be discussed in Chapter IV, the domain of the prosodic word is either the same as or smaller than the terminal node of the syntactic tree (Nespor and Vogel 1986, 2009), thus, the prosodic domain for application of TS rules at phrasal level must be larger than the prosodic word. However, as argued by Zhang (2017), the foot and syllable belong to the rhythm-based hierarchy, which employ pure

phonological information. Thus, it is inappropriate to consider foot as the domain of application of TS rules which actually operate in the larger domain and can actually be better explained by employing the concepts of the prosodic word and phonological phrases.

To conclude, as discussed in Section 3.2.1, one significant motivation to establish the domain of the foot is based on the phonological phenomena that make crucial reference to this certain domain. However, in Ningbo dialect, I have not found nor there have been any reported phonological phenomena in literature that make specific reference to this domain. As I will demonstrate and discuss in the following chapters, all the tone sandhi phenomena can be accounted for by making reference to the other domains in the prosodic hierarchy in Ningbo dialect. For example, the tone sandhi rule that Duanmu tries to account for can be easily explained by employing the notions of the phonological word, clitic group and phonological phrase. Therefore, there is no necessity to establish such domain in the Ningbo dialect.

Nevertheless, as Zhang (2017) points out, the unemployment of the notion of the foot does not disqualify it as a prosodic constituent in the universal prosodic hierarchy since, as presented in Section 3.2.1, there are a lot of languages in which certain phonological rules do indicate that foot has to be a dispensable domain in those languages. Thus, whether the foot exist in a language or not is a language-specific issue in terms of language typology.

Chapter IV. The Phonological Word in the Ningbo Dialect

This chapter examines the domain of prosodic word in the Ningbo Dialect. The goal of this chapter is to provide a critical review of the studies on the prosodic word (PW) in various languages of the world, and to investigate the phonological phenomena within the domain formed by morpho-syntactic words in the Ningbo dialect as well as discussing the role that the prosodic word plays in the phonological rule application in the Ningbo dialect.

This chapter is organized as follows. Section 4.1 includes the basic introduction to the definition of the prosodic word and its domain. Section 4.2 offers the common diagnostics for the prosodic word across languages. Section 4.3 provides a complete survey on various types of morpho-syntactic formation in Ningbo dialect. Section 4.4 will examine application of phonological phenomena with reference to the different types of morpho-syntactic words discussed in Section 4.2, and then provide the definition of the prosodic word domain in the Ningbo dialect as well as further discussion on some outstanding issues in this dialect, such as the rhythm effect and minimal disyllabic word requirement. A short conclusion is provided in Section 4.5

4.1 Introduction

4.1.1 Definition of the Prosodic Word

The prosodic word is the prosodic unit that is higher than the foot and which directly dominates

the foot, but is smaller than the clitic group and the phonological phrase in the hierarchy. In relevant literature, this constituent is often termed the 'prosodic word' or the 'phonological word'. According to Nespor & Vogel (1986, 2007) and others, the prosodic word constitutes the lowest unit in prosodic hierarchy constructed on the basis of mapping rules that make use of non-phonological information. In particular, the mapping rules defining the constituent represent the interface between morphology and phonology.

It has been claimed by a number of linguists that the prosodic word is an independent prosodic constituent in the hierarchy that provides a domain for application of various phonological rules across languages.

4.1.2 The Prosodic Word Domain

A number of linguists (Booij, 1993, among others) have claimed that there are three basic possibilities for the size of the prosodic word domain, namely, that it is the same size as, larger than or smaller than the terminal node of a syntactic tree which will be demonstrated in the next section.

However, according to Nespor & Vogel (1986, 2007), the domain of the phonological word can only be either of the same size or smaller than a syntactic terminal node, depending on language-particular definitions of the prosodic domain. The definition of the phonological word domain proposed by Nespor & Vogel (1986) is presented in (1).

(1) Prosodic Word (ω) domain (adapted from Nespor & Vogel 1986, 2007)

A. The domain of ω is the terminal node of the syntactic tree, or,

B. I. The domain of ω consists of

a. a stem;

b. any element identified by specific phonological and/or morphological criteria;

c. any element marked with the diacritic [+W].

II. Any unattached elements within the terminal node of the syntactic tree form part of the adjacent ω closest to the stem; if no such ω exists, they form a ω on their own.

Generally speaking, the Type A refers to the prosodic word that is the same size of the terminal node of the syntactic tree while the Type B refers to the one that is smaller. In languages such as Greek and Latin, there is coincidence between the prosodic word domain and the terminal syntactic node: a PW includes a stem plus all adjacent affixes, as well as both member of compounds. Type BIa refers to cases in languages such as Turkish and Sanskrit, in which the domain of prosodic word is smaller than a syntactic terminal node, since, in compounds, each stem forms a phonological word joining by its adjacent affixes (cf. Nespor & Vogel 1986: 117-122, Nespor & Ralli 1996). Type BIb refers to the cases in languages such as Hungarian, where prefixes can form

independent prosodic word, as well as Italian, where certain prefixes can form their own prosodic word domain (cf. Nespor & Vogel 1986: 122-134). Type BIb is also exemplified by the cases in languages such as Yidiñ, in which a prosodic word is formed by either a stem or a suffix that meets the requirements of a well-formed word (cf. Nespor & Vogel 1986: 134-136). Type BIc refers to the cases in languages such as Dutch, where certain suffixes form their own prosodic word domain and have to be lexically marked as prosodic words (cf. Nespor & Vogel 1986: 136-140).

As for Type BII, the elements that do not contain stems will attach to a prosodic word within the terminal node of the syntactic tree or form a prosodic word by themselves, respect to the requirement of the Strict Layer Hypothesis.

More recently, some aspects of Nespor & Vogel's definition have been either questioned or refined. For example, unlike Nespor & Vogel, Booij (1996), among others, argues that the combination of a lexical host and a clitic constitutes a case where a prosodic word may respond to a unit larger than a syntactic node. Moreover, as Nespor & Vogel claim in Type BII, that unattached elements may form a prosodic word by themselves if there is no adjacent such PW for them to attach to, it may allow clitics to form their own prosodic word. Such kind of over-generalization of the definition has met objections (cf. among others, Itô & Mester 1992, Selkirk 1996). For those who disagree, elements such as clitic should not be analyzed as prosodic word.

Furthermore, Nespor and Ralli (1996) argue that compound words both in Greek and Italian maybe identified either as a single prosodic word or as two prosodic words. According to them,

the distinction lies in the morphological structure of the compound in question. Peperkamp (1997) proposes a different analysis of Italian prefixed word in which prefixes are not incorporated into the base prosodic word, regardless of syllabic structure.

To conclude, although it is clear that there must be a word-size prosodic domain distinction from any other morphosyntactic constituents, cross-linguistically, the definition of the prosodic word is still an open question. Different languages may vary in the way how morpho-syntactic information is operated when the prosodic word is formed.

4.2 Diagnostics for the Prosodic Word

In European languages, primary word stress is one of the most intuitive diagnostics for the prosodic word domain. As a matter of fact, in European languages, it is generally accepted that the prosodic word must bear one and only one primary stress.

Moreover, like other domains, it has been long recognized that the domain of the prosodic word is sensitive to segmental rules. For example, Nespor & Vogel (1986) report several processes of various languages that are bound by prosodic word domain, such as Nasal Assimilation and Stop Voicing in Greek, Intervocalic s-Voicing, Vowel Raising, and Vowel Lengthening in Italian, Main Stress Rule in Latin, Final Voicing in Sanskrit, and Vowel Harmony in Turkish.

Take Sanskrit as an example. According to Selkirk (1980a), in Sanskrit, each word of a syntactic marker constituent a phonological word domain, unless it is composed of a compound

stem, in which case the first member constitutes one phonological word and the second member plus its affixes constitute a separate phonological word. The phonological word so defined is the domain of application of several phonological rules, including the Final Voicing rule, which assimilates a

[-sonorant] segment in voicing to the following segment only at a phonological juncture, as exemplified in (2). The hyphen '-' stands for the phonological juncture.

- (2) a. sat - aha → sad - aha 'good day'
 b. tat - namas → tad - namas 'that homage'

In addition, the prosodic word has also been reported to be the domain for phonotactic generalizations. For example, Booij (1995) reports that, in Dutch, the right edge of the prosodic word allows for syllables longer than those found internally. Peperkamp (1997) reports that prosodic word cannot begin with [ʌ]. In German, short full lax non-low vowels cannot appear on the right side of prosodic word (Hall 1999). And in English, there are more consonantal clusters word internally than at the edge of the prosodic word (Raffelsiefen 1999).

Pitch accent assignment in some pitch accent languages has also been reported to be sensitive to the domain of the prosodic word. For example, Godjevac (2000) reports that pitch accent assignment in Serbo-Croatian only applies to the prosodic word but not to the clitics. Pitch accent assignment, therefore, can be used as a diagnostic of the prosodic word domain in such languages.

Booij (1985, 1988) and Wiese (1993, 1996), Kleinhenz (1994) propose that in Dutch and German the deletion of element within complex words in partially similar coordinate structures depends not only on morphosyntactic information, but also on prosodic status of the elements omitted in the string: besides partial phonological identity with respect to the other element of the coordinate structure, it must form an independent prosodic word. I am not going to delve deeper in this case, but generally speaking, it shows that Deletion under Identity may also be related to the prosodic word.

A number of languages have been reported to show the prosodic word is also necessary for Minimal Word requirements. That is, the prosodic word is argued to have a minimal size, usually being at least disyllabic or bimoraic. According to the literature surveyed in Kenstowicz (1994), among others, languages can be divided into three types in respect to the minimal size of the prosodic word, presented in (3).

(3) Minimal word requirement across languages (cf. Dixon 1977a, b, McCarthy & Prince 1986, 1990, Kenstowicz 1994)

Type 1: disyllabic (e.g., Yidj, cf. Dixon 1977a, b; Lardil, cf. Hale 1973)

Type 2: bimoraic (e.g., German, cf. Hall 1999, Japanese, cf. Itô 1990; Estonian, cf. Prince 1980; Choctaw, cf. Lombardi & McCarthy 1991; Iraqw, cf. Mous 1993)

Type 3: no minimal word requirements: a prosodic word may consist of a single mora/syllable. (e.g., Irish, cf. Green 1997; Brazilian Portuguese, cf. Bisol 2000; European

Portuguese, cf. Vigário 2003)

Clipping (or truncation) is another process that may provide evidence for prosodic word domain. Various languages have been reported to have morphological operations consisting of the shortening of words, the output of which forms a minimal prosodic word (e.g., Japanese, cf. Mester 1990; Spanish, cf. Prieto 1992; Catalan, Cabre 1993, and Cabre and Kenstowicz 1995; Italian, Thornton 1996).

In Germanic languages, where (re)syllabification is bound by a word-size constituent, the domain of syllabification is also usually taken as reference to the prosodic word domain (e.g., Dutch, Booij 1995, 1996; German, Wiese 1996, Hall 1999; English, Raffelsiefen 1999)

To conclude, several types of diagnostics may cue the prosodic word domain. Nevertheless, it is possible that only one type of the abovementioned diagnostics may make crucial reference to the prosodic word domain in a particular language.

4.3 Morphosyntactic Words in the Ningbo Dialect

4.3.1 Monomorphemic Words

Similar to the morpho-syntactic words in many other Chinese languages or dialects, the morpho-syntactic words in the Ningbo dialect contains several sub-types based on the morphosyntactic process of their formation.

In Chinese, it is widely accepted that morpho-syntactic words refer to both free and bound morphemes. In Ningbo dialect, there are a number of monomorphemic words, each of which only contains one single morpheme. There are quite a few disyllabic monomorphemic words in Ningbo dialect while monomorphemic words that include three or four syllables are rare. Most of the long polysyllabic monomorphemic words are loan words borrowed from foreign languages while the monosyllabic ones are the basic words in Ningbo dialect. Examples of monomorphemic words are given in (4) below.

(4) a. monosyllabic:

山	se	'mountain'	人	niŋ	'human'
饭	ve	'rice; food'	炮	pə	'canon'
吃	tɛhyo?	'to eat'	派	pha	'to send'
争	tsã	'to argue'	摘	tɕa?	'to pick up'
木	mo?	'dumb'	忙	mɔ̃	'busy'
皮	bi	'naughty'	花	huo	'lusty'

b. Disyllabic:

荔枝	li	tɛi	'litchi'	葡萄	bu	dɛu	'grape'
巴西	pa	ɛi	'Brazil'	波兰	pɛu	lɛ	'Poland'

c. Trisyllabic or quadrisyllable:

加拿大	tɛia	na	da	'Canada'
-----	------	----	----	----------

司别灵	si	bjeʔ	liŋ		'lock'
马来西亚	mo	lɛ	ɛi	ja	'Malaysia'
哥伦比亚	kɛu	luəŋ	pi	ja	'Columbia'

There are very few monomorphemic words containing more than four syllables in Ningbo dialect. However, the tone sandhi behavior of the monomorphemic words containing five syllables or more is different from that of those with fewer syllables, which will be discussed later in this chapter.

4.3.2 Derived Words

A large number of morpho-syntactic words in Ningbo dialect are derived words. A derived word is formed on the basis of an existing word by adding a prefix or suffix. In the Ningbo dialect, there are a few prefixes and suffixes, most of which attach to the stem of nouns to derive new nouns, while there are few suffixes which attach to the stem of adjectives or verbs to create new words.

In the following part, some commonly used affixes are discussed with examples. (cf. Zhou 2012, among others).

4.3.2.1 Prefix 阿- [aʔ]

In Ningbo dialect, the prefix 阿- [aʔ] is attached to a noun, the derived form of which is used to address people and indicates intimacy. 阿- can be used in front of a monosyllabic stem for kinship term to address people, as in (5a). It is also used before people's given names, as in (5b). Moreover, it can be used to precede a monosyllabic noun of number to address people by their birth order among the siblings, as in (5c).

- (5) a. 阿娘 aʔ njã 'grandmother' 阿婆 aʔ bæu 'husband's mother'
 b. 阿根 aʔ kɛŋ 'Gen' (person's given name) 阿花 aʔ huə 'Hua' (person's given name)
 c. 阿一 aʔ jeʔ 'the oldest one among the siblings'
 阿四 aʔ si 'the fourth one among the siblings'

However, it should be noted that the usage of 阿- in (5a) is different from that in (5b) and (5c). The 阿- in (5a) is used as prefix, however, while the 阿- in (5b) and (5c) is actually a proclitic. In the cases of (5b) and (5c), the second syllables are all person's name or numeral words, they are the host for the proclitic 阿- to attach to form clitic groups, while the second syllables in the words of (5a) are just stems which need the suffix to form a word. I will discuss about the cases like (5b) and (5c) in Chapter V.

4.3.2.2 Prefix 老- [ləu]

老- [ləu] can be used as a free morpheme which means 'old'. When it is used as a prefix, it can

be attached to a name (usually a family name) to express a sense of intimacy, as in (6a), the usage of which is the same as *lao* 老- in Mandarin Chinese. In Ningbo dialect, 老- can be used to precede a monosyllabic noun to address people with a sense of intimacy as well, as in (6b). 老- can also be used in animal terms, as in (6c). Moreover, it can be used to precede a monosyllabic numeral noun to address people by their birth order among the siblings, as in (6d).

- (6) a. 老王 ləu wɔ̃ 'Old Wang' 老张 ləu tɕjã 'Old Zhang'
 b. 老公 ləu koŋ 'husband' 老娘 ləu njã 'mother'
 c. 老鼠 ləu tshɿ 'mouse' 老虎 ləu fu 'tiger'
 d. 老三 ləu sɛ 'the third one among the siblings'
 老七 ləu 'the seventh one among the siblings'

However, same as 阿-, the usage of 老- in (6a) & (6d) is different from that in (6b) and (6c). 老- in (6b) and (6c) is used as prefix, while 老- in (6a) and (6d) is actually a proclitic. The second syllables in the former cases are the stems while those in the latter cases are the hosts for 老-, as a proclitic, to attach to.

4.3.2.3 Suffix -头 [dɔy]

As a free morpheme, -头 [dɔy] means 'head' in Ningbo dialect. When it is used as a suffix, it can attach to nouns, verbs or adjectives to form new nouns with no easily definable meaning. Comparing with its counterpart in Mandarin Chinese, -头 is more productive in creating new

words in Ningbo dialect. Examples are presented as in (7).

- (7) a. 纸头 tsɿ dəŋ 'paper' 斧头 fu dəŋ 'axe'
 b. 上头 zɔ̃ dəŋ 'upside' 后头 həŋ dəŋ 'backside'
 c. 看头 khi dəŋ 'what to watch' 滑头 huaʔ dəŋ 'slippery fellow'
 d. 苦头 khu dəŋ 'hardship' 甜头 di dəŋ 'benefit'
 e. 乡下头 ɛjã ho dəŋ 'country side' 冷饭头 lã ve dəŋ 'leftover'
 f. 一角头 jeʔ koʔ dəŋ 'one dime coin' 十块头 zoʔ khuəi dəŋ 'ten dollar bill'

4.3.2.4 Suffix -子 [tsɿ]

子 [tsɿ] as a free morpheme in Ningbo dialect means 'son'. Different from its counterpart in Mandarin, -子 in Ningbo dialect is very productive. It can follow a stem of time to create a new time word, as in (8a), as well as going after some other nouns, which is not legitimate in Mandarin Chinese, as in (8b).

- (8) a. 旧年子 dzy ni tsɿ 'last year' 明朝子 miŋ tɕio tsɿ 'tomorrow'
 b. 新娘子 ɛiŋ njã tsɿ 'bride' 角子 koʔ tsɿ 'coin'
 迹子 tɕjeʔ tsɿ 'stain' 谜子 mi tsɿ 'riddle'

4.3.2.5 Suffix -刮气 [kuaʔ tɕhi]

In Ningbo dialect, the suffix -刮气 [kuaʔ tɕhi] is used after a disyllabic adjective or a disyllabic

noun to form a new adjective, expressing the state or condition that the adjective or the noun describes, which usually have negative connotations. It can never be used as a free morpheme.

Examples are presented as in (9).

(9) a. adjective+刮气

呆大刮气 ŋe dɛu kua? tɛhi 'stupid'

老三刮气 lɛu se kua? tɛhi 'impolite'

b. noun+刮气

异样刮气 ji jã kua? tɛhi 'weird'

腥气刮气 ɛiŋ tɛhi kua? tɛhi 'smelly'

4.3.2.6 Infix -打- [tã]

As a free morpheme, -打- [tã] means 'to beat'. When it is used as an infix, it is usually inserted between two reduplicated monosyllabic measure words to express the meaning of 'every', which is exemplified as in (10).

(10) 只 tsa? measure word → 只打只 tsa? tã tsa? 'every'

个 kɛu measure word → 个大个 kɛu tã kɛu 'every'

4.3.2.7 Infix -刮- [kua?] or -刮斯- [kua? sɿ]

The infixes -刮- [kua?] and -刮斯- [kua? sɿ] can only be bound with a disyllabic adjective of

internal modifier-head structure to indicate somewhat superlative degree of adjectives. A modifier-head adjective in the Ningbo dialect refers to an adjective within which the morpheme on the left modifies the one on the right. If we use AB to stand for a disyllabic modifier-head adjective in Ningbo dialect, A 刮斯 B usually indicates a higher degree than A 刮 B. The examples of these two cases are given in (11).

(11)a. A 刮 B

冰冷 piŋ lã 'cold' → 冰刮冷 piŋ kua? lã '(very) cold'

雪淡 so? dɛ 'tasteless' → 雪刮淡 so? kua? dɛ '(very) tasteless'

b. A 刮斯 B

冰冷 piŋ lã 'cold' → 冰刮斯冷 piŋ kua? sɿ lã '(extremely) cold'

雪淡 so? dɛ 'tasteless' → 雪刮斯淡 so? kua? sɿ dɛ '(extremely) tasteless'

4.3.2.8 Infix -得斯- [ta? sɿ]

The infixes -得斯- [da? sɿ] can only be bound with disyllabic modifier-head adjectives. Similar as A 刮斯 B in section 4.3.2.7, the form A 得斯 B also indicates somewhat superlative degree of adjectives. The examples of these two cases are given in (12).

(12) 滚圆 kuəŋ jy 'round' → 滚得斯圆 kuəŋ ta? sɿ jy '(very) round'

血红 ɛyo? fiŋ 'red like blood' → 血得斯红 ɛyo? ta? sɿ fiŋ '(very) red'

4.3.2.9 Derived words containing more than one affixes

A derived word in Ningbo dialect can contain more than one affixes, as exemplified in (13).

(13) stem+two suffixes

寿头刮气 zy dəŋ kuaʔ tɛhi 'stupid'

4.3.3 Compounds

A compound is a word formed by combining two, sometimes three or more, free morphemes (stems). Based on the syntactic/semantic relation between the member of a compound, in Ningbo dialect, compounds can be divided into the following sub-types: (1) subject-verb (SV); (2) verb-object (VO); (3) adverbial modifier-head (MH); (4) adnominal modifier-head (MH); (5) coordination (CC); and (6) verb-complement (VC).

4.3.3.1 Subject-verb Compounds

A subject-verb compound is created by two stems in such a way that the stem on the right takes the stem on the left as its subject, as exemplified in (14). The meaning of the resulting compound is not necessarily equal to the simple combination of the meanings of the two stems.

(14) 夏至 fiə tsɿ 'summer' + 'arrive' → 'June solstice (a fortnightly period)'
 夜到 ja tɔ 'night' + 'arrive' → 'night'

4.3.3.2 Verb-object Compounds

A verb-object compound is derived through the combination of two stems that have the internal verb-object construction, and the stem on the left takes the one on the right as its object. The meaning of the newly created compound does not always as same as the combination of the meanings of the two stems, as in (15).

- (15) 回头 fuəi dəɿ 'return' + 'head' → 'to refuse'
 领径 liŋ ɬeiŋ 'to get' + 'path' → 'convenient'
 出手 tshoʔ ɛy 'go out' + 'hand' → 'to set about'

4.3.3.3 Adverbial Modifier-head and Adnominal Modifier-head Compounds

In a modifier-head compound in Ningbo dialect, generally speaking, the stem on the left modifies the one on the right. The relation between the members of modifier-head compounds can further be divided into adnominal modification, as in (16a), and adverbial modification, as in (16b)

(16)a. Adverbial MH

- 旧年 dzy ni 'old' + 'year' → 'last year'
 外国 ŋa koʔ 'outside' + 'country' → 'foreign country'
 眼火 ŋɛ hɛu 'eye' + 'fire' → 'insight; vision'
 肚皮 du bi 'belly' + 'skin' → 'belly'
 b. 难熬 nɛ ŋɔ 'difficult' + 'suffer' → 'suffering'

老早	ləu	tsəu	'old' + 'early'	→ 'already'
尽够	tɕiŋ	kəy	'completely' + 'enough'	→ 'enough'

4.3.3.4 Coordination Compounds

A coordination compound is created through the combination of stems between which there exists an antonymous or a synonymous relationship, as given in (17). The meaning of the resulting compound may be different from a simple combination of the meanings of the stems.

(17) a. Stems with identical or similar meanings

饭菜	vɛ	tse	'rice' + 'vegetable; dishes'	→ 'food'
沙泥	so	ni	'sand' + 'mud'	→ 'sand and mud'

b. Stems with opposite meanings

好坏	hə	va	'good' + 'bad'	→ 'no matter'
开关	khe	kue	'open' + 'close'	→ 'switch'

c. Stems with related meaning (the resulting meaning of the compound comes from one of the stems)

国家	ko?	tɕia	'country' + 'family'	→ 'country'
事体	zɿ	thi	'affair' + 'shape'	→ 'affair'

d. Stems with related meaning (the resulting compound has a new meaning that is totally different from the simple combination of the meaning of the two stems)

乌青	wu tɛhiŋ	'black' + 'blue'	→ 'gore'
风光	foŋ kuõ	'wind' + 'light'	→ 'famous; be admired'

4.3.3.5 Verb-complement Compounds

A verb-complement compound consists of a verb followed by a complementary element, in which the complementary element serves to describe the manner or result of the action expressed by the verb, as presented in (18).

(18)	磕开	kha?	ke	'knock + 'open'	→ 'injured'
	冻掉	toŋ	dio	'freeze' + 'drop'	→ 'get cold'
	养出	jã	tso?	'raise' + 'out'	→ 'finish supporting children'
	吓煞	ha?	sa?	'scare' + 'die'	→ 'extremely scared'

4.3.4 Reduplication

Reduplication is a morphological process of forming new words by doubling an entire free morpheme (total reduplication) or part of it (partial reduplication). Morphologically speaking, reduplication is one of the word-building processes, and the reduplicated morphemes are different from the original morpheme in semantics and syntax sometimes. Mandarin Chinese makes use of reduplication sporadically, and so does the Ningbo dialect. In the Ningbo dialect, nouns, adjectives, verbs, or other content words have certain reduplication forms. The following discussions pertain

to the phenomena of reduplication in the Ningbo dialect.

4.3.4.1 Reduplicated Nouns

In the Ningbo dialect, the appellation or the call of family members commonly uses the reduplication to express a sense of intimacy or endearment. They can not only be used when talking to children but can also be used to speak with an adult. Moreover, the reduplication to address family members cannot be applied to the disyllabic call of family members. Only monosyllabic call of family members can be reduplicated, as illustrated in (19).

- (19) 爸 pa 'father' → 爸爸 pa pa 'father'
 舅 dzy 'uncle' → 舅舅 dzy dzy 'uncle'
 囡 nø 'child' → 囡囡 nø nø 'darling (to call child)'

Just as Mandarin Chinese can use the reduplication of nouns to form adverbs or adjectives, so too can the Ningbo dialect demonstrated by the data presented below. Using A to stand for a monosyllabic stem and AB for a disyllabic noun, a monosyllabic noun stem can be reduplicated as AA, as given in (20a), and disyllabic nouns may be reduplicated as AABB, as given in (20b).

- (20)a. 处 tshɿ 'place' → 处处 tshɿ tshɿ 'everywhere'
- b. 生 sā 'born' 世 sɿ 'life'
 → 生生世世 sā sā sɿ sɿ 'generation after generation'

角 koʔ 'corner' 落 loʔ 'corner'

→ 角角落落 koʔ koʔ loʔ loʔ 'everywhere'

4.3.4.2 Reduplicated Adjectives

The second type of reduplication in Ningbo dialect is the reduplication of adjectives, typically denoting emphasis, changing the degree of the quality described, or an attempt at more indirect speech. A monosyllabic adjective can be reduplicated as AA, while a disyllabic one can be reduplicated as ABB, AAB or AABB. The major forms of reduplicated adjectives are exemplified in (21).

(21)a. AA

冷冷 lā lā '(very) cold'

慢慢 mɛ me '(very) slow'

b. ABB

酸汪汪 sɤ wɔ̃ wɔ̃ '(very) sour'

淡刮刮 dɛ kuaʔ kuaʔ '(very) tasteless'

c. AAB

血血红 ɛyoʔ ɛyoʔ ɦioŋ '(very) red'

滚滚圆 kuəŋ kuəŋ y '(very) round'

d. AABB

平平安安 biŋ biŋ ɐi ɐi '(very) peaceful and safe'

快快乐乐 khua khua loʔ loʔ '(very) happy'

Generally speaking, the reduplication form ABB denotes a less acute level of the degree described by the original adjective, which is similar to the adverb *yidiar* 一点儿 'a little' in Mandarin Chinese, while the forms of AAB and AABB indicate a somewhat superlative degree of adjectives.

Moreover, it should be noted that the reduplicated adjectives normally cannot stand alone as a predicate or attributive. They are bound together with an element such as 个 [goʔ] on their right, which is an enclitic in the Ningbo dialect, as will be demonstrated in Chapter V.

4.3.4.3 Reduplicated Verbs

The third type of reduplication in Ningbo dialect is the reduplication of verbs. Monosyllabic verbs can simply be reduplicated as AA, or can be reduplicated as A 记 A 记 or AA 依依, etc. Disyllabic verbs can be reduplicated as ABAB, which usually are used for suggestion or to express one's willing to try something. Examples of these major forms of reduplicated verbs are presented in (22).

(22)a. AA. The simple reduplication form, namely AA, may express various meanings, such as repetition, continuity or completion of an action, depending on the context.

跑跑 bəu bəu 'to run'

开开 khe khe 'to open'

做做 tsəu tsəu 'to do'

b. A 记 A 记. This form of reduplication usually indicates the repetition of an action.

看记看记 khi tɛi khi tɛi 'to peek once in a while'

跳记跳记 thio tɛi thio tɛi 'in a state of constantly jumping'

c. AA 依依. This form usually denotes the repetition or continuity of an action.

唱唱依依 tshō tshō ji ji 'in the state of constantly singing'

摸摸依依 moʔ moʔ ji ji 'in the state of repeatedly touching'

d. ABAB

商量商量 sō ljā sō ljā 'to discuss'

反省反省 fɛ ɛiŋ fɛ ɛiŋ 'to reflect on oneself'

4.3.5 Summary

In Section 2.3.4, I have discussed the major types of morphological processes of morpho-syntactic word formation in Ningbo dialect. In the next section, I will talk about the phonological process of the above-mentioned morpho-syntactic word formations, during which phonological rules may apply to lexical items, that is, the prosodic word domain.

4.4 Phonological Rule Application in the Phonological Word Domain in the Ningbo Dialect

In this section, I will first present the analysis of the phonological tone sandhi in various types of morphosyntactic words which have been mentioned in Section 4.3. This examination will help to identify the domain within which these phonological phenomena occur. Then, I will specifically address the diminutive nouns in Ningbo dialect, the phonological realization of which is quite different from that of Mandarin. Moreover, I will talk about the rhythm effect based on the observation of the sandhi forms applying to a sound string containing more than three or four syllables. In the last subsection, I will conclude with the formation of the prosodic word domain in the Ningbo dialect.

4.4.1 Application of Phonological Tone Sandhi

As discussed in Section 2.2.4, when two syllables combine together to form a certain domain, one of the two types of tone sandhi may apply, namely the lexical tone sandhi rule (LTS) or the post-lexical tone sandhi rule (PTS). On the basis of the survey data on the Ningbo dialect, LTS is applied to the lexical items while application of PTS is much more complicated. LTS is a tone spreading mode, namely, all the syllables except the leftmost one lose their tones, then the base tone of the first syllable is associated with the syllables in the domain from left to right in a one-to-one fashion. If there is any syllable which does not get assigned a tone, a default low tone will be introduced to the floating syllable(s). The tone spreading patterns of LTS in Ningbo dialect is

given in (23). The spreading pattern of D2 is not included below since, as discussed in 2.2.4, it is always a mapping mode.

(23) LTS Tone Spreading Patterns in ND

	BT	Disyllable	Tri-syllable	Quadra-syllabic
A1	MHL	M-HL	M-H-L	M-H-L-L
B1, C1 & D1	H	H-L	H-L-L	M-L-L-L-
A2 & C2	LHL	L-HL	L-H-L	L-H-L-L
B2	LHL	LH-L	LH-L-L	LH-L-L-L

Now let us start with the examination of application of lexical tone sandhi (LTS) in monomorphemic words, derived words, and compounds before then moving on to the reduplicated words and then proceed to the diminutive words as well as the special phonological phenomenon related to them.

4.4.1.1 Application of LTS in Monomorphemic Words, Derived Words and Compound Words

Among the major types of the morpho-syntactic words introduced in Section 4.3, the LTS can be applied within the domain formed by monomorphemic words which contain four or fewer syllables, as in the (24a) (except the type 2 of (24a-i), in which -阿 or -老 are proclitics that attach to the hosts, (namely, person's names or numeral words), by derived words, as in (24b), or by

compounds, as in (24c). The base tone of the leftmost syllable is marked in bold for comparison with the sandhi form. On the left side of the arrow are the base tones while the sandhi forms are marked in bold on the right side of the arrow. If the low tone featured in the sandhi form is assigned by the default low tone, it will be underlined.

(24)a. Monomorphemic Words

i. Disyllabic:

荔枝	li tei	LHL + MHL	→ [L= HL]	'litchi'
波兰	pəu lɛ	MHL + LHL	→ [M=HL]	'Poland'

ii. Tri-syllabic:

加拿大	teia na da	MHL + LHL + LHL	→ [M=H=L]	'Canada'
俄罗斯	nəu ləu sɿ	LHL + LHL + MHL	→ [L= H=L]	'Russia'

iii. Quadra-syllabic

马来西亚	mo le ei ja	LHL + LHL + MHL + H	→ [L H=L=L=L]	'Malaysia'
哥伦比亚	kəu ləŋ pi ja	MHL + LHL + H + H	→ [M=H=L=L]	'Columbia'

b. Derived words:

Prefix+root

阿娘	aʔ njā	H + LHL	→ [H=L]	'grandmother'
老虎	ləu fu	LHL + H	→ [L H=L]	'tiger'
老公	ləu koŋ	LHL + MHL	→ [L H=L]	'huaband'

Clitic+host (the second syllable remains its citation tone while the first one changes to low tone)

阿根	aʔ kəŋ	H + H	→	[L # HL]	'Gen' (person' given name)
阿四	aʔ si	H + H	→	[L # HL]	'the fourth one among the siblings'
老王	ləu wɔ̃	LHL + LHL	→	[L # LHL]	'Old Wang'
老二	ləu ni	LHL + LHL	→	[L # LH]	'the second one among the siblings'

Root+suffix

纸头	tsɿ dəŋ	H + LHL	→	[H= <u>L</u>]	'paper'
后头	ɦəŋ dəŋ	LHL + LHL	→	[LH=L]	'backside'
看头	khi dəŋ	H + LHL	→	[H= <u>L</u>]	'what worth to see'
苦头	khu dəŋ	H + LHL	→	[H= <u>L</u>]	'hardship'
乡下头	ɛjã ɦo dəŋ	MHL + LHL + LHL	→	[M=H=L]	'countryside'
一角头	jeʔ koʔ dəŋ	H + H + LHL	→	[H= <u>L=L</u>]	'one dime coin'
明朝子	miŋ tɕio tsɿ	LHL + MHL + H	→	[L=H=L]	'tomorrow'
新娘子	ɛiŋ njã tsɿ	MHL + LHL + H	→	[M=H=L]	'bride'
迹子	tɕjeʔ tsɿ	H + H	→	[H= <u>L</u>]	'stain'
呆大刮气	ŋɛ dəu kuaʔ tɕhi	LHL + LHL + H + H	→	[L=H=L= <u>L</u>]	'stupid'
猩气刮气	ɛiŋ tɕhi kuaʔ tɕhi	MHL + H + H + H	→	[M=H=L= <u>L</u>]	'smelly'

Root-infix-root

只打只 tsa? tã tsa? H + H + H → [H=L=L] 'every'

雪刮淡 so? kua? dɛ H + H + LHL → [H=L=L] '(very) tasteless'

冰刮斯冷 piŋ kua? sɿ lã MHL + H + MHL + LHL → [M=H=L=L] '(very) cold'

血得斯红 ɛyo? ta? sɿ fiŋ H + H + MHL + LHL → [H=L-L-L] '(very) red'

Root+two suffixes:

寿头刮气 zy dəy kua? tɛhi LHL + LHL + H + H → [L=H=L=L] '(very) stupid'

c. Compound

SP:

夏至 ho tsɿ LHL + H → [L=HL] 'June solstice'

夜到 ja tɔ LHL + H → [L=HL] 'night'

VP:

出手 tsho? ɛy H + H → [H=L] 'to set about'

回头 fiuɛi dəy LHL + LHL → [L=HL] 'to refuse'

Adnominal MH:

旧年 dzy ni LHL + LHL → [L=HL] 'last year'

肚皮 du bi LHL + LHL → [LH=L] 'belly'

Adverbial MH:

老早 ləu tsəu LHL + H → [LH=L] 'already'

难熬 nɛ ŋɔ LHL + LHL → [L=HL] 'suffering'

CC:

沙泥	so ni	MHL + LHL	→	[M=HL]	'sand and mud'
开关	khe kue	MHL + MHL	→	[M=HL]	'switch'
国家	ko? tɛia	H + MHL	→	[H=L]	'country'
乌青	wu tɕhiŋ	MHL + MHL	→	[M=HL]	'gore'

VC:

冻掉	toŋ dio	H + LHL	→	[H=L]	'get cold'
磕开	kha? ke	H + H	→	[H=L]	'injured'

4.4.1.2 Application of LTS in Reduplicated nouns, Adjectives and Verbs

The domain created by reduplicated stems can be the domain for application of LTS, as exemplified in (25).

(25) Application of LTS in Reduplicated Forms

a. Reduplicated Nouns

爸爸	pa pa	H + H	→	[H=L]	'father'
囡囡	nø nø	H + H	→	[H=L]	'darling (to call child)'
处处	tshɥ tshɥ	H + H	→	[H=L]	'everywhere'
角角落落	ko? ko? lo? lo?	H + H + LHL + LHL	→	[H=L=L=L]	'everywhere'

b. Reduplicated Adjectives

i. AA

冷冷 lā lā **LHL + LHL** → [**LH=L**] '(very) cold'

慢慢 mε me **LHL + LHL** → [**L=HL**] '(very) slow'

ii. AAB

酸汪汪 sɔ wō wō **MHL + H + H** → [**M=H=L**] '(very) sour'

淡刮刮 dε kua? kua? **LHL + H + H** → [**LH=L=L**] '(very) tasteless'

iii. ABB

血血红 ɛyo? ɛyo? fiŋ **H + H + LHL** → [**H=L=L**] '(very) red (just like blood)'

粘胶胶 ni kɛu kɛu **H + MHL + MHL** → [**H=L=L**] '(very) sticky'

iv. AABB

平平安安 biŋ biŋ ɛi ɛi **LHL + LHL + MHL + MHL** → [**L=H=L=L**] '(very) safe'

快快乐乐 khua khua lo? lo? **H + H + LHL + LHL** → [**H=L=L=L**] '(very) happy'

c. Reduplicated Verbs.

i. AA

吃吃 tɛhyo? tɛhyo? **H + H** → [**H=L**] 'to eat'

做做 tsɛu tsɛu **H + H** → [**H=L**] 'to do'

ii. A 记 A 记

看记看记 khi tɛi khi tɛi **H + H + H + H** → [**H=L=L=L**] 'repeat peeking'

跳记跳记 thio tɛi thio tɛi **H + H + H + H** → [**H=L=L=L**] 'repeat jumping'

iii. AA 依依

唱唱依依 tshō tshō ji ji **H** + H + H + H → [**H=L=L=L**] 'in a state of singing'

擦擦依依 kha kha ji ji **H** + H + H + H → [**H=L=L=L**] 'in a state of cleaning'

iv. ABAB

商量商量 sō ljā sō ljā **MHL** + LHL + MHL + LHL → [**M=H=L=L**] 'to discuss'

检讨检讨 tēi thō tēi thō **H** + H + H + H → [**H=L=L=L**] 'to reflect on oneself'

4.4.1.5 Summary

Based on the discussion above, it is evident that the LTS applies to the domain formed by monomorphemic words, derived words (except cases where 老- and 阿- attached to a person's names or numeral words), compounds and reduplicated forms in Ningbo dialect.

The odd case concerns the words for addressing people which is formed by 老- or 阿- with personal names or numeral words. As a matter of fact, in these cases, both of 老- and 阿- change their tones to the low tone, and the nouns for person's name or number that 老- or 阿- attach to remain their tones. This TS pattern conforms to that of the clitic group formed by 'proclitic+host', in which the proclitic is assigned a default low tone while the host remains in citation tone if it is monosyllabic.

4.4.2 Diminutive Tone Sandhi

4.4.2.1 Diminutive Nouns and Diminutive Tone Sandhi

A diminutive is a word which has been modified to convey a slighter degree of its root meaning, to convey the meaning of the smallness of the object or quality named, or to convey a sense of intimacy or endearment. It can happen to nouns, adjectives or verbs.

In many languages, the formation of diminutives is by adding suffixes. According to Chen (1992), there exist two types of phonological process for diminutive noun formation in the southern dialects in China, namely diminutive nasalization and diminutive glottalization, which are quite different from the process in the case of Mandarin Chinese. In Mandarin, generally speaking, a diminutive noun is created by adding the suffix -儿 [r] while deleting the vowel coda [i] or [u] or deleting the nasal coda and making the nucleus nasalized, as shown in (26).

In dialects such as Dongyang, Yiwu, Pujiang, among others, a diminutive noun is formed by adding a nasal coda [-n] or [-ŋ] at the end of the stem, meanwhile the preceding vowel will be lengthened (Fu 1985), as exemplified in (26) as well.

(26)

Written form of Mandarin	刀儿	袋儿	桃儿	枣儿
	'knife'	'bag'	'peach'	'jujuba'
Non-diminutive in Mandarin	tau	tai	tau	tsau
Mandarin Chinese	tar	tar	thar	tsar
Dongyang	tau:n	de:n	dau:n	tsau:n

Yiwu	to:n	de:n	do:n	tso:n
Pujiang	to:n	de:n	do:n	tso:n

In some dialects of Wu, the nasal coda [-n] and [-ŋ] added in the diminutive noun formation may have been lost during their historical change, such as some cases in Shanghai (Fu 1985), as illustrated in (27).

- (27) a. 虾 'shrimp' [ho] + [ŋ] → hoŋ → hō → hō̃ → hø
 b. 囡 'female' [ŋy] + [ŋ] → ŋyŋ → ŋỹ → nō̃ → nø

In other dialects of southern China, however, the diminutive nouns can be created by adding a glottal stop coda [-ʔ] accompanied by tone sandhi (Zhengzhang 1980, 1981, 1987; Pan 1988; Egerod 1983; Fu 1985; among others). Although the tonal values of the diminutive sandhi forms may vary in different dialects, it is a universal process to add the glottal stop code [-ʔ] or to make the nucleus of the syllable glottalized, as illustrated in (28) (Egrod 1983, Hu & Cui 1983 and Pan 1983).

- (28) a. Nanxiong dialect
- | regular noun | diminutive form | glossary |
|-------------------|-------------------|------------|
| hei ²¹ | heiʔ ² | 'monkey' |
| muŋ ²¹ | muŋʔ ² | 'mosquito' |

ŋiŋ ²¹	ŋiŋʔ ²	'human'
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b. Shaoguan dialect

regular noun	diminutive form	glossary
jyŋ ²¹	jyŋʔ ²	'meatball'
luŋ ³⁵	luŋʔ ²	'cell'
ʃiŋ ²¹³	ʃiŋʔ ²	'box'
mɔŋ ²¹	mɔŋʔ ²	'net'

c. Qingtian dialect

regular noun	diminutive form	glossary
lue ²¹³	lueʔ ³³⁵	'donkey'
ŋe ²¹³	ŋeʔ ³³⁵	'fish'
ji ²¹³	jiʔ ³³⁵	'sheep'
ja ²²	jaʔ ²²⁴	'swallow (animal)'
bǎa ²²	bǎaʔ ²²⁴	'swallow (animal)'

As can be seen in (28), it is quite common to have the original tone of the syllable changing to a high even or a high rising tone for a glottalized diminutive noun in the dialects of southern

China (Li 1978, Cheng 1973, Ye 1983, Zhou 1987, Wang 1981, Zhengzhang 1980, Chen 1966, among others). Dell (1977) points out that a diminutive noun with *rusheng* 'entering tone' in Chinese dialects may lose the glottal stop and result in the nucleus being glottalized. Moreover, in such cases, the original short entering tone will change to a high even or rising tone.

The two different ways of creating diminutive nouns in southern Chinese dialects have been formulized by Chen (1992). As presented in (29), each of which has undergone several stages of historical changes.

(29) Two Types of Diminutive Nouns Historical Formation

a. Nasalized diminutive nouns: Syllable+[-n]/ [-ŋ] → CV₁+[-n]/ [-ŋ] → C \tilde{V} ₁ → CV₂

b. Glottalized diminutive nouns: Syllable+[-ʔ] → C \underline{V} (N)^{tone change} → CV(N)^{tone change}

(C stands for the initial, V stands for vowel, \tilde{V} stands for a nasalized vowel, \underline{V} stands for a vowel with the characteristic of a glottal sound, and N stands for any nasal coda)

As presented in (29a), historically speaking, there are four stages of creating a nasalized diminutive noun. At the first stage, a nasal coda [-n]/[-ŋ] is added to a syllable. At the second stage, the original coda of the syllable will be lost if there any exists. In other words, the diminutive nasal coda [-n]/[-ŋ] replaces the original coda at the second stage. At the third stage, the diminutive nasal coda will be lost, but the nucleus of the syllable will be nasalized. In the last stage, the nasalized vowel will change to a different unnasalized vowel. The cases in Dongyang, Yiwu and Pu as in

(26) occur at the first or second stage, while the cases in Shanghai occur at the final stage. It should be pointed out that the diminutive nasalization only occurs to the last syllable in the domain. In other words, if the diminutive noun contains more than one syllable, only the last one will be nasalized.

For the glottalized diminutive noun formation, there are three stages, as presented in (29b). At the first stage, a glottal stop coda [-ʔ] is added at the end of the syllable, while at the second stage, the diminutive glottal stop will be lost but the nucleus of the final will carry the characteristic of a glottal sound accompanied by tone sandhi, which usually changes the original tone of the syllable to a high or high rising tone. At the third stage, the nucleus will be de-nasalized and change to a different vowel, but the high tone sandhi remains.

Both of the two types of diminutive noun formation can be found in Ningbo dialect, as given in (30). The nasalized and glottalized segments and tone change are marked in bold.

(30)a. Nasalized Diminutive Nouns

麻雀 $mo^{LH} + tehja^{ʔH}$ → $mo^{LH} tej\tilde{a}^H$ 'sparrow'

阿叔 $a^{ʔH} + so^{ʔH}$ → $a^{ʔH} so\eta^H$ 'uncle'

b. Glottalized Diminutive Nouns

i. 虾 ho^{HL} → $ho^{ʔH}$ 'shrimp'

鸡 tei^{HL} → $tei^{ʔH}$ 'chicken'

ii. 小人 $ei\sigma^H + ni\eta^{LH}$ → $ei\sigma^H ni\eta^H$ 'child'

背心 $\text{pei}^{\text{HL}} + \text{ei}\eta^{\text{HL}}$ \rightarrow $\text{pei}^{\text{H}} \text{ei}\eta^{\text{H}}$ 'vest'

Let's discuss the glottal diminutive nouns in Ningbo dialect first as presented in (30b). Both of 鸡 and 虾, as in (30b-i), belong in *yinping* tonal category in Middle Chinese. However, instead of carrying a high falling tone as the citation form of *yinping* tone in modern Ningbo dialect, both of them are pronounced in *yinshang* tone, namely a high tone, and the nuclei of both syllables carry a characteristic of glottal sound. On the other hand, for a disyllabic diminutive noun, such as 小人 'child' or 背心 'vest' in (30b-ii), the final syllable, which originally is assigned a low tone by LTS, changes the tone to a high tone. Different from the cases in (30b-i), the nucleus of the final syllables in both examples of (30b-ii) are not glottalized. In other words, the diminutive tone sandhi occurs in both cases. More cases of application of the diminutive tone sandhi are provided in (31). The diminutive high tone sandhi is marked bold.

(31)	non-diminutive		diminutive	
雪花	$\text{so}^{\text{H}} \text{ho}^{\text{L}}$	\rightarrow	$\text{so}^{\text{H}} \text{ho}^{\text{H}}$	'snowflake'
杜仙	$\text{du}^{\text{LH}} \text{ei}^{\text{L}}$	\rightarrow	$\text{du}^{\text{LH}} \text{ei}^{\text{H}}$	'witch'
中国人	$\text{tso}\eta^{\text{M}} \text{ko}^{\text{H}} \text{ni}\eta^{\text{L}}$	\rightarrow	$\text{tso}\eta^{\text{M}} \text{ko}^{\text{H}} \text{ni}\eta^{\text{H}}$	'Chinese people'
眼泡皮	$\eta\epsilon^{\text{LH}} \text{pho}^{\text{L}} \text{phi}^{\text{L}}$	\rightarrow	$\eta\epsilon^{\text{LH}} \text{pho}^{\text{H}} \text{phi}^{\text{H}}$	'eyelid'

As shown in the cases in (31), diminutive nouns in Ningbo dialect always undergo a

diminutive tone sandhi (DTS) no matter if they undergo the glottalization or the nasalization sandhi.

The tone sandhi patterns of DTS are presented as in (32) below. The diminutive nouns with D2 tone (*yangru* tone) is an exception since the LTS will be blocked and the syllable following the one of D2 tone will form a TS domain of its own.

(32) DTS Patterns in ND

	BT	Monosyllabic	Disyllable	Tri-syllable	Quadra-syllabic
A1	MHL	H	M-H	M-H-H	M-H-H-H
B1, C1 & D1	H	H	H-H	H-H-H	M-H-H-H-
A2, C2	LHL	LH	L-H	L-H-H	L-H-H-H
B2	LH	LH	LH-H	LH-H-H	LH-H-H-H

As given in (32), generally speaking, after application of LTS, all the low tonal feature after the first high tonal feature will be deleted, and then the first high tonal feature in the domain will multi-associate with all the syllables on its right side that are not assigned tone. The examples in (33) shows how DTS applies. It should be pointed out that the first syllable '老' in (33c) belongs to the B2 tonal category, namely the *yangshang* tone, in the tonal pattern of which, the LH features are bound to be assigned to the first syllable in LTS or DTS.

(33) DTS in Ningbo dialect

a.	背	心		'young man'
	pɛi	ɛiŋ		
	H	H		Underlying form (DF)
	H			Tone deletion (TD)
	H			Association convention (AC)
	H	L		Default low tone assignment
	H			Low tone Deletion for diminutive words
	H	H		High tone Association convention (AC)
	H	H		Surface form (DF)
b.	牛	皮	糖	'a type of sticky malt sugar'
	ŋəy	phi	dā	
	LHL	LHL	LHL	Underlying form (DF)
	LHL			Tone deletion (TD)
	L	H	L	Association convention (AC)
	L	H		Low tone deletion for diminutive words
	L	H	H	High tone Association convention (AC)
	L	H	H	Surface form (DF)

c.	老	早	百	里	'already'
	lau	tsau	paʔ	li	
	LHL	H	H	LHL	Underlying form (DF)
	LHL				Tone deletion (TD)
	LH	L			Association convention (AC)
	LH	L	L	L	Default low tone assignment
	LH				Low tone deletion for diminutive words
	LH	H	H	H	High tone Association convention (AC)
	LH	H	H	H	Surface form (DF)

d.	乡	下	人	'countryside'
	ɕjã	fo	niŋ	
	MHL	LHL	LHL	Underlying form (DF)
	MHL			Tone deletion (TD)
	M	H	L	Association convention (AC)
	M	H		Low tone deletion for diminutive words
	M	H	H	Tone Association convention (AC)
	M	H	H	Surface form (DF)

Now, let's go back to the cases in (30a). Underlyingly, both of the morphemes 雀 and 叔 have a glottal stop coda [ʔ]. In the diminutive sandhi forms, both the morphemes undergo the diminutive nasalization, and losing the original glottal stop results in changing the tone to a long one. Interestingly, the diminutive nouns 麻雀 and 阿叔 occur at different stages of nasalization. The former one has lost the diminutive nasal coda and the nucleus is nasalized, while for the latter one, it still carries the nasal coda.

Moreover, it should be noted that in the cases of diminutive nouns in Ningbo dialect, the diminutive tone sandhi (DTS) applies to all the words that become diminutive, even if they do not undergo glottalization rule, as shown in (33c), in which the last three syllables all get assigned high tone although there is no segmental change happening to them. In other words, the diminutive tone sandhi applies universally to diminutive nouns in Ningbo dialect regardless of whether there is segmental diminutive change or not.

To briefly conclude, there are two types of diminutive segmental sandhi rules in Ningbo dialect, namely glottalization and nasalization. Regardless of what diminutive segmental sandhi applies, the diminutive tone sandhi (DTS) rule applies to all the diminutive nouns. This rule can be described as: after application of LTS, all the low tonal features after the first high tonal feature are deleted, and then the high tonal feature will be multi-associated with the unsigned tone of the syllable(s).

4.4.2.2 Diminutive Adjectives and Verbs

In Ningbo dialect, some adjectives and verbs may also have diminutive forms which are created by applying the diminutive tone sandhi rule in the domain. The major examples are given in (34). The segments and tones that undergo diminutive sandhi are marked in bold.

(34)a. Diminutive adjectives

	non-diminutive		diminutive	
圆圆	jy ^L jy ^{HL}	→	jy ^L jy ^H	'(very) round'
圆滚滚	jy ^L kuəŋ ^H kuəŋ ^L	→	jy ^L kuəŋ ^H kuəŋ ^H	'(very) round'
漆漆黑	tsha ^{ʔH} tsha ^{ʔL} ha ^{ʔL}	→	tsha ^{ʔH} tsha ^{ʔH} ha ^{ʔH}	'(very) dark'
冰刮斯冷	piŋ ^M kua ^{ʔH} sɿ ^L lã ^L	→	piŋ ^M kua ^{ʔH} sɿ ^H lã ^H	'(very) cold'
滚得斯圆	kuəŋ ^H ta ^{ʔL} sɿ ^L jy ^L	→	kuəŋ ^H ta ^{ʔH} sɿ ^H jy ^H	'(very) round'

b. Diminutive verbs

摸摸依依	mo ^{ʔL} mo ^{ʔH} ji ^L ji ^L	→	mo ^{ʔL} mo ^{ʔH} ji ^H ji ^H	'repeatedly touching things'
看看看	khi ^H khi ^L khi ^L	→	khi ^H khi ^H khi ^H	'to take a look'

In the same way as the instances in (34a) and (34b), the diminutive tone sandhi applies to all adjectives and verbs as long as they are diminutive and no segmental change occurs to these forms.

4.4.2.3 LTS vs. DTS in the Ningbo Dialect

As discussed earlier, in Ningbo dialect, except in some rare cases, LTS applies to the domain formed by monomorphemic words, derived words, compounds and reduplicated forms from left to right. Meanwhile, there is another tone sandhi rule, namely, the DTS, whose application is restricted to the domain formed by diminutive nouns, verbs or adjectives. According to my analysis in Section 4.4.2.3, the DTS applies after the LTS.

While a great number of regular nouns can become diminutive by undergoing DTS, some nouns only have the diminutive forms but lack of the corresponding regular forms. For some nouns, their diminutive form may even have a completely different meaning, instead of conveying a slighter degree of its root meaning, as shown as follows.

(35) Non-diminutive form	diminutive form
哥哥 [kœu ^M kœu ^{HL}] 'elder brother'	哥哥 [kœu ^M kœu ^H] 'elder brother (with intimacy)'
小人 [œio ^H niŋ ^L] 'villain'	小人 [œio ^H niŋ ^H] 'child'
none	伯伯 [pã ^H pã ^H] 'uncle'
妹妹 [mœi ^H mœi ^L] 'younger sister'	妹妹 [mœi ^H mœi ^L] 'younger sister (with intimacy)'
none	小妹妹 [œio ^H mœi ^H mœi ^H] 'young girl'

As shown above, some nouns, such as 哥哥 'elder brother' and 妹妹 'younger sister', have

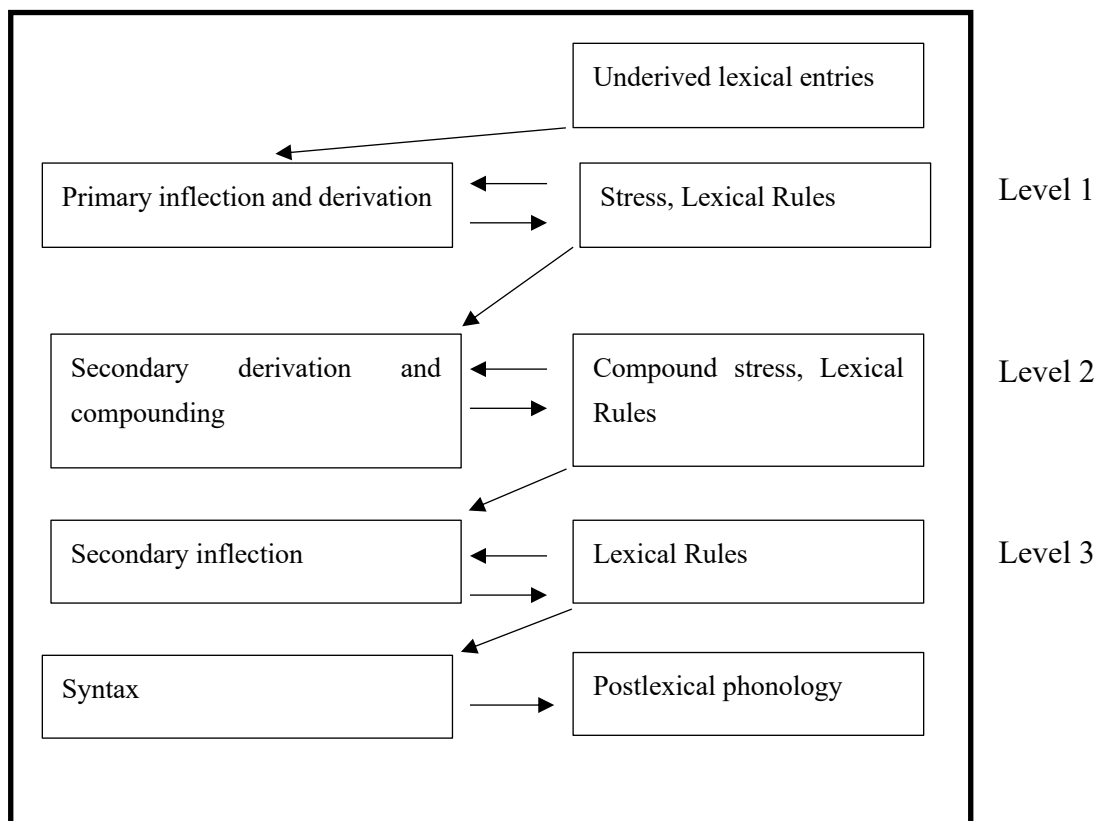
both non-diminutive and diminutive forms since the latter ones are formed simply by applying DTS to the non-diminutive reduplicated nouns. By comparing 小人 [ɕio^H niŋ^L] 'villian' and 小人 [ɕio^H niŋ^H] 'child', it seems that the diminutive formation also creates new words, the meaning of which cannot simply be derived from the non-diminutive ones.

However, take a look at the example of 伯伯 [pã^H pã^H] 'uncle', which does not have the corresponding non-diminutive forms. The citation form of the monosyllabic 伯 is [pa^{ʔH}], which does not contain a nasal coda. It indicates that the 伯 [pa^{ʔH}] in the reduplicated form 伯伯 [pã^H pã^H] 'uncle' not only undergoes DTS, but also undergoes the process of nasalization, and the diminutive nasalization must occur before the reduplication so that the first syllable in the reduplicated forms can be nasalized. In other words, the DTS of the case of 伯伯 [pã^H pã^H] happens before reduplication and LTS. This case makes a sharp contrast with the example of 哥哥, in which, DTS happens after reduplication and application of LTS. More cases can be seen in the diminutive adjectives and verbs in (34), such as 圓滾滾 [y^L kuəŋ^H kuəŋ^H] '(very) round' and 看看 [ki^H ki^H ki^H] 'to take a look', as well as some reduplication nouns, such as 小妹妹 [ɕio^H mɛi^H mɛi^H] 'young girl' in (35). Clearly, in these cases, DTS must apply after the word formation of reduplication and affixation. Thus, herein lies the paradox: which rule applies first?

Because the main purpose of this chapter is to identify the domain of application of phonological phenomena such as LTS and DTS, I will briefly discuss the order of application of LTS/DTS. LTS/DTS can be accounted for if we adopt the theory of Lexical Phonology that

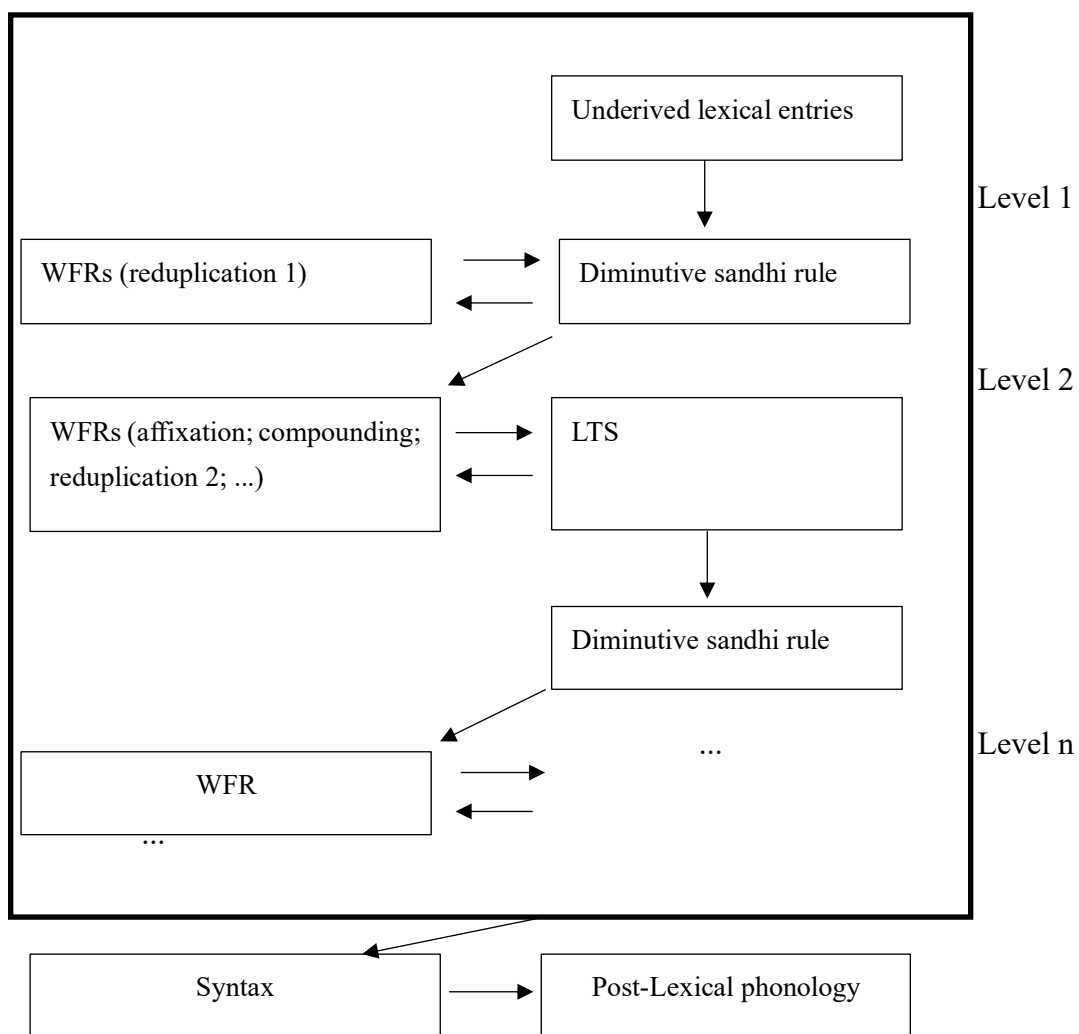
assumes the lexicon consists of ordered levels, which are the domains for certain phonological or morphological processes (cf. Kiparsky 1982, 1985; Mohanan 1982; among others). In this view, phonological rules fall into two classes: lexical rules, which may interact with morphological rules, and postlexical rules, which may not interact with morphological rules. All lexical phonological rules are placed into a series of ordered levels in the lexicon. In other words, after every word-formation rule, lexical phonological rules re-apply. The effect of this is that lexical phonological rules apply cyclically. Kiparsky's model of the English lexicon is provided as below in Figure 6.

Figure 6 Lexical phonology in English (cf. Kiparsky 1982)



Influenced by the framework of Lexical Phonology, Zhang & Yu (2009) and Yu & Yin (2014) propose the model of Mandarin Chinese lexicon in order to account for the order of application of the third tone sandhi rule and the neutral tone rule in Mandarin Chinese, as given in Figure 7.

Figure 7. Lexical phonology in Mandarin Chinese

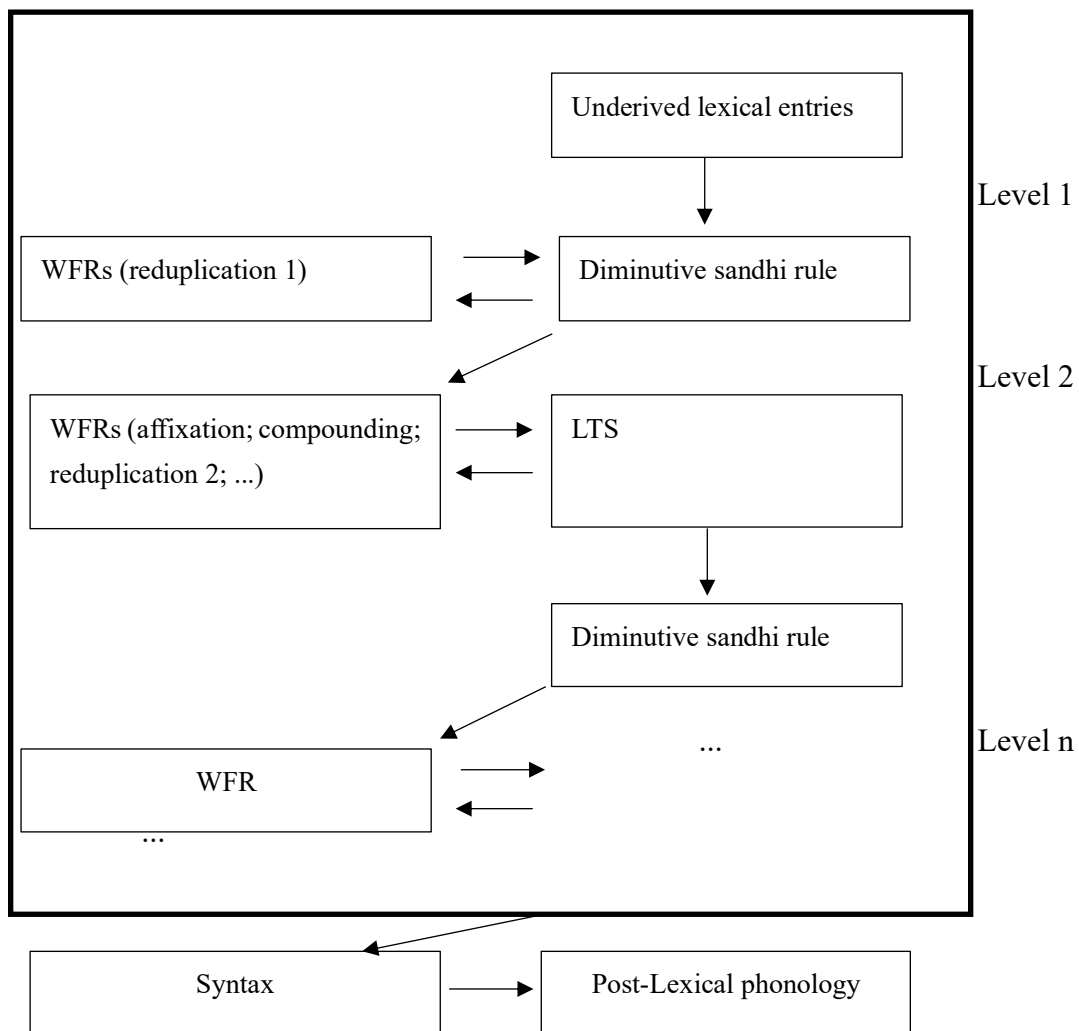


Yin (2014) distinguishes two types of reduplication in Mandarin Chinese. The first type of reduplication refers to the word formation of reduplicated nouns, such as 姐姐 [teie²¹⁴ teie⁰] (0

represents the neutral tone), in which the first syllable remains the third tone while the second one changes to a neutral tone. The second type of reduplication refers to the formation of reduplicated adjective, verbs, and adverbs, such as 美美 [mei³⁵ mei²¹⁴] and 想想 [ɛiaŋ³⁵ ɛiaŋ²¹⁴], in which the first syllable changes to a rising tone.

Similarly, in Ningbo dialect, I shall distinguish two types of reduplication as well. The first type refers to the formation such as 伯伯 [pã^H pã^H] in (35), in which the first syllable also undergoes diminutive sandhi, while the second case refers to the cases such as 圓滾滾 [y^L kuəŋ^H kuəŋ^H] '(very) round', 看看看 [ki^H ki^H ki^H] 'to take a look' 小妹妹 [ɛio^H mɛi^H mɛi^H] 'young girl', in which the non-final syllable does not undergo DTS. Therefore, in Ningbo dialect, we can assume that LTS and DTS can also be placed at different levels in the lexicon, as given in Figure 8.

Figure 7. Lexical phonology in Ningbo dialect



From Figure 8, we can see that the diminutive nouns such as 伯伯 [pã^H pã^H] are formed at level 1 in the lexicon. After undergoing DTS at level 1, the output will be sent to the syntax of the grammar, if they do not undergo the process of other morphological word formation at level 2. Other morphological word formation rules are placed at level 2 in Ningbo dialect, where LTS applies. After that, the output may undergo DTS if the output is a diminutive such as 圓滾滾 [y^L

kuəŋ^H kuəŋ^H] '(very) round', 看看看 [ki^H ki^H ki^H] 'to take a look' and 小妹妹 [ɕio^H mɛi^H mɛi^H].

In other words, the diminutive tone sandhi applies cyclically.

To conclude, there are two types of tone sandhi rule which apply to morpho-syntactic words in Ningbo dialect. LTS only applies to morpho-syntactic words formed by affixation, compounding, or reduplication at level 2, while DTS applies to the diminutive nouns formed at level 1, or at level 2 after LTS is applied. Therefore, these two tone sandhi phenomena can be viewed as evidence to support the prosodic word as a necessary constituent in the prosodic hierarchy.

4.4.3 Lexical Diffusion in the Ningbo Dialect

As mentioned earlier, in the Ningbo dialect, LTS applies to the morphosyntactic words formed by affixation, compounding or reduplication at level 2 or later. However, in some rare cases, the LTS will be blocked. Instead, the PTS may apply. To begin with, let us take a look at the examples in (37).

- (37) a.
- | | | |
|-----------|-----------------|---------------------|
| | 还 | 潮 |
| | return | wave; tide |
| | ‘(food) go bad’ | (verb or adjective) |
| BT | LHL | LHL |
| CT | LH | LH |
| * by LTS | L | HL |
| ok by PTS | L | LH |
- b.
- | | | |
|-----------|-----------------------------------|--------|
| | 凑 | 头 |
| | tshɛi | dɛi |
| | assemble | head |
| | ‘to hand out with; to be friends’ | (verb) |
| BT | H | LHL |
| CT | HL | LH |
| ok by LTS | H | L |
| * by PTS | H | LH |

The examples in (37) have internal structures of VP, but instead of undergoing LTS which applies to the morphosyntactic words in Ningbo dialect, they both undergo PTS as mentioned in

Chapter II, which is a mapping case.. It should be pointed out that both of the examples in (37) are words instead of phrases. In Mandarin Chinese, there are words called *liheci* 离合词 'separable verbs', in which there holds an internal verb-object relation between the two members of the compound. We can insert some elements between the two members of the separable words. However, this is not the case in Ningbo dialect. As we can see in (37a), the newly created word '还潮' does not only differs in meaning from a simple combination of the meanings of the two morphemes, but also changes into an adjective. In other words, morpho-syntactically speaking, these words are not separable in the Ningbo dialect, but phonologically speaking, they are still treated as phrases. I believe this kind of mismatch between morphosyntax and phonology is caused by neutralization, i.e., disyllabification.

It is well known that Chinese, including Wu dialects such as Ningbo dialect, is a disyllabic-word language derived from a monosyllabic-word language (L. Wang 1980). In old Chinese, the word-bearing unit is one character, i.e. one syllable. However, in modern Chinese, the word-bearing unit has become two characters, i.e. two syllables. There are many factors responsible for such disyllabification, but what should be noted is that this language change is not limited to morphology, and what has happened to morphology surely happened to phonology and syntax. Because of this change, Chinese has gradually changed from a syllable-tone language into a word-tone language (Chen 1986a; Shih 1986; Z. Zhang 1988; Zhang & Chen 1995; Zhang 2008a). As Zhang (2017) pointed out, it is the re-division of morphosyntactic and phonological units that is

most relevant to this language change. Taking a morphosyntactic example that Zhang (2017) provides, in old Chinese, one syllable is one syntactic word and two syllables form a syntactic phrase, as seen in (38a); but in modern Mandarin Chinese, the exact same two syllables form only one syntactic word, and the meaning and part of speech also changes, as seen in (38b).

(38) a. Old Chinese (phrase)

宣 言

declare speech

‘to make a declaration’

b. Modern Mandarin Chinese (word)

宣 言

declare speech

‘declaration’

Since this disyllabification is still underway, in many cases, it is difficult to determine whether a disyllable is a syntactic word or a syntactic phrase, and in such exceptional cases, the so-called potentialized lexicon (Thompson 1973), actually represents the variant stages in the process of sound change. For some reason, the mismatch is naturally reflected in phonology. Take the Ningbo dialect for example, now the LTS mode is adopted as the pattern for disyllabic TS. When two monosyllabic words are adjacent and influenced by lexicalization to form a new lexical item, they

will phonologically be taken as one unit to form one TS domain regardless of their internal structure. Therefore, diachronically speaking, the LTS is the new form while the PTS is the old form, while viewing from a synchronic perspective, the PTS cases, as shown in (37) are irregular cases.

If we consider, in the Ningbo dialect, those new forms, which undergo LTS, to be a kind of TS phenomenon that replaces the old forms, as shown in (37), we may suggest that the completion of such kind of TS is obtained through lexical diffusion. In other words, within the same morphosyntactic type, the timing of such change is different for different lexicon, the sound change happens from one specific lexical expression to another and finally to all the lexicons, which conform to the conditions of change. The process of lexical diffusion in a particular morphosyntactic type is presented in (39).

(39) Morphosyntactic structure	Unchanged stage	Variant stage	Changed stage
Lexical item 1	+	-	-
Lexical item 2	+	+	+
Lexical item 3	-	-	+

Therefore, the TS classification for phonological words in the Ningbo dialect is a typical lexical diffusion case, summed up in (40).

(40)	Stages	Unchanged stage	Variant stage	Changed stage
	Status	PTS	LTS/PTS	LTS

More examples are provided in (41), which shows that such kind of lexical diffusion is happening in the words which hold the internal relationship of VO and SP between the members as well.

(41) a. VO

做	对
tsau	tal
do	pair
'together'	

BT	H	H
CT	HL	HL
*by LTS	H	L
ok by PTS	H	HL

b. SP

样 有 份

jǎ y vən

everything have part

‘people who want to intervene in everything’

BT LHL LHL LHL

CT LH LH LH

*by LTS L H L

ok by PTS [LH [L LH]]

4.4.4 TS within Longer Polysyllabic Words

In the previous part of this chapter, I have only talked about the cases where the LTS applies to the prosodic word domain which contains four or fewer syllables. In this section, I will discuss the TS phenomena that happen on morpho-syntactic words containing four or more syllables, namely quadri-syllabic words or longer words, which the general LTS fails to account for.

4.4.4.1 Rhythm Effect in the TS for Monomorphemic Words

To begin with, let us compare the examples in (42) and (43).

(42) a. 'Romania'

罗 马 尼 亚

lau mo ni ja

BT LHL LH LH LH

ok by LTS [L = H = L = L]

b. 'Australia'

澳 大 利 亚

o da li ja

BT H LH LH H

ok by LTS [H = L = L = L]

(43) a. 'Ethiopia'

埃 塞 俄 比 亚

e se ŋau pi ja

BT M H LHL H H

*by LTS [M = H = L = L = L]

correct [M = HL] # [L = H = L]

b. ‘Algeria’

	阿	尔	及	利	亚
	a	ə	teIeʔ	li	ja
BT	MHL	LH	H	LH	H
*by LTS	[M = H	= L	= L	= L]	
correct	[M = HL]	#	[H = L	= L]	

As shown in (42), which are all quadri-syllabic monomorphemic words on the terminal node of a syntactic tree, the LTS is applied left-to-right regardless of its internal structure. On the contrary, for the penta-syllabic examples in (40a) and (40b), without doubt, either of which is one monomorphemic word as well, but are divided into two TS domains, respectively.

We may ask what causes such irregular readings for the penta-syllables in the Ningbo dialect. Chan (2001) and Zhang (2017) argue that the so-called irregular or exceptional TS cases in Chinese dialects are, in fact, the result of the rhythmic effect, which has been discussed also by Chen (1984, 1992c), Hsiao (1991), and Hsu (1992). Hsiao focuses on the rhythm of idioms, Hsu’s discussion is mainly concerned with rhythm of set-pattern phrases and proper names, while Chen provides a thorough study of the rhythmic effect on locative phrases, numerals, morphosyntax, etc. Zhang particularly points out that the rhythmic effect, which affects TS behaviors, is relevant to the metrical structures of classical Chinese poetry. The primary pattern for earliest poetry in Chinese

is to have four syllables for every line, very similar to (44a) below. And its rhythm is that every two syllables form a meter and every two meters make up a line. Such metrical characteristic has been preserved to the present day in the readings of four-syllabic idioms in Chinese. After the Archaic Chinese poetry with the patterns of four syllables composing a line, there evolved into the poems with five syllables making up one line, which is constituted by two meters, i.e., combination of the two preceding syllables and the remaining three syllables, similar to (44b) below, or a combination of the preceding three and the remaining two, similar to (44c). Because the pattern in (44b) is more popular and commonly used than that of (44c), it became the main metrical pattern for the poems with penta-syllabic lines. Chen (1979, 1980, and 1984) provides us with the metrical patterns as shown in (44) based on the linguistic analysis of Chinese poetry.

(44)a. [X - X - X - X]

T = T # T - T

b. [X - X - X - X - X]

T = T # T = T = T

c. [X - X - X - X - X]

T = T = T # T = T

Zhang (2017) argues that the rhythm patterns in (44), which were derived from Chinese poetry, cast a great influence on the phonological structures, especially TS. According to his analysis on

the Shanghai dialect, one penta-syllabic TS domain in normal speech splits into two TS domains in adagio speech (i.e., deliberate style) in accordance with the rhythmic principles.

Zhang's analysis can also explain the irregular cases in Ningbo dialect as well, such as shown in (43). Both of the examples in (43) do not have the internal branching structure, but in both of normal and adagio speeches, the penta-syllabic morphemes are read as having two TS domains respectively, the formation of which follows the pattern given in (45d) instead of (45a) -(45c).

(45) Possible formation patterns for penta-syllabic phonological word in ND

- a. [X] # [X = X = X = X]
- b. [X = X = X = X] # [X]
- c. [X = X = X] # [X = X]
- d. [X = X] # [X = X = X]

As aforementioned, the examples in (43) has only one morpheme respectively. Logically speaking, they should under LTS. If not, then the TS patterns in (45a) -(45d) are all possible. However, only (45d) wins, which happens to be the main rhythmic patterns for the penta-syllabic poetry in Chinese. while all of the other three possible patterns are ruled out in the Ningbo dialect. Thus, it can be seen that in this dialect, such so-called irregular penta-syllabic TS cases are in fact the result of rhythmic effect.

Moreover, different from Shanghai dialect, the rhythmic patterns of Chinese poetry do not cast

any influence on the quadri-syllabic word in the Ningbo dialect if we compare the examples in (42) with those of Shanghai dialect, as seen in (46).

(46) Rhythmic effect in Shanghai dialect (2017)

a. 'the critical moment'

	要	紧	关	子	
BT	MH	MH	HL	MH	
ok	[M = H = M = L]				normal speech
ok	[M = H]		#	[H = L]	adagio speech

b. 'Ethiopia'

	埃	塞	俄	比	亚
	e	se	ɲu	pi	ia
BT	HL	HL	LH	MH	MH
ok	[H = M = M = M = L]				normal speech
ok	[H = L]		#	[L = H = L]	adagio speech

Whichever of the TS cases of Shanghai dialect in (46) it is, quadrisyllabic or penta-syllabic, the example will have two reading forms, one of which must result from the rhythmic effect. On the contrary, in the Ningbo dialect, as shown in (42) and (43), a quadrisyllabic morpheme is always

considered as one domain, where LTS applies, while the penta-syllabic morpheme only has one reading, which results from the rhythmic effect. In other words, if we consider the irregular TS cases resulting from the rhythmic effect to be a TS phenomenon which replaces the normal one domain reading with the rhythmic two-domain reading, we may suggest that such kind of TS has been completed in the penta-syllables, but not started in quadrisyllables in the Ningbo dialect.

Then what will happen in a domain with longer string of syllables? Let us take a look at an example of heptasyllable, as shown in (47).

(47) Heptasyllabic word: ‘Buenos Aires’

	布	宜	诺	斯	艾	利	斯
BT	H	LHL	LH	MHL	H	LH	MHL
*by LTS	[H = L = L = L = L = L = L]						
ok	[H = L = L = L]			#	[H = L = L]		
ok	[H = L]		#	[L = HL]		#	[H = L = L]

Since quadrisyllabic string is the maximal domain of for LTS to apply, any string longer than that will be cut into smaller-sized domains. As can be seen, the [4+3] reading is accepted in normal speech. As for the [2+2+3] reading in adagio speech, it could be affected by the rhythmic effect of the Chinese poetry with heptasyllabic lines, the main metrical pattern of which is also [2+2+3].

Last, let us take a look at the hexasyllabic, as given in (48).

(48) Hexasyllabic word: 'Addis Abāba (a city in Ethiopia)'

	亚	的	斯		亚	贝	巴
BT	H	H	MHL		H	H	MHL
*by LTS	[H = L = L	=	L = L = L]				
ok	[H = L = L]	#	[H = L = L]				

As shown in (48), it seems that, for a hexasyllabic monomorphemic word, it will be divided into two domains as a [3+3] pattern, which also happens to conform to rhythmic patterns for the hexasyllabic poetry in Chinese.

4.4.4.2 Restructuring of Longer Compounds

Now let's move to the compounds that contains four or more syllables, as provided in (49).

- (49) a. 金门岛 [tɕiŋ mən] + [təu] 'Jinmen island'
 'Jinmen' + 'island'
 [M=H=L]
- b. 金门大桥 [tɕiŋ mən] + [da tɕio] 'Goldegate bridge'
 'Jinmen' + 'huge bridge'
 [M=H=L=L] (normal speech)
 or [M=HL] # [L=HL] (adagio only)

- c. 中华民国 [tsoŋ fiə] + [miŋ koʔ] 'Republic of China'
 'China' + 'country'
 [M=H=L=L] (normal speech)
 or [M=HL] # [L=H] (adgio only)
- d. 中华人民共和国 [tsoŋ fiə] + [zoŋ miŋ] + [goŋ fiəu koʔ] 'People's Republic of China'
 'China' + 'people' + 'republic country'
 [M=HL] # [L=HL] # [LH=L=L]
- e. 飞毛腿导弹 [fi məu tɕi] + [dɔ dɛ] 'Scud missile'
 'fleet-footed' + 'missile'
 [H=L=L] # [LH=L]
- f. 黑龙江省 haʔ loŋ kɔ̃ sā 'Heilongjiang Province'
 'Heilongjiang' + 'province'
 [H=L=L=L]
- g. 秦皇岛市 tɕiŋ huɔ̃ tɕu sɿ 'Qinhuangdao City'
 'Qinhuangdao' + 'city'
 [L=H=L=L]

As seen in (49a) through (49f), the examples are all compounds that are located in the terminal node of the syntax tree. The trisyllabic compound in (49a) only has one possible reading [M=H=L],

and the whole compound is viewed as one single prosodic word domain where LTS applies.

Similarly, the compounds in (49b) and (49c) only has one reading in normal speech, in which, each compound can only be considered as one single TS domain, i.e., 金门大桥 'Goldengate bridge' as [M=H=L=L] and 中华民国 'Republic of China' as [M=H=L=L], regardless of their internal morpho-syntactic structure. However, in a really slow adagio speech, they can also be divided into two domains depending on their internal morpho-syntactic structures, respectively. As will be discussed in Chapter VI, such redivision is affected by the restructuring rule of the intonational phrase.

Differently, both of the compounds in (49d) and (49e) are obligatorily divided into two domains, which are their only possible reading, respectively, i.e., 中华人民共和国 'People's Republic of China' as [M=HL] # [L=HL] # [LH=L=L] ('China' + 'people' + 'republic country'), and 飞毛腿导弹 'Scud missile' as [H=L=L] # [LH=L] ('fleet-footed' + 'missile'). In other words, although the compounds in (49d) and (49e) are both morpho-syntactic word that are located on the terminal node of the syntax tree, they are obligatorily further divided into two domains, respectively.

By comparing the examples in (49a-e), we may draw a conclusion that, for a compound word that contains four or more syllables, it will be divided into multiple domains based on its internal morpho-syntactic structure. However, if we take a look at the quadri-syllabic examples in (49f) and (49g), i.e., 黑龙江省 'Heilongjiang Province' ('Heilongjiang' + 'province') as [H=L=L=L]

and 秦皇岛市 'Qinhuangdao City' ('Qinhuangdao' + 'City') as [L=H=L=L], we can see that each of them can only be considered as one domain even though their internal structures are the same as those in (49b-e), namely, the modifier-head (MH) structure. The only difference that the examples (49f) and (49g) make is that their internal morpho-syntactic patterns are [3+1]. In other words, one member of each of the compounds in (49f) and (49g) is a monosyllabic stem, while all the members in the compounds of the examples in (49b) through (49e) are disyllabic or longer ones.

Thus, I propose that there is a minimal word requirement for the restructuring of prosodic word domain in Ningbo, namely, each restructured domain must contain at least two syllables. For example, the examples in (49f) and (49g) have the internal morpho-syntactic pattern as [3+1]. If they are divided into two patterns based on the morpho-syntactic relation in each case, one member in each compound will violate the minimal word requirements, thus such redivision of the quadrisyllabic words are prohibited, while, in the cases as (49b) through (49e), the newly created domain all meet the minimal word requirement, so the re-division is allowed.

4.4.4.3 Minimal and Maximal Requirements

As discussed in 4.4.4.1 through 4.4.4.2, in Ningbo dialect, if a monomorphemic word contains more than four syllables, it will be redivided into several TS domains based on rhythm effect, while for a compound containing more than four syllables, it will also be redivided into several TS

domains based on its internal morpho-syntactic structure, and each of the newly created domains must conform to the disyllabic minimal word requirement. Similarly, any newly created domain within a monomorphemic word depending on the rhythm effect also have to meet the disyllabic requirement, which is disyllabic.

Therefore, on the one hand, based on the observation, we can conclude that in Ningbo dialect, when a TS domain is determined, it is not only the morpho-syntactic information that it make reference to, but the phonological information may also matter such as the rhythm pattern and the minimal word requirement of syllable number.

On the other hand, as for the monosyllabic morphosyntactic words, they do not undergo LTS but simply keeps their citation tones. As discussed in Chapter II, citation tones and sandhi tones belong to different phonological domain. In Ningbo dialect, the citation form applies to the domain of syllable while the sandhi form applies to a higher domain, i.e., prosodic word. It should also be noted that based on Nespor and Vogel's (1986) definition of prosodic word, the monosyllabic morpho-syntactic words should also be treated as prosodic words. Theses monosyllabic words directly upgrade from the domain of the syllable to the prosodic word according to the Strict Layer Hypothesis since they have no adjacent element to form prosodic words with together, as illustrated as follows.

(50) Monosyllabic Morpho-syntactic Words in Ningbo dialect

山 [[sɛ]σ]ω 'moutain'

摘	[tsaʔ]σ]ω	'to pick up'
忙	[mɔ̃]σ]ω	'busy'

In Ningbo dialect, it seems that the minimum and maximum syllables that a TS domain can contain are both restricted. It can be no more than four syllables. For the monosyllabic word, technically, they do not undergo any LTS, but instead simply keep their citations. Because they do not have any other element to combin with, they themselves become one prosodic domain by the basic formation rule proposed by Nespor and Vogel (1986). However, for the restructuring of the morpho-syntactic words containing two or more syllables, there also exists a minimal word requirement, by which a restructured prosodic domain must contain at least two syllables.

The minimal disyllabic word requirement is naturally motivated by the requirement of the TS since, in Ningbo dialect, TS only happens to the combination of two or more syllables. It should be noted that the minimal word requirement only put restrictions on prosodic words that are not directly upgraded from monosyllables. It is different from the minimal word requirement that is proposed by Duanmu (1993, 1999, 2000), who claims that there is a Dual-Trochee in the Wu language/dialect family because the minimal disyllabic word requirement does not deal with any binary contrast and only works within the prosodic word domain.

As for the maximal quadri-syllabic word requirement, I believe it is related to the number of tonal features of the base tones in Ningbo dialect as well as to some phonetic reasons. If we revisit

the LTS spreading pattern in Ningbo dialect, as given in (32), the base form of a tone in Ningbo dialect maximally can contain three tonal features, i.e., MHL as the base tone of *yinping* tone. In a domain containing three syllables and starting with *yinping* tone, the TS melody will be M-H-L. If a prosodic word contains four syllables, the fourth one will be assigned a default low tone, i.e., M-H-L-L. Take a quadri-syllabic word starting with *yinping* tone as example, the low tone of the fourth syllable is slightly lower than that of the third one which, phonetically, may sounds like [M-H-M-L]. However, if the LTS is allowed to happen in a penta-syllabic domain and the word is not divided into two domains, the fifth tone will be even lower than that of the fourth one, i.e., M-H-L^{normal}-L^{lower}-L^{lowest}. Phonetically speaking, because a low tone is naturally lower than its preceding low tone, it cannot endlessly assign low tone in one domain. Therefore, for a penta-syllabic or longer morpho-syntactic word, it will be naturally divided into smaller domains based on its internal morpho-syntactic relation if it is a compound; or based on the rhythm effect if it is a monomorphemic word.

However, it does not mean that any penta-syllabic word can be divided into two domains, as exemplified in the following:

- (51)a. 乌 兰 巴 托 市
 Ulan Bator city
 'Ulan Bator City'
 wu lɛ pa thoʔ zɿ
 BT MHL LHL MHL H LHL
 LTS[M H L L L]
- b. 乌 鲁 木 齐 市
 Urumqi city
 'Urumqi City'
 wu lu moʔ dʒi zɿ
 BT MHL LHL LH LHL LHL
 LTS[M H L L L]
- c. 维 吾 尔 族 区
 wɛi wu ə zoʔ tɛhy
 'Uyghur Region'
 BT LHL LHL LHL LH MHL
 LTS [L H L L L]

As shown in (51), although they are all penta-syllabic morpho-syntactic words that are located under the terminal node of the syntactic tree, LTS applies to them without exception. In (51a), syntactically speaking, the compound word can be divided as a quadrisyllabic morpheme plus 市 'city'. However, because the second member of this compound, namely 市, is monosyllabic, the restructuring is blocked due to disyllabic minimal word requirement. (51b) follows the same logic as in (51a).

As for (51c), the compound can be analyzed as a trisyllabic morpheme, 维吾尔 'Uyghur', plus 族 'minority race' plus 区 'district'. However, the further division of this compound violates the disyllabic minimal word requirement. Therefore, this penta-syllabic compound forms one single prosodic word as a whole.

To sum up, in the Ningbo dialect, there exists the minimal disyllabic word requirement and the maximal quadrisyllabic requirement, and the former one ranks higher than the latter.

4.5 Summary

Based on the discussion above, I have demonstrated the TS phenomena which occur within the domain formed by the major types of morpho-syntactic words in Ningbo dialect. Generally speaking, the lexical tone sandhi (LTS) rule applies to most of the morpho-syntactic words that are formed by affixation, compounding or derivation as well as to the monomorphemic words that contains less than five syllables. However, if the word contains five or more syllables, it will be

divided into smaller-sized domains. As for the diminutive nouns, verbs or adjectives, the DTS is restricted to apply within the domain.

In Section 4.1, it has been indicated by Nespor & Vogel (1986) that the size of the prosodic word can be the same size as or smaller than the terminal node of a syntactic tree. There exist several types of diagnostics that may cue the prosodic word domain. Based on the analysis above, I now provide the definition of the prosodic word in Ningbo dialect, as given in (52).

(52) Prosodic Word Domain in Ningbo dialect

(a) The domain of prosodic word in Ningbo dialect is the terminal node of the syntactic tree if it contains four or fewer syllables, or

(b) Restructuring Rules

A syntactic word containing more than four syllables will be further divided

- i. based on the rhythm effect if it is a monomorphemic word, or
- ii. based on the internal morpho-syntactic structure if it is a compound
- iii. the restructured domain must meet the minimal disyllabic word requirement.

Therefore, it can clearly be seen in (52) that the formation of prosodic word in Ningbo dialect does not only make reference to syntactic information, but also is cued by pure phonological information.

Chapter V. Clitic Groups in the Ningbo dialect

In this chapter, I will investigate the prosodic constituent immediately above the prosodic word in the prosodic hierarchy, namely the clitic group (cf. Hayes 1984/1989, Nespor & Vogel 1986, among others). A clitic group is formed by a host (i.e., prosodic word) plus adjacent clitic(s). In the Ningbo dialect, according to its location to the host that a clitic attaches to, there are two types of clitics, which are called enclitics and proclitics. The clitic group formed by 'host+enclitic' (clitic group type A) provides a prosodic domain of application for lexical tone sandhi rule between the host and the enclitic(s). On the other hand, Ningbo dialect has another type of clitic group, which is formed by 'proclitic+host' (clitic group type B), blocking tone sandhi, not only between the proclitic and its host on the right side, but also between a preceding lexical item and the proclitic after it but not attaches to it, the latter situation of which usually is considered to form a domain for tone sandhi in the literature, but I will show in this chapter that such understanding in Ningbo dialect will be proved to be wrong based on my analysis on the data of Ningbo dialect.

This chapter is organized as follows. Section 5.1 introduces the definition, classification and common properties of clitics cross-linguistically as well as providing definition of clitic groups and evidence in previous studies to support the existence of clitic groups as the domain of phonological rule application in various languages. In Section 5.2, I will identify both enclitics and proclitics in Ningbo dialect, review the previous studies on the phonological phenomena within

the domain formed by clitic groups in the Ningbo dialect, and then examine application of phonological rule in both type of clitic groups. In Section 5.3, while showing the difference of the properties of enclitics and proclitics, I will prove that, different from previous studies, the clitic group as a prosodic domain differs from the domain of prosodic word and the domain of phonological phrase in Ningbo dialect so that it can provide evidence to argue for the existence of this indispensable constituent in the prosodic hierarchy in the theory. The final point I will make in this chapter is that, although the Non-recursivity is violable in the morpho-syntactic hierarchy proposed by Zhang (2017), it cannot cross the boundary between this hierarchy and the hierarchy above, namely, the information/focus-based hierarchy.

5.1 Introduction

5.1.1 Definition of Clitics

Clitics have attracted attentions for a long time in the literature. It has been observed by Zwicky (1977) that some clitics behave as independent words while others like affixes, and some could be affixes or words based on the context. This means there is a whole spectrum of units between clear affixes and clear words. In Crystal's *Dictionary of Linguistics and Phonetics* (2008), the definition of the clitic is given as below.

(1) Definition of clitics (Crystal 2008)

A term used in grammar to refer to a form which resembles a word, but which cannot

stand on its own as a normal utterance, being phonologically dependent upon a neighboring word (its host) in a construction.

The broad term 'clitics' can generally be divided into two categories, simple clitics and special clitics based on their syntactic positions. Simple clitics are free morphemes, meaning they tend to appear in the same syntactic position as its correspondent free form (cf. Zwicky 1977, Halpern 1998, Haspelmath & Sims 2010, among others). A typical example of the simple clitics are the contracted forms of English auxiliary verbs, as illustrated in (2). The clitics are in bold and underlined.

(2) English contracted auxiliary verbs (adopted from Zwicky 1977)

full forms

contracted forms

He is tall.

He'**s** tall.

Zhang is going.

Zhang'**s** going.

Wang has never gone.

Zhang'**s** never gone.

I would have known it when I had seen it.

I'**d've** known it when I'**d** seen it.

Special clitics are morphemes that are bound to the word they are dependent upon, meaning they exist as a part of their hosts. The syntactic distribution of this type of clitics, however, differs from that of its corresponding free forms (if any) and must be described in its own right. The

second-position clitics (2P clitics) are typical special clitics commonly discussed, also known as Wackernagel's Law clitics. Second-position clitics must appear second in the relevant domain. They do not attach to a host of any particular category, and do not (necessarily) form syntactic or semantic constituents with their hosts. For example, the words in the Serbo-Croatian sentence in (3a), provided by Halpern (1998), may be rearranged in any order, as long as the clitic(s) are in the second position. In this way they contrast with their corresponding full forms. Compare the position of *mu* in (3a) with that of *njemu* in (3b).

(3) Special clitics (Serbo-Croatian)

a. Marija =mu =je dala knjigu. (SCr.)

Maria.NOM to.him AUX gave book.ACC

‘Maria gave him a book.’

b. Njemu =je Marija dala knjigu.

to.him AUX Maria.NOM gave book.ACC

‘Maria gave HIM a book.’

Halpern also points out that the clitic *je* is an auxiliary in (3b), which illustrates another significant fact about 2P clitics: they may serve a variety of functions other than pronominal, including that of auxiliary, voice marker, discourse particle, and so on.

The weak pronouns in French also serve as an example of special clitics (Halpern 1998). While

nonclitic objects follow the tensed verb, those pronoun clitics must precede it. Similar behavior for weak pronouns is observed in many languages, including nearly all of the modern Romance languages and several Balkan languages (Greek, Macedonian, Albanian). Their special distribution and other ways in which they differ from independent words distinguish them from simple clitics, as exemplified in (4). The weak pronouns are marked in bold and underlined.

- (4) a. Jean **le** vois.
 Jean it sees
 ‘Jean sees it.’
 *Jean vois le.
- b. Jean vois le livre.
 Jean sees the book
 ‘Jean sees the book.’
 *Jean le livre vois.

A clitic must attach to an adjacent host. Typical clitics are prosodically dependent on their host. According to their positions of attachment, namely, to the left or to the right of the host, clitics can also be divided into two types, proclitics and enclitics. A clitic that occurs before its host is proclitic, i.e., French weak pronouns in (4). On the other hand, a clitic following its host is called enclitic, i.e., English contracted auxiliary verbs in (2). In Ningbo dialect, some clitics precede their hosts

and thus belong to proclitics, while others appear to the right of their hosts and thus belong to enclitics. In Section 5.2 and 5.3, I will show the necessity to distinguish proclitics and enclitics in Ningbo dialect in order to account for their distinct phonological behaviors.

5.1.2 Properties of Clitics

It has been long recognized that the problematic behavior of clitics is due to their hybrid nature. According to Zwicky (1977), some clitics behave as independent words, some like affixes, and some either like words or affixes depending on the specific rule.

For the first type of clitics, a typical example comes from Spanish clitic pronouns, which do not have effect on the location of stress on their hosts, as exemplified in (5), in which, the initial stress of *dándo* 'giving' is unchanged when it is followed by two clitics.

(5) Spanish clitic pronouns (cf. Zwicky 1977)

- a. *dándo* 'giving'
- b. *dándonoslos* 'giving us them'

On the other hand, classical Latin, provides an example in which clitics are considered as word internal. In classical Latin, when an enclitic is attached to a word, the primary stress is shifted from its original position in the word to the syllable that immediately precedes the clitic, as exemplified in (6), in which *-que* 'and', interrogative *-ne*, and *-cum* 'with' are all enclitics, and the primary stress

in each case is shifted to the syllable that immediately precedes the enclitic.

- | | | |
|--------|-----------|----------------------|
| (6) a. | vírum | 'the man (acc.)' |
| | virúmque | 'and the man (acc.)' |
| b. | vidēs | 'you see' |
| | vidésne? | 'do you see?' |
| c. | cum vóbis | 'with you (pl.)' |
| | vobíscum | 'with you (pl.)' |

Zwicky (1984) argues that the term clitic should be used in a more precise and restricted way, and thus he proposes a series of tests in order to distinguish clitics from words or affixes. Some linguists argue that clitics could be classified into one of the two categories, namely words (cf. Cysmann 1997, 2000, among others) or affixes (cf. Miller 1992, Monachesi 1999, Cocchi 2000, among others). However, other scholars argue that clitics should be recognized as an independent category due to their syntactic and phonological properties that differ from both words and affixes (cf. Hayes 1984/1989, Nespor & Vogel 1986, Haspelmath & Sims 2000, among others).

Given the commonly seen properties of clitics which are bound up with their ambiguous status between affixes and words, further criteria are needed to establish to put dividing line between clitics and affixes/words. On the one hand, several criteria have been postulated to distinguish clitics from affixes (cf. Zwicky & Pullum, Haspelmath & Sims 2010, among others), as given in

(7).

(7) Clitics vs. Affixes

- a. Clitics do not select their hosts. That is, they can attach to whichever word happens to be in the right place, i.e., English auxiliary 's, which can attach to nouns, verbs, adjective, prepositions, or adverbs. Affixes do select their host, i.e., English plural suffix -s, which only attaches to noun stems.
- b. Clitics do not exhibit arbitrary gaps. Affixes, on the other hand, are often lexicalized and may simply not occur with certain words, i.e., English plural -s, for example, does not occur with "child".
- c. Clitics do not exhibit morphophonological idiosyncrasies. That is, they follow the morphophonological rules of the rest of the language. Affixes may be irregular in this regard, i.e., in English, *feet* as the plural form of *foot*, *felt* as the past tense for *feel*.
- d. Clitics do not exhibit semantic idiosyncrasies. That is, the meaning of the phrase-plus-clitic is predictable from the meanings of the phrase and the clitic. Affixes may have irregular meanings, i.e., in English, the suffix *-ize* has different effects in *publicize*, *vaporize* and *winterize*.
- e. Clitics can attach to material already containing clitics (and affixes). Affixes can attach to other affixes, but not to material containing clitics.
- f. An affixed word is regularly treated as one unit by syntactic operations, while a string

of the host plus clitic(s) may be treated as separated units by syntactic operations.

On the other hand, clitics must be distinguishable from words. Linguists have proposed a number of criteria to differentiate between the two categories as well. Some criteria, specifically, are based upon the understanding that when comparing the two, clitics resemble affixes, while words resemble syntactic phrases. Six such criteria are described below in (8) by Zwicky (1985).

(8) Clitics vs. Words

- a. If a morpheme is bound to a word and can never occur in complete isolation, then it is likely a clitic, i.e., the contracted auxiliary 'll in English. In contrast, a word is not bound and can appear on its own.
- b. If the addition of a morpheme to a word prevents further affixation, then it is likely a clitic.
- c. If a morpheme combines with single words to convey a further degree of meaning, then it is likely a clitic. A word combines with a group of words or phrases to denote further meaning.
- d. If a morpheme must be in a certain order with respect to other morphemes within the construction, then it is likely a clitic. Independent words enjoy free ordering with respect to other words, within the confines of the word order of the language.
- e. If a morpheme's allowable behavior is determined by one principle, it is likely a clitic.

For example, "a" proceeds indefinite nouns in English. Words can rarely be described with one such description.

f. In general, words are more morphologically complex than clitics. Clitics are rarely composed of more than one morpheme.

Moreover, it is useful to distinguish two dimensions of clitics: a phonological one, and a morphosyntactic one. The phonological sense of 'clitic' is that of an element which, in contrast with normal lexical items, is prosodically subordinate to adjacent material. As argued by Nespor & Vogel (1986), what has been observed to be a peculiar phonological phenomenon of a group of host-plus-clitic(s) is best accounted for within the prosodic theory by establishing a constituent with exactly this extension. Thus, the clitic group as a prosodic domain of phonological rule application can provide further evidence to distinguish clitic from words or affixes.

5.1.3 Definition of Clitic Group

On the basis of the evidence that the combination of a host plus a clitic form a domain for application of certain phonological rules which do not apply in other domain(s) in a certain language, clitic group is established as a separate prosodic level of the prosodic hierarchy, located between prosodic word and phonological phrase. It is Hayes (1984/1989), who first proposes the notion of such a constituent, namely, the clitic group, which immediately dominates phonological

word and is dominated by phonological phrase. Following Hayes, Nespors & Vogel (1986: 154) proposes the definition of the clitic group, as given in (9).

(9) Clitic Group Formation

I. C domain

The domain of C consists of a prosodic word containing an independent (i.e. nonclitic) word plus any adjacent prosodic words containing

a. a directional clitic (DCL), or

b. a plain clitic (CL) such that there is n possible host with which it shares more category memberships.

II. C construction

Join into an n-ary branching C all prosodic words included in s string delimited by the definition of the domain of C.

Directional clitics refer to those clitics whose phonological attachment to the existing elements on the left side or the right side depends on the intrinsic features of the clitic itself, while normal clitics are those which can freely adjoin to the elements on their left or right side. As Nespors & Vogel (1986) point out, the *b* part of the clitic group domain definition produces constituents whose domain may not have counterparts in syntactic structure, thus, the clitic group is not necessarily isomorphic to any constituent of syntactic structure.

Although other scholars have argued that clitic groups cannot be established as an independent constituent, and the sound string consisting of host plus clitic(s) are simply one variety of prosodic word (cf. Selkirk 1986, Booij 1996, among others), or that clitic groups are prosodic words in some languages and are phonological phrases in other languages (cf. Inkelas 1989, Inkelas & Zec 1995, among others), some scholars still support the existence of clitic group as an independent prosodic constituent (cf. Nespor & Vogel 1986, Hayes 1989, Zhang 1992, 2014, 2017, among others). In responding to the criticism and objections on the notion of clitic group, Vogel (2009) argues that the problems are not caused by the clitic group itself but are due to the restrictions posed by the Strict Layer Hypothesis. However, Vogel's (2008, 2009) approach still regards Non-Recursivity as an inviolable principle. He rejects recursive process and accepts skipping under the condition of maintaining the clitic group and modifying the process of skipping. Zhang (1992, 2017), on the other hand, proposes that it is necessary to add a supplementary principle to the Strict Layer Hypothesis. He argues that, although there is no recursivity among prosodic constituents between the three different major hierarchies, namely, the rhythm-based hierarchy, the morpho-syntactic-based hierarchy, and the discourse/focus-based hierarchy, recursivity may be allowed within each of the major hierarchy.

In this chapter, I will adopt the weakened version of the Strict Layer Hypothesis and Zhang's (1992, 2017) stipulation, and argue that the principles of Exhaustivity, Nonrecursivity and Layeredness are violable in Ningbo dialect, which is sufficiently supported by the evidence from

this dialect. Following Nespor & Vogel (1986), a tentative definition of clitic group formation in Ningbo dialect is formulated as in (10).

(10) Clitic Group Formation in Ningbo dialect

The domain of C consists of a prosodic word containing an independent (i.e. nonclitic) word plus any adjacent prosodic words containing

a. a directional clitic (DCL), or

b. a plain clitic (CL) such that there is n possible host with which it shares more category memberships.

5.1.4 Evidence for the Clitic Groups Across Languages

Based on the assumption that prosodic domains are primarily defined with respect to the particular phonological processes they exhibit, the clitic group, whose phonological behavior does not match that of regular PWd or PPh, has been reported as the domain of application of many phonological phenomena in different languages, which provides evidence in confirmation of this level in the prosodic hierarchy. The first often cited example is the stress assignment in Latin. Nespor and Vogel (1986) point out that clitic groups in Latin has their own stress pattern. Compare (11a) and (11b):

- (11) a. *fēmina* 'the woman (nom.)'
 b. *femináque* 'and the woman'
 **femínaque*

While the regular Latin stress rule will assign stress onto the antepenultimate syllable as in (11a) since the penultimate syllable is a short one, this does not occur to the clitic group in (11b), which would suggest there is a special stress assignment rule in clitic groups in Latin.

Additional evidence has been reported for the clitic group as the domain for certain phonological rules in English and Greek. For examples, it has been reported that the clitic group is the domain of application of *v*-Deletion and *s*, *z*-Palatalization in English (cf. Hayes 1984/1989, Nespor & Vogel 1986, among others). The *v*-Deletion rule deletes a word-final [v] before a [-syllable] segment within certain lexical items. This rule applies, according to Hayes, only if the two words involved are within the same clitic group in fast speech, as exemplified in (12a), while fails across the boundary between two clitic groups, as shown in (12b). Clitics are marked in bold and underlined.

- (12) Application and Blocking of the *v*-Deletion rule in English (adapted from Hayes 1984/1989)

- a. [Please]_C [leave **him**]_C [alone]_C
 ↓
 ϕ

- b. [Please]_C [leave]_C [Clark]_C [alone]_C
 ↓
 *ϕ

The second rules, namely, the *s, z*-Palatalization will cause [s,z] palatalized before [š, ž]. Hayes (1984/1989) argues that it only applies between a clitic and its host in normal colloquial speech or fast or sloppy speech, as exemplified in (13a), but fails in other cases, as shown in (13b).

(13) Application and blocking of *s, z*-Palatalization rule in English (adapted from Hayes 1984/1989)

- a. [is Sherley]_C [coming?]_C
 ↓
 [ž]
- b. [Ziva's]_C [shoes]_C
 ↓
 *[ž]

Another example as the evidence for clitic group is the Nasal Deletion rule in Greek, which optionally applies within the prosodic word. According Nespors & Vogel (1986), this rule does not only occur to the prosodic word domain, but also happens across two words that belong to the same clitic group domain. However, in the latter domain, the rule applies obligately. Example of application of the Nasal Deletion across prosodic words in clitic group is given in (14a), while the example in (14b) shows that the nasal is present when the segmental conditions on the second

word are not satisfied.

(14) Application and Nasal Deletion rule in Greek (adapted from Nespov & Vogel 1986)

a. τη θέα [ti θέα]_C (<[tin])

'the view (acc.)'

b. τον αλήθεια [tin alíθia]_C (*[ti])

'the truth (acc.)'

Other phonological phenomena, which is best accounted for by establishing the clitic group domain for application of their rules include Stress Readjustment, Nasal Assimilation, Stop Voicing in Greek, Stress Assignment and Vowel Harmony in Turkish, Syncope rule in Old French, as well as *t*-Deletion in Catalan (cf. Hayes 1984/1989, Nespov & Vogel 1986, Horne 1990, Hannas 1995a, Kabak & Vogel 2001, among others).

5.1.5 Summary

In this section, I have discussed the definition and classification of clitics cross-linguistically. We have seen that clitics cannot be forced into either of words or affixes because of their unique hybrid nature comparing with independent words and affixes. Moreover, because there are a number of phonological phenomena that are characteristic only of the group containing a host plus clitic(s), there must exist an independent constituent in the prosodic hierarchy as the domain for

application of those phonological rules. In the following sections, I will show that certain phonological phenomena in the Ningbo dialect can only be best accounted for with the notion of clitic groups.

5.2 Clitics in the Ningbo Dialect

5.2.1 Introduction

It has been noticed that there exist a number of functional elements that have unique phonological behavior in Wu language/dialect family. As a sub-branch in Wu, Ningbo dialect has not gotten enough attention in the previous studies as well, except Hu's (2003) discussion on the tone sandhi regarding function words in Ningbo dialect. While Hu (2003) successfully explains some tone sandhi phenomena of the function words in Ningbo dialect based on the single-edge/end-based approach (EBA), he fails to explain the odd tone sandhi phenomena such as the assignment of default low tones to some clitics (specifically, proclitics). Moreover, he treats the personal pronouns that precede the possessive particle as a special case where the tone sandhi rule is blocked. Hu's analysis is quite problematic to isolate the blocking of TS concerning possessive pronouns, while grouping other function words together. Hu (2003) also treats the conjunction words, together with auxiliary verbs, negation words, and the *wh*-interrogative words, as a group which blocks CTS. I agree with him that the later three should be treated differently due to different reasons, while according to my analysis, the conjunction words should be grouped with proclitics

that attach to their host on their right side, thus a default low always applies instead of application of LTS. Generally speaking, Hu (2003) does not distinguish proclitics and enclitics so that he fails to explain their different TS behaviors. Moreover, while the single-edge-based theory he adopted from Selkirk (1986) can account for some TS phenomena of clitic group in Ningbo dialect, it cannot explain other phenomena unless the relation-based theory is adopted as well as distinguishing the enclitic and proclitics.

Different from Hu, I will show in this chapter that, by assuming relation-based theory, the clitic group should be established as an independent domain for application of tone sandhi in the Ningbo dialect, and the odd case of the possessive pronouns can be solved by distinguishing enclitics and proclitic in Ningbo dialect.

The clitics in Ningbo dialect, according to their locations to the hosts that they attach to, can be divided into two types, namely, enclitics and proclitics. In the following sections, I will introduce all the clitics mentioned above one by one before moving to talk about the phonological phenomena that occur in the domain of clitic group in Ningbo dialect.

5.2.2.1 Sentence-final Question Marker 伐 [va^{ʔLH}] and 未 [vɛi^{LH}]

In the Ningbo dialect, there is two question markers, 伐 [va^{ʔLH}] and 未 [vɛi^{LH}], which are placed at the end of yes-or-no questions. Generally speaking, these two particles are similar to that of the sentence-final question marker 不 *bu* and 没 *mei* in Mandarin Chinese, respectively (cf.

Hu 1992, among others). The examples of the question markers in Ningbo dialect are presented as below.

(15) a. 其 要 去 [[北 京]ω 伐 c]CG?

ɕzi jo tɕhi [[po? tɕiŋ] va?]

he want to go to Beijing Qu.

'Does he want to go to Beijing?'

b. 橘 子 [[要]ω 未 c]CG?

tɕio? zɿ [[jo] vɕi]

orange want Qu.

'Do you want orange?'

It should be noted that these two function words are the same as the preverbal negation word in Ningbo dialect except that they are post-positied to form yes-or-no questions.

5.2.2.2 Aspect Markers

There are several aspect markers in Ningbo dialect, which may occur after or before the verb/verb phrase.

5.2.2.2.1 Durative Aspect Marker 喋 [tje^H] and 该 [ke^{HL}]

The first two aspect markers that I would like to introduce are the durative aspect markers 喋

[tjeʔ^H] and 该 [ke^{HL}], both of which occur after the verb/verb phrase to indicate a continuous state or situation denoted by the verb/verb phrase, as exemplified as in (16). It should be noted that 喋 [ke^{HL}] usually combines with verb/verb phrase that denotes an action happening relatively closer to the speaker, or happening in the place where the speaker can easily see or point to, while 该 with the verb/verb phrase of an action happening not that close.

- (16) a. 其 [[坐]ω 喋 c]_{CG}
 dzi [[zæu] tjeʔ]
 he sit DUR
 'He is sitting here.'
- b. 其 帽子 [[戴]ω 该 c]_{CG}
 dzi mɔ tsɿ [[ta] ke]
 he hat wear DUR
 'he is wearing the hat.'
- e. 橘子 桌凳 高头 [[摆]ω 该 c]_{CG}
 tɕioʔ tsɿ zoʔ tɕŋ kɔ dəŋ [[pa] ke]
 orange chair top put DUR
 'The orange is put on the top of the chair.'

Moreover, similar to 着 *zhe* in Mandarin Chinese, the durative aspect markers 喋 [tjeʔ^H]

and 该 [ke^{HL}] in the Ningbo dialect can also occur between two verbs. In the 'verb₁+aspect marker+verb₂' structure in Ningbo dialect, 勒/该 attach to the preceding verb and indicate that the action or the event denoted by the second verb happens when the action denoted by the first verb is carrying out. The difference of 'verb₁ 喋 verb₂' and 'verb₁ 该 verb₂' lies on that the action denoted by the former one happens closer than that denoted by the second one. This can be illustrated in (17).

- (17) a. [[坐]ω 喋_c]CG 讲
 [[zəu] tjeʔ] kɔ̃
 sit DUR speak
 'to speak while sitting down (here)'
- b. [[困]ω 该_c]CG 听
 [[khuəŋ]ke] thiŋ
 lie downDUR listen
 'to listen while lying down (there)'

The durative aspect markers 喋 and 该 can also be used in imperative sentences, as shown in (18).

(18)a. 依 [[坐]ω 喋 c]_{CG}

nəu [[zəu] tjeʔ]

you sit DUR

'You, sit here.'

b. 依 去 [[困]ω 该 c]_{CG}

nəu tɛhi [[khuəŋ]ke]

you go to lie downDUR

'You, go to lie down there.'

5.2.2.2.2 Durative Aspect Markers 勒 [ljeʔ^{LH}] and the Variants

The aspect marker 勒 [ljeʔ^{LH}] is a versatile, which not only can be used as the durative aspect marker, but can also serve as the perfective aspect marker, complementizer maker as well as postposition. As the durative aspect marker, 勒 [ljeʔ^{LH}] appears before verb/verb phrase to indicating a continuous state or condition denoted by the verb/verb phrase. Moreover, the aspect marker 勒 [ljeʔ^{LH}] usually occurs with particle 喋 [tjeʔ^H] and 该 [ke^{HL}]. The verbs or verb phrases that appear after the three aspect markers or combination of aspective markers, namely, 勒, 勒喋 and 勒该, are usually those denoting states or actions that can last for a certain amount of time duration. Usually, an action denoted by the verb/verb phrase with 勒喋 happens closer to the speaker than that with 勒该, and the action denoted by the verb/verb phrase with 勒 can be

used universally. The difference between these three aspect markers are quite subtle.

It should be noted that the co-appearance of 勒 [ljeʔ^{LH}] with 喋 [tjeʔ^H]/该 [ke^{HL}] does not make them a disyllabic word because they are separable so that do not undergo the morpho-syntactic word formation. The one that sits closer to the host forms the inner clitic group with the host, while the one sits farther from the host will form an outer clitic group. For example, in the clitic group [勒_C[喋_C吃 ω]_{CG}]_{CG} 'is eating (here)', there are two clitic group, within which, one CG is embedded within the other CG. Therefore, the Strict Layer hypothesis is violated.

The examples of these durative aspect markers are given in (19). Be aware that the violation of Non-recursivity principle in the Strict Layer Hypothesis is allowed in (19b) and (19c).

(19) Pre-verbal durative aspect markers

- a. 其 [勒_C 喝 ω]_{CG} 可 乐
 ɬzi [ljeʔ haʔ] khəu loʔ
 he DUR drink cola

'He is drinking cola.'

- b. 其 [勒_C [喋_C 困 ω]_{CG}]_{CG} 觉
 ɬzi [ljeʔ [tjeʔ khuəŋ]] kɔ
 he DUR DUR sleep a sleep

'He is taking sleep here.'

- c. 其 [勒_C [该_C 吃 ω]_{CG}]_{CG} 饭
 dzi [ljeʔ [ke tɕhio]] vɛ
 he DUR DUR eat rice
 'He is eating rice.'

Similar as 喋 [tjeʔ^H] and 该 [ke^{HL}], the durative aspect marker 勒 [ljeʔ^{LH}] can occur between two verbs to form a 'verb₁ 勒 verb₂' structure, in which 勒 attaches to the preceding verb and indicates that the action or event denoted by the second verb happens when the action denoted by the first one is carrying out. 勒 may also co-occur with 其 [dzi^{LH}], 仔 [zɿ^H] and 眼 [ŋɛ^{LH}], respectively. These aspect marker and combinations of aspect marks are basically interchangeable in the 'verb₁+DUR+verb₂' structures. The examples are given in (20).

- (20) a. [坐 ω 勒_C]_{CG} 讲
 [zøu ljeʔ] kɔ̃
 sit DUR speak
 'to speak while sitting down'
- b. [[困 ω 勒_C]_{CG} 眼_C]_{CG} 听
 [[khuəŋ ljeʔ] ŋɛ] thiŋ
 lie down DUR DUR listen
 'to listen while lying down'

The three above-mentioned aspect markers or combinations of aspect markers, namely, 勒/勒其/勒仔/勒眼, can also be used in imperative sentences, as given in (21).

(21)a. 依 [[坐 ω 勒 c]CG 其 c]CG 讲

nəu [[dʒəu ljeʔ] dʒi] kɔ̃

you sit DUR DUR speak

'You, speak while sitting down (sit down and speak).'

b. 眼睛 [[眯 ω 勒 c]CG 眼 c]CG 听

ŋɛ tɛiŋ [[mi ljeʔ] ŋɛ] thiŋ

eyes squint DUR DUR listen

'Close your eyes and listen.'

5.2.2.2.3 Durative Aspect Markers 动 [doŋ^{LH}]

There is one more durative aspect marker 动 [doŋ^{LH}] in Ningbo dialect, which only appears after verb/verb phrase. 动 can also occur with 勒 to show up as 勒动, which can be used in 'verb₁ 勒动 verb₂' as well, the usage of which is similar to that of 勒其. The examples of these two aspect markers are provided in (22). Again, it should be noted that the cooccurrence of 勒 and 动 does not make them form a prosodic words.

- (22) a. 其 [坐 ω 喋 c]_{CG}
 dzi [zøu doŋ]
 he sit DUR
 'He is sitting.'
- b. 手表 [戴 ω 动 c]_{CG}
 ɛy pio [[ta] doŋ]
 watch wear DUR
 '(he is) wearing the watch.'
- c. [[坐 ω 勒 c]_{CG} 动 c]_{CG} 讲
 [[dzøu ljeʔ] doŋ] kō
 sit DUR DUR speak
 'to speak while sitting down.'

Furthermore, these aspect marker/combination of aspect markers can also be used in imperative sentences, as in (23). Note the violation of the Non-recursivity in (22c) and (23).

- (23) 依 [[坐 ω 勒 c]_{CG} 动 c]_{CG} 讲
 nœu [[dzøu ljeʔ] doŋ] kō
 you sit DUR DUR speak
 'You, speak while sitting down (sit down and speak).'

5.2.2.2.4 Durative Aspect Markers 仔 [zɿ^H]

The last main durative aspect marker in Ningbo dialect is 仔 [zɿ^H], which only appears after verb/verb phrase. The examples of these two aspect markers are provided in (24).

- (24) a. 嘴巴 [扞 ω 仔 c]_{CG}
 zɿ po [mæŋ zɿ]
 mouth cover DUR
 'to keep one's mouth covered (by hand)'
- b. 屁股 [出 ω 仔 c]_{CG}
 phi ku [tshoʔ zɿ]
 ass uncover DUR
 'to have one's ass uncovered'

Moreover, 仔 can also serve as the perfective aspect marker, as discussed in the Section 5.2.2.2.5.

5.2.2.2.5 Perfective Aspect Markers 勒 [ljeʔ^H] and 仔 [zɿ^H]

There are two perfective aspect markers in Ningbo dialect, 勒 [ljeʔ^H] and 仔 [zɿ^H]. Similar to the perfective marker 了 *le* in Mandarin Chinese, both of these two aspect markers in Ningbo

dialect attach to the verb/verb phrase on their left side and indicate the completion of actions. Generally speaking, the perfective aspect marker 勒 occurs after verb and precedes other elements such as objects. On the other hand, 仔 appear after a verb/verb phrase. Examples of these two perfective aspect markers are presented in (25).

(25) a. V1+勒(+O1)+VP2

- i. [吃 ω 勒 c]_{CG} 饭 没 事 体 做
 [tɕhyoʔ ljeʔ] vɛ mjeʔ sɿ thi tsəu
 eat PERF rice neg. things to do

'After eating rice, he has nothing to do.'

- ii. 我 [买 ω 勒 c]_{CG} 两 瓶 酒 [送 ω 依 c]_{CG}
 ŋo [ma ljeʔ] ljã biŋ tɛy [soŋ nɛu]
 I buy PERF two Cl wine give you

'I bought two bottles of wine to give to you as present.'

b. V1+仔+VP2

- 饭 [吃 ω 仔 c]_{CG} 再 去
 vɛ [tɕhyoʔ zɿ] ze tɕhi
 rice eat PERF then go

'to finish eating rice before going'

It is worth to mention that in (25b), the object pronoun is also an enclitic, which attaches to the host on its left, the verb 送 'to given (as present)', which will be discussed later.

5.2.2.2.6 Experience Aspect Marker 过 [kəu^{HL}]

In Ningbo dialect, there is one experience aspect maker 过 [kəu^{HL}], which occurs after the verb. The morpho-syntactic function of 过 [kəu^{HL}] in Ningbo dialect is similar to its corresponding one, 过 *guo*, in Mandarin Chinese, both of which indicate the past experience of the actions or events denoted by the preceding verbs. Examples of 过 [kəu^{HL}] are presented as follows.

- (26) a. 我 [去 ω 过 c]_{CG} 宁 波
 ŋo [tɕhi kəu] niŋ pəu
 I go EXP Ningbo
 'I have been in Ningbo.'
- b. 其 [喝 ω 过 c]_{CG} 可 乐
 dʒi [haʔ kəu] khəu loʔ
 he drink EXP cola
 'He has drunk cola.'

5.2.2.3 Possessive/modification/nominalization Marker 个 [goʔ^{LH}]

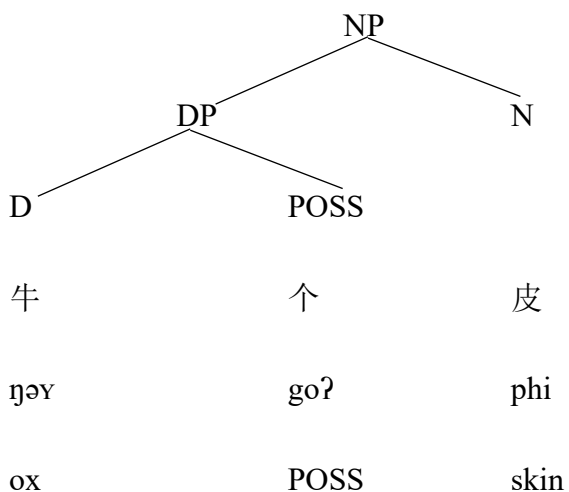
Like its counterpart 的 *de* in Mandarin Chinese, 个 [goʔ^{LH}] in Ningbo dialect can attach to:

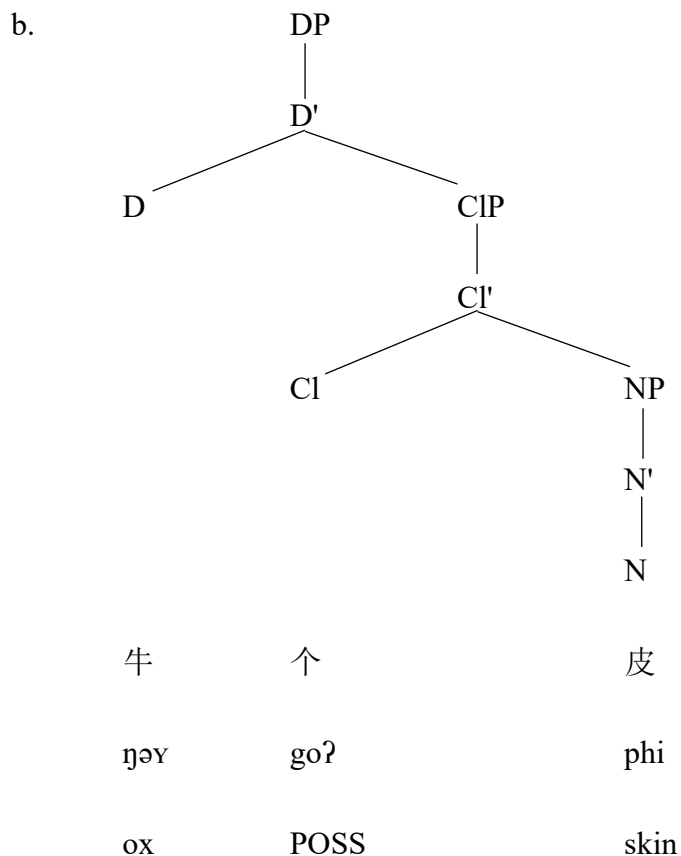
(a) the right of a noun/pronoun to indicate procession, as presented in (28); (b) the right of a modifier to connect the modifier with the head that it modifies, as presented in (29); (c) the right of a verb/verb phrase, adjective/adjective phrase, noun/noun phrase or pronoun to create a noun phrase, as presented in (30).

Traditionally, in the possessive structure, the noun on the right edge is the head of NP, as given in (27a). However, according to the theory of DP, determiners are not inside the NP, but instead, NP is the complement to the determiner head D (cf. Abney, 1987, among others). Therefore, the tree of a construction is different from that in (27a), as presented in (27b), and the possessive marker 个 [goʔ^{LH}], as a proclitic, attaches to the host o its right.

(27) 'the skin of ox'

a. NP theory





The phonological evidence in Ningbo dialect also supports the DP theory. Compare the tone sandhi forms of 牛皮 'ox skin' and 牛个皮 'the skin of ox'. The former one is a prosodic word, within which LTS applies, and the tone melody of 牛皮 is 'L-HL'. However, in the later one, 个 [goʔ^{LH}] consistently gets assigned a low tone, which indicates that TS is actually blocked between 牛 'ox' and 个 [goʔ^{LH}]. As I will discuss in detail in Section 5.2, in Ningbo dialect, the enclitics always undergo TS with their hosts on the left, while proclitics does not only block TS to their hosts on the right, but also block TS spreading from the lexical items on their left. By adopting the DP theory, the possessive 个 [goʔ^{LH}] should be treated as proclitics so that its TS behavior is in

accordance with that of other proclitics. However, the TS in (29a) proves that the modification 个 [goʔ^{LH}] should undergoes TS with its preceding lexical item when it follows an adjective, thus, they form a clitic group domain for application of LTS. As for the nominalization 个 [goʔ^{LH}], it is an enclitic since there is no host for it to attach to on the right side, it can only form one clitic group with the lexical item on its left side.

(28) 个 as Possessive marker

a. 我 [个 c 书 ω]_{CG}

ŋo [goʔ sɿ]

I POSS book

'my book'

b. 张三 [个 c [车子]ω]_{CG}

teã se [goʔ [tso zɿ]]

Zhang San POSS car

'Zhang San's car'

(29) 个 as modification marker

a. [旧 ω 个 c]_{CG} 书

[tey goʔ] sɿ

old MOD book

'old book'

b. [[老实]ω 个 c]_{CG} 做人

[[lɔ soʔ] goʔ] zɛu niŋ

honest MOD behave

'to behave honestly'

(30) 个 as nominalization marker

- | | |
|---|--|
| <p>a. [吃 ω 个 c]_{CG}</p> <p>[tehyo? go?]</p> <p>eat NOM</p> <p>'what is to eat'</p> | <p>b. [[小 学]ω 个 c]_{CG}</p> <p>[[eio? fo?] go?]</p> <p>primary school NOM</p> <p>'primary school's (things)'</p> |
| <p>e. [蓝 ω 个 c]_{CG}</p> <p>[le go?]</p> <p>blue NOM</p> <p>'what is red/ red things'</p> | |

5.2.2.4 Post-verbal Complementizer Markers 勒 [la^{2LH}], 到 [tə^{HL}]

In Ningbo dialect, 勒 [la^{2LH}] can also be used as the post-verbal complementizer marker, which connects the preceding verb or adjective and the following complement word, indicating the result, manner of the action, degree, or possibility. Thus, the morpho-syntactic function of 勒 in Ningbo dialect is similar to that of the complementizer 得 *de* in Mandarin Chinese.

Generally speaking, except the potential complement case, which will be discussed in Chapter VII, the descriptive and result complement following the post-verbal particle 勒 [la^{2LH}] usually contain more than one syllable. Moreover, in the potential complement structure, the verb is the focus of the phrase/sentence, which will start a resturctured intonational phrase that includes the

complement and LTS applies within the domain.

It should be noted that the nucleus of the complementizer 勒 [laʔ^{LH}] is neutralized that changes to a low central vowel [a]. The examples of the complementizer marker 勒 are given in (31).

(31)a. [看 ω 勒 c]_{CG} 交 关 清 爽

[khi laʔ] teio kue tehij sã

look PVP very clear

'look very clearly'

b. [打 ω 勒 c]_{CG} 血 出 乌 拉

[tã laʔ] eyoʔ tshoʔ wu la

beat PVP bleed

'beat someone to bleed'

As the complementizer in Ningbo dialect, 到 [tɔ^{HL}] is similar to its counterpart 到 *dao* in Mandarin Chinese. It can be used as a verb, meaning 'to arrive', while it can also be used as the complementizer to follow a verb and to precede noun/noun phrases, especially the place words and time word, or even clauses or sentences to indicate the result or degree of an action, as exemplified in (32).

- (32)a. [跑 ω 到 c]CG 宁 波
 [bɔ tɔ] niŋ pəu
 run PVP Ningbo
 'run to Ningbo'
- b. [做 ω 到 c]CG 十 点
 [zəu tɔ] zoʔ ti
 do PVP ten o'clock
 'work until/to 10 o'clock'
- c. [看 ω 到 c]CG 眼 睛 近 视
 [ki tɔ] ŋɛ tɛiŋ tsiŋ zɿ
 look PVP eyes shortsighted
 'to look until eyes become shortsighted'

It should be noted that the complementizers 勒 [laʔ^{LH}], 到 [tɔ^{HL}] can have two optional readings, respectively, if the preceding host is monosyllabic verb. On the one hand, together with the preceding host, the complementizers can form a TS domain for LTS to apply; on the other hand, the complementizers may simply assimilate the sandhi tone of the tone of preceding monosyllabic verb. Take (32c) as example, the clitic group '看到' can undergo LTS in one way, the sandhi melody of which is 'H-L', while the clitic 到 [tɔ^{HL}] can also assimilate the sandhi tone of '看', which is a high tone, to form a 'H-H' melody. On the other hand, if the preceding verb is a disyllabic one, the complementizer may be assigned a low tone since in LTS of Ningbo, the third syllable within one domain is always assigned a low tone, or it may assimilate the sandhi tone of the second syllable of the verb.

Nevertheless, no matter what kind sandhi melody such clitic groups will take on surface, it is sufficient to say that the complementizers 勒 [laʔ^{LH}], 到 [tə^{HL}] are both enclitics, which form clitic groups with their preceding host to provide a domain for application of tone sandhi.

5.2.2.5 Adjective/verb Reduplication Markers 个 [goʔ^{LH}], 叫 [təio^{HL}] and 动 [doŋ^{LH}]

Chapter IV has discussed the reduplication of adjectives and verbs in Ningbo dialect, which usually cannot stand by their own. Instead, the reduplication forms of adjectives and verbs are usually joined with enclitics 个 [goʔ^{LH}], 叫 [təio^{HL}] and 动 [doŋ^{LH}] on the right side. 个 and 叫 are interchangeable when they attach to reduplicated adjectives to serve as the modification marker, as given in (33a), while 动 can follow both reduplicated forms of adjectives and verbs to express a meaning of 'in a state of', as presented in (33b).

- (33) a. i. 东 西 [[轻 轻]ω 个 c]_{CG}
 doŋ ei [[təhiŋ təhiŋ] goʔ]
 thing light-weight light-weight AdjR
 'This thing is light-weight.'
- [[轻 轻]ω 叫 c]_{CG} 放
 [[təhiŋ təhiŋ] təio fɔ̃
 gentle gentle AdjR put down
 'to gently put (it) down'

- b. i. [[跳 跳]ω 动 c]CG
 [[thio thio] doŋ]
 jump jump VR
 'be in a state of jumping'
- ii. [[晕 晕]ω 动 c]CG
 [[yoŋ yoŋ] doŋ]
 dizzy dizzy AdjR
 'in a state of being dizzy'

5.2.2.6 Localizers

There are a number of localizers in Ningbo dialect, which occur after noun/noun phrase, to change a noun/noun phrase to a place word. The commonly used localizers include 里 [li^{LH}] 'inside', 边 [pi^{HL}] 'by the side of', 下 [fo^{LH}] 'under'. Examples of the localizers are presented in (34).

- (34) a. [[弄 堂]ω 里 c]CG
 [[loŋ tɕ] li]
 alley LOC
 'in the alley'

- b. [桌 ω 边 c]CG
 [tsoʔ bi]
 table LOC
 'on the side of the table'
- c. [床 ω 下 c]CG
 [zɔ̃ fo]
 bed LOC
 'under the bed'

5.2.2.7 Directional Particles

Similar as those in Mandarin Chinese, the directional particles in Ningbo dialect occur after verb/verb phrase to indicate the direction of an action, thus, the verb/verb phrase that precedes these particles should contain the meaning of movement. The examples of directional particles are presented in (35).

- (35) a. [走 ω 过 去 c]CG
 [tsəY kəu tɛhi]
 walk DerP
 'to walk over there'

b. [跑 ω 回 来 c]_{CG}

[pəu uəi le]

run back

'to run back'

5.2.2.8 Pre-verbal *ba*-construction and *bei*-construction Particles, 搭 [taʔ^H] and 扒 [paʔ^H]

Similar to Mandarin Chinese, Ningbo dialect also has *ba*-construction and *bei*-construction. The former one is a disposal construction which focuses on the fluence or the result of an action, while the latter one, generally speaking, is a passive construction. In Mandarin Chinese, the word order in *ba*-construction usually is as: subject+*ba*+object+verb phrase; and the word order in *bei*-construction is: subject+*bei*+object+verb phrase. These two structures are also adopted in Ningbo dialect. The corresponding particles for *ba* and *bei* in Ningbo dialect, are 搭 [taʔ^H] and 扒 [paʔ^H], respectively. In a sentence, the noun/noun phrase that follows 搭 is the receiver of the action denoted by the verb/verb phrase in the *ba*-construction, while in *bei*-construction, the subject that precedes 扒 is the receiver of the action denoted by the verb/verb phrase. It should be noted that both 搭 [taʔ^H] and 扒 [paʔ^H] are proclitics that attach to the noun/noun phrase to their right. The examples of these two constructions in Ningbo dialect are presented in (36).

- (36) a. 李 四 [搭_c 我 ω]_{CG} [个_c [名 字]ω]_{CG} [[读 错]φ 嘞_c]_{CG}
 li sɿ [taʔ ŋo] [goʔ [minj zɿ]] [[tdoʔ sɐu] lɛi]
 Li Si Part. I POSS name read wrong CRS
 'Li Si read my name wrong.'
- b. 杯 子 [扒_c [张 三]ω]_{CG} [[敲 碎]φ 嘞_c]_{CG}
 pɛi tsɿ [paʔ [tɛã sɛ]] [[kheu sɛi] lɛi]
 cup Passive Zhang San crack break CRS
 'The cup was cracked by Zhang San.'

It can be seen, as shown in (36a) and (36b), violation of both principles of Nonrecursivity and Layerdeness are allowed. For example, as in (36b), the phonological phrase 敲碎 'knock to break' is dominated by a clitic group, and thus, both Layerdeness and Recursivity principles are violated. However, it should be pointed out that, since the three prosodic constituents as presented in (36a) all belong to the morpho-syntactic-based hierarchy, by assuming Zhang's (1992, 2017) stipulation and the weakened version of SLH, they are still legitimate.

Moreover, it should be pointed out that, as shown in (36a), although 我的名字 'my name' syntactically are dominated by the same DP node, however, as will be discussed in Chapter VI, they cannot form one single phonological phrase because the 的名字 is on the recursive side of the head D 我 'I' and they are branching.

5.2.2.9 Pronouns

5.2.2.9.1 Demonstrative pronouns

Generally speaking, Ningbo dialect only has one demonstrative pronoun, 该 [kjeʔ^H], which can be used to refer to the target either close to or far away from the speaker. There does exist another morpheme, 荡, which can refer to the targets even closer to the speaker. However, 荡 [dɔ̃^{LH}] can never be used freely, but must be bound with other items to form an independent word, such as 荡间 'this room', 荡头 'here'. Both of the demonstrative pronouns are not clitics in Ningbo dialect because 荡 [dɔ̃^{LH}] should be treated as a prefix, while 该 [kjeʔ^H] cannot stand alone in the position of object.

5.2.2.9.2 Personal pronouns

As for personal pronouns, there are six basic personal pronouns, as given in (37).

(37) Personal pronouns in Ningbo dialect

English meaning	Ningbo dialect	Mandarin Character
I/me	ŋo ^{LH}	我
you/you	nɿu ^{LH}	侬
he/she/it/him/her/it	dzi ^{LH}	其
we/us	aʔ ^H laʔ ^H	阿拉

you/you (plural)	naʔ ^{LH}	纳
they/them	ɕjeʔ ^L laʔ ^H	其拉

As shown above, Ningbo dialect does not distinguish subject pronouns and object pronouns as English. In other words, the subject pronouns look identical to their counterpart in the object position. However, the subject pronouns actually differ from the object pronouns while tone sandhi rule applies. The pronouns on the object position are prosodically dependent on an adjacent verbal host, and thus, they are enclitics, similar to the weak pronouns in French.

Moreover, there are two sets of possessive pronouns in Ningbo dialect, as given (38).

(38) Possessive pronouns in Ningbo dialect

English meaning	1st set		2nd set	
my	ŋo goʔ	我个	a laʔ	阿拉
your	nɿu goʔ	依个	naʔ	纳
his/her/its	ɕzi goʔ	其个	ɕleʔ laʔ	其拉
our	aʔ laʔ goʔ	阿拉个	aʔ laʔ	阿拉
your (plural)	naʔ goʔ	纳个	naʔ	纳
their	ɕjeʔ laʔ goʔ	其拉个	ɕjeʔ laʔ	其拉

As shown above in (38), both of the singular and plural possessive personal pronouns have

two set of expressions. The first set are combination of personal pronouns plus the possessive marker 个. In the first set, the possessive 个 [goʔ], as discussed in Section 5.1.2.4, are proclitics that attach to the host to the right side, and the personal pronouns in the first set are not object pronouns, thus, should not be treated as clitics, but are actually prosodic words. However, when the sandhi rule applies, the second set will lose their tones and phonologically dependent on their hosts on the right side, thus, the second set of possessive pronouns should be treated as proclitics. The examples of object personal pronouns and possessive personal pronouns as clitics are presented in (39). Compare (39b) and (39c), the pronoun in the former one is not clitic while the possessive pronoun in the latter one is a proclitic.

(39) a. [[批 评]_ω [其 拉]_c]_{CG}

[[phi piŋ] [dʒleʔ laʔ]]

criticize them

'to criticize them'

b. 欢 喜 我 [个_c [姐 姐]_ω]_{CG}

hu ei ŋɔ [goʔ [teia teia]]

like I POSS elder sister

'to like my sister'

b. 欢 喜 [我_c [姐 姐]_ω]_{CG}

hu ei [ŋɔ [teia teia]]

like my elder sister

'to like my sister'

5.2.2.9.3 interrogative pronouns

The commonly used interrogative pronouns in the Ningbo dialects include 啥西 [soʔ^H ɕi^L] 'what', 啥人[soʔ^H niŋ^L] 'who', 几 [tɕi^H] 'how many', 多少 [tɕu^M tɕi^{HL}] 'how many', 阿里 [aʔ^H li^H] 'where', 为啥看[uei^L soʔ^H ki^L] 'why', 咋 [za^{LH}] 'how come', 啥晨光 [soʔ^H zoŋ^L kuã^L] 'when'. However, these interrogative pronouns are not clitics and do not form clitic groups with their immediate nearby lexical items, the phonological behavior of these interrogative pronouns differs from that of the clitics introduced above. According to the movement and binding theory, these elements are all bound with the lexical items that they refer to, and in reality, these words are usually the focus of sentences. Thus, they cannot be treated as clitics.

5.2.2.9.3 interrogative pronouns

The commonly used interrogative pronouns in Ningbo dialects include 啥西 [soʔ^H ɕi^L] 'what', 啥人[soʔ^H niŋ^L] 'who', 几 [tɕi^H] 'how many', 多少 [tɕu^M tɕi^{HL}] 'how many', 阿里 [aʔ^H li^H] 'where', 为啥看[uei^L soʔ^H ki^L] 'why', 咋 [za^{LH}] 'how come', 啥晨光 [soʔ^H zoŋ^L kuã^L] 'when'. However, these interrogative pronouns are not clitics and do not form clitic groups with their immediate nearby lexical items, the phonological behavior of these interrogative pronouns differs

from that of the clitics we introduce above. According to the movement and binding theory, these elements are all bound with the lexical items that they refer to, and in reality, these words are usually the focus of sentences. Thus, they cannot be treated as clitics.

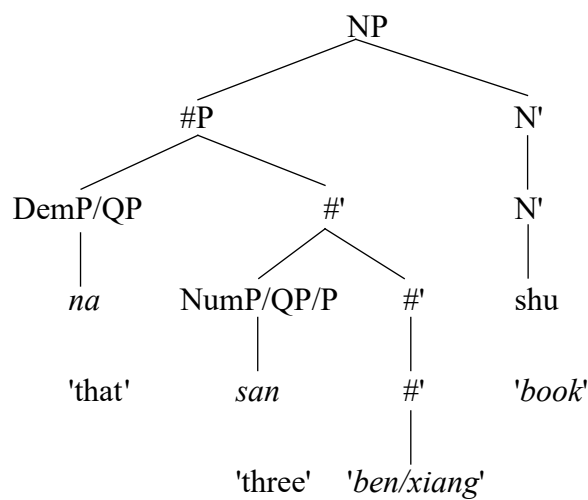
5.2.2.10 Measure Words

The measure words refer to the category of the classifiers that are used after the numerals and precede the following noun/noun phrase. Measure words are commonly used to denote unit or measurement. In Ningbo dialect, there are a great amount of measure words, and different nouns should collocate with different measure words. The examples of measure words in Ningbo dialect are presented in (41). However, different from the possessive marker 个 [go?] analyzed by the DP theory, I consider the measure words in Ningbo dialect should be bound with the numeral words first so the measure word are enclitic in Ningbo dialect.

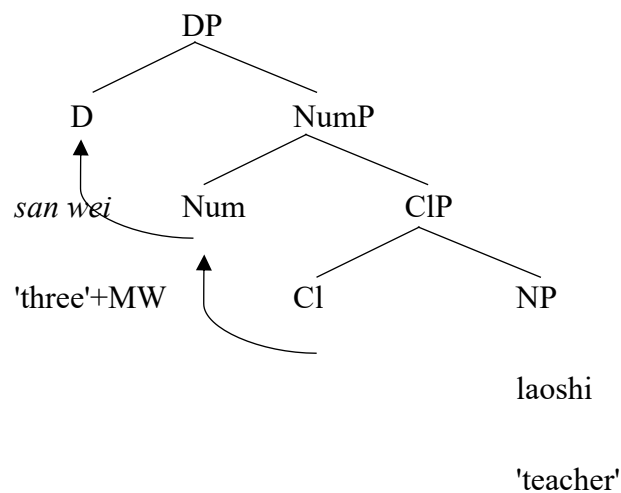
In terms of the formal syntactic structure involving classifiers (Cl) and measure words (MW) in Mandarin, there are two opposing views in recent studies. Tang (2005) and M. Hsieh (2008) consider Cl and MW to be syntactically alike and offer the same structure analysis. Thus, Tang (2005) has both Cl and MW as the head of a classifier phrase (ClP), as in (40a). By contrast, Cheng & Sybesma (1998, 1999), Borer (2005), and Zhang (2009) argue that Cl is base-generated as the head of ClP, while MW is base-generated under N and then moves upward to Cl, as in (40b). Nevertheless, in the former analysis, MW is under the same node with Numeral word, while in the

latter analysis, MW have moved upward to Cl. Therefore, in either way, measure word, as a clitic, should not be bound with the numeral noun on its left. As a matter of fact, in Ningbo dialect, MWs always undergoe LTS with the numeral nouns on its left, which exhibits a differernt TS pattern from that of the proclitics. Therefore, in Ningbo dialect, I consider measure word as enclitic that attaches to the host. The examples of MW are examplied in (41).

(40) a.



b.



(41). Example of MW as clitic in Ningbo dialect

c. [一 ω 只 c]_{CG} 狗

[jeʔ tsaʔ] kəY

one MW dog

'one dog'

d. [两 ω 根 c]_{CG} 毛 巾

[ljã kã] mɔ tɕiŋ

two MW towel

'two towels'

5.2.2.11 Approximate Quantifiers

As mentioned earlier, the numeral word 两 [ljã^{LH}] 'two', besides indicating the exact number of two, can also be used to indicate an uncertain number. Similarly, 几 [tɕi^H] can also mean 'several' when it is not used as the interrogative pronoun. In such cases, both of 两 and 几 are approximate quantifiers. They can denote an uncertain quantity of countable nouns. However, when they are used as approximate quantifiers, they consistently lose their tones. The approximate quantifiers are treated as clitic in this dissertation because (1) they cannot be used alone when answering questions; (2) their semantic meanings are not clear; (3) their phonological behavior is same as other proclitics. As shown in both examples in (42), the principle of Nonrecursivity are

violated. Also, compare the examples in (41b) and (42a), where 两 have different meanings and classifications.

(42) a. 张 三 [个_c [两_c [个_c [朋友]_ω]_{CG}]_{CG}]_{CG}

tejã sɛ [goʔ [ljã [goʔ [bã y]]]]

Zhang San POSS several MW friend

'several friends of Zhang San's'

b. 李 四 [个_c [几_c [本_c [书]_ω]_{CG}]_{CG}]_{CG}

li sɿ [goʔ [tɛi [pəŋ [sɿ]]]]

Li Si POSS several MW book

'several books of Li Si's'

It should be noted that, in the cases above, since the approximate numeral words 两 [ljã^{LH}] and 几 [tɛi^H] are proclitics here, the measure word enclitics that immediately following them cannot find possible host to their left. Therefore, according to the *b* part of the definition of clitic groups proposed by Nespor & Vogel (1986), as presented in (9), they become proclitic here, forming the clitic group with the following host.

5.2.2.12 Locative Preposition 勒 [laʔ^{LH}]

勒 [laʔ^{LH}] has been identified as an aspect marker in literature, it is also the most commonly

used locative preposition in Ningbo dialect to introduce the location where an action is carried out, the meaning and morpho-syntactic function of which is similar to that of 在 *zai* in Mandarin Chinese except the groups of '勒+location word' appear after the verb/verb phrase in the Ningbo dialect. The examples are given in (43).

(43) a. 张 三 蹬 [勒_c [香 港]ω]_{CG}

tɛjã se dən [laʔ [ɛjã kɔ̃]]

Zhang San live at Hong Kong

'Zhang San lives in Hong Kong.'

b. 李 四 困 [勒_c [[眠 床]ω [高 头]ω]φ]_{CG}

li sɿ khuəŋ [laʔ [[mi zɔ̃] [kəu thəy]]]

Li Si sleep at sleep bed top suffix

'Li Si sleeps on the bed.'

5.2.2.13 Pre-verbal Auxiliaries

There are a few monosyllabic pre-verbal auxiliaries in the Ningbo dialect, including 是 [ʒ^{LH}] 'to be', 有 [y^{LH}] 'have; own; exist', 会 [wei^{LH}] 'will; can', 好 [hɔ^H] 'be allowed to; should', which are commonly used. These auxiliaries are treated as prosodic word instead of clitic in this dissertation because: (1) although they belong to the functional category, their meanings are more concrete; (2) they can be used alone when answering questions; (3) as will be argued in Chapter

VI, these elements are usually used in VO structure, in which LTS is blocked and these auxiliaries form their own phonological phrase domain, respectively.

It should be noted that application of PTS may make these monosyllabic auxiliaries look like proclitics since the tone of 是, 有 and 会 all bear a low tone in a sentence. However, it is due to application of PTS which deletes the second part of the tone of these monosyllabic auxiliaries. In other words, the H feature of the LH tone that these words bear is deleted due to PTS, and the L tonal feature is assigned to the auxiliaries. By contrast, the base tone of the auxiliary 好 is a H tone, thus, it remains the H tone in a sentence after applying PTS. I will discuss it in Chapter VI.

There are a few disyllabic pre-verbal auxiliaries in Ningbo dialect, such as 应该 [iŋ^M ke^{HL}] 'should', 必须 [pje^{ʔH} əyL] 'must', 最好 [tsøi^H hɔ^L] 'had better', etc. Similarly, they not are treated as clitics in this dissertation for the following reasons: (a) although they belong to the functional category, their meanings are more concrete; (b) these disyllabic auxiliaries exhibit different phonological behavior comparing with any clitics in the Ningbo dialect, which means they are actually prosodic words instead of clitics; (c) these auxiliaries, such as 必须, 应该, are usually the focus of the sentence and are comonly emphasized.

5.2.2.14 Sentence-final Particle 嘞 [ləi^{LH}]

The sentence-final particle 嘞 [ləi^{LH}] is another aspect marker, the morpho-syntactic function of which is similar to its counterpart in Mandarin Chinese, the sentence-final 了 *le*. It occurs at

the end of a sentence or a clause to indicating the emergence of a new situation, as presented in (44). Moreover, it may also serve as the modal particle to indicate the mood to attitude of the speaker, as presented in (44b). As shown in (44a-ii), (44a-iii) and (44a-iv), the violation of Nonrecursivity is allowed in these cases.

- (44) a. i. 饭 [好 ω 嘞 c]_{CG}
 vε [hɔ lɛi]
 rice ready CRS
 'The rice is ready.'
- ii. 饭 [[好 ω 喋 c]_{CG} 嘞 c]_{CG}
 vε [[hɔ] tjeʔ lɛi]
 rice ready PERF CRS
 'The rice is already ready.'
- iii. 其 来 [[[弄 堂]ω 里 c]_{CG} 嘞 c]_{CG}
 dʒi le [[[loŋ dā] li] lɛi]
 he come alley inside CRS
 'He has come into the alley.'

iv. 可 乐 我 [[喝 ω 过 c]CG 嘞 c]CG

khəu loʔŋo [[haʔ kəu] ləi]

cola I drink EXP CRS

'I have drunk the cola.'

b. i. 生 意 [做 ω 勒 c]CG 交 关 [大 ω 嘞 c]CG

sā yi [zəu laʔ] tɛio kuɛ [dɛu ləi]

business do PVP very big CRS

'The business has become very big!'

ii. 其 已 经 交 关 [壮 ω 嘞 c]CG

dzi ji tɛiŋ tɛio kuɛ [zɔ̃ ləi]

he already very strong CRS

'He is already very strong!'

Moreover, it should be noted that the sentence-final particle 嘞 [ləi^{LH}] may have two readings. For the example in (44b-i), the sentence-final particle can undergo TS with the preceding host, 大 'big', to get a 'L-HL' tone sandhi melody. However, the combination of '大嘞' in (44b-i) may also read as 'LH-L', in the case of which, the tone sandhi actually is blocked and 嘞 gets assigned a low tone. Different from Hu (2003), who claims that the high tonal feature of 大 is optionally assigned to the following clitic, I believe that the second reading is due to the assignment of

contrastive prominence on the item that precedes 嘞, which will start an intonational phrase and receive prominence so that sentence-final particle 嘞 is assigned a default low tone, as exemplified as follows. The item that are emphasized is in bold and underlined.

- (45) [[生 意]ω]φ [[做 ω 勒 c]CG]φ [[交 关]ω]φ [[**大**]ω]φ 嘞]ι
 [[sã yi] [zøu laʔ] [tɕio kuɛ]]ι [**deu** lei]ι
 business do PVP very big CRS
 'The business has become very big!'

5.2.2.15 Conjunction Words

The commonly used conjunction words in Ningbo dialect includes 搭 [taʔ^H] 'and/with', 即使 [tɕjeʔ^H sɿ^L] 'even if', 万一 [vɛ^L jeʔ^H], etc. Interestingly, the conjunction words are divided into two categories, monosyllabic conjunction 搭 [taʔ^H] that connects nouns, which should be treated as proclitics, and disyllabic ones, within which the LTS applies. The monosyllabic 搭 [taʔ^H] usually is not the focus of the sentence, and it can never be used alone so that 搭 is treated as clitic, while other conjunction words belong to another group since they can be used alone independently as well as serving as the focus of the sentence frequently. The examples of the conjunction word 搭 [taʔ^H] as proclitic are given as follows.

- (46) a. [张 三]ω [搭 c [李 四]ω]CG
 [tɕjã sɛ] [taʔ [li sɿ]]
 Zhang San CONJ Li Si
 'Zhang San and Li Si'
- b. [我]ω [搭 c 侬 ω]CG
 [ŋɔ] [taʔ nɛu]
 I CONJ you
 'I and you'

5.2.2.16 Negations

There are three commonly seen negation words in the Ningbo dialect, 不 [vaʔ^{LH}] 'don't', 灭 [mjeʔ^H] 'didn't' and 覯 [fe^H] 'don't want to', which are used preverbally. Generally speaking, 不 [vaʔ^{LH}] and 灭 [mjeʔ^H] correspond to 不 *bu* and 没 *mei* in Mandarin Chinese, respectively, in a sense that 不 [vaʔ^{LH}] is used to negate adjective/adjective phrase or is used before verb/verb phrase to express the meaning of 'don't' or 'don't want to', while 灭 [mjeʔ^H] is used before verb/verb phrase to denote meaning like 'didn't'. 覯 [fe^H] is a phonetic combination of two words, 勿 and 要, meaning 'don't want to', which is created by combining the initial of 勿 and the final of 要 and then undergoing vowel change, i.e., from [io] to [e].

These three major negation words are not treated as clitics based on three reasons: (1) They

can be used alone when answering questions; (2) their semantic meanings are clear and concrete; (3) they usually are the focus of negative sentences; (4) their phonological behavior is different from clitics. Moreover, both 不 [vaʔ^{LH}] and 灭 [mjeʔ^H] can be post-located at the end of a sentence to serve as the yes-or-no question markers.

5.2.2.17 Summary

On the basis of the above discussion and the examples presented in 5.2.1.2 through 5.2.1.16, it can be seen that the clitic-like elements in Ningbo dialect share some of the common morpho-syntactic properties of clitics across languages, including: (a) they all belong to functional category; (b) they never occur as the only element of an utterance and must attach to the adjacent unit; (c) the meaning of the string of the host plus enclitic or proclitic plus the host is predictable from the combination of the meanings of the elements; (d) they can attach to the elements that already included affix, or clitics. Therefore, it is reasonable to consider most of the elements discussed above are clitics in Ningbo dialect.

As mentioned in Section 5.2.1.1, there are two types of clitic in Ningbo dialect, namely, proclitics and enclitics. The classification of the clitics in Ningbo dialect are listed as follows.

(47) Classification of clitics in Ningbo dialect

- Enclitics:
- a. Sentence-final question marker, i.e., 伐 [aʔ^{LH}] and 未 [vei^{LH}];
 - b. Post-verbal durative aspect markers, i.e., 喋 [tjeʔ^H], 该 [ke^{HL}], 勒

[ljeʔ^H], 仔 [zɿ^H], 勒其 [ljeʔ^H dʒi^H], 勒仔 [ljeʔ^H zɿ^H], 勒眼 [ljeʔ^H ŋɛ^H], 动 [doŋ^{LH}] and 勒动 [ljeʔ^H doŋ^H];

- c. Perfective aspect markers, i.e., 勒 [ljeʔ^H] and 仔 [zɿ^H];
- d. Experience aspect marker, i.e., 过 [kœu^{HL}];
- e. Post-verbal Complementizer markers, i.e., 勒 [laʔ^{LH}] and 到 [tɔ^{HL}];
- f. adjective/verb reduplication markers, i.e., 个 [goʔ^{LH}], 叫 [teio^{HL}] and 动 [doŋ^{LH}];
- g. Localizers, i.e., 里 [li^{LH}], 边 [pi^{HL}], 下 [fiɔ^{LH}];
- h. Directional particles, i.e., 过去 [kœu^H tɕhi^L];
- i. Object personal pronouns;
- j. Sentence-final particle, i.e., 嘞 [lɛi^{LH}]
- k. Modification marker, i.e. 个 [goʔ^{LH}];
- l. Measure words;

- Proclitics:
- a. Pre-verbal durative aspect markers, i.e., 勒 [ljeʔ^H], 勒喋 [ljeʔ^L tjeʔ^H], 勒该 [ljeʔ^L ke^{HL}];
 - b. Possessive marker, i.e., 个 [goʔ^{LH}];
 - c. *Ba*-construction and *bei*-construction particles, i.e., 搭 [taʔ^H] and 扒 [paʔ^H];
 - d. Approximate quantifiers, i.e., 两 [ljã^{LH}] and 几 [tei^H];

- e. Monosyllabic conjunction word, i.e., 搭 [taʔ^H];
- f. Prepositions, i.e., 勒 [laʔ^{LH}];
- g. Possessive personal pronouns

While most of the clitics can be easily classified according to their position to the host that they attach to, there are several types of clitics which require further discussion.

The first of such clitics is the possessive marker 个 [goʔ^{LH}]. Traditionally, it is considered as enclitic that attaches to the host on the left. However, as shown earlier, on the basis of the DP theory (cf. Abney 1987, among others), it should be reanalyzed as proclitic to accommodate the DP hypothesis, and thus application of the default low tone to this clitic in TS can be accounted for.

Another group of clitics that need further discussion are the object person pronouns. Different from the Indo-European languages, it seems that Chinese does not distinguish the object pronouns versus non-object ones in the literature. However, as Zhang (2017: 208) points out, the TS in Mandarin Chinese provides support to identify the object personal pronouns as clitics, as cited in (48). The number of the citation tone indicates the tonal category in Mandarin Chinese.

(48) a. Clitic group

我 比 你 小

I than you smaller

'I am smaller than you.'

wo bi ni xiao

Citation tone: 3 3 3 3

Tone Sandhi *2 3 2 3

b. phonological phrase

狗 比 马 小

dog than horse smaller

'Dog is smaller than horse.'

gou bi ma xiao

Citation tone: 3 3 3 3

Tone Sandhi 2 3 2 3

The TS in (48a) is illegitimate while that of (48b) is allowed because (48a) is a clitic group and (48b) is a phonological phrase. Moreover, in most of the Indo-European languages, it is commonly seen that there is a set of object pronouns that differ from those locate in the position

of subject, i.e., 'I' vs. 'me' in English.

Therefore, in Ningbo dialect, the object personal pronouns should be grouped into enclitics because: (a) the similar classification in Mandarin Chinese, in which non-subject pronouns are treated as enclitics; (b) they all belong to functional categories; (c) their TS phenomena are same as other enclitics.

5.3 Phonological Phenomena within Clitic Groups in the Ningbo Dialect

This section investigates the phonological behavior of the two types of clitic groups, namely the group of 'host+enclitic(s)' (clitic group type A), and the group of 'proclitic(s)+host' (clitic group type B) through the examination of application of tone sandhi rules in Ningbo dialect. This section is organized as follows: in Section 5.3.1, I will briefly review the previous studies on the clitic groups, especially Hu's (2003) analysis on the TS of function words in the Ningbo dialect; in Section 5.3.2, I will show application of LTS in the clitic group type A as well as the blocking cases in the clitic group B. Thus, in Section 5.3.3, I will reach the conclusion that, different from the previous studies on the TS in the clitic groups in Ningbo dialect, which all claim that it is always a tone spreading mode in the clitic groups, the clitic group type B actually exhibits different phonological behavior as compared to the type A in a way that the type A undergoes TS while the type B blocks TS. On the other hand, the clitic group as a whole should be identified as an independent domain different from the domain of prosodic word and the domain of prosodic phrase

so that the blocking of TS between proclitics and their preceding lexical items can be accounted for.

5.3.1 Review of Previous Studies on Clitic Groups in the Ningbo Dialect

The phonological phenomena of the clitic groups in Ningbo dialect has not attracted enough attention in history. By now, the only systematic research on this topic is Hu's (2003) discussion on the TS within clitic groups in Ningbo dialect. Based on Hu's analysis, the tone sandhi within clitic groups is slightly different from that within the prosodic words, as summarized in (49). Hu's (2003) definition of clitic group are given in (50).

(49) CTS in Ningbo dialect (Hu, 2003)

- a. Tone deletion: delete the tones of function words within the same clitic group;
- b. Tone assignment: assign default low tone to the syllables on the functions;
- c. Tone Convention (optional): assign a high tone feature from the lexical item within domain to the leftmost syllable of the function word to its right.

(50) Formation of clitic group in Ningbo dialect

Mark the left edge of every lexical item unless it is a personal pronoun which is dominated by possessive marker.

By the definition of clitic group in (50) and CTS in (49), some TS phenomena in Ningbo

dialect, typically the TS within the groups of 'host+enclitic(s)' can be accounted for, as exemplified in (51). Because no segmental change that have been observed within the clitic group in Ningbo dialect. For the sake of convenience, I will simply provide the description of tones from now on.

- (51). a. 游 泳 [[游 好] φ 嘞 c]_{CG}
 Swim [[swim RC] CRS]
 'I have finished swimming'
 base tone LHL H LHL H LHL
 TS L H [[L H] L]
- b. 张 三 [[蹲]_ω 了 c]_{CG} 香 港
 Zhang San [live at] Hong Kong
 base tone MHL MHL LHL LHL MHL H
 TS M HL [L H] M HL

As we can see in (49), Hu's theory is generally based on Selkirk's (1986) single-edge-based approach since it is only relevant to one edge of a type of constituent, i.e., the right edge of a lexical item, and there are no syntactic relations governing the mapping at all. He also adds a condition which treats personal pronoun followed by the possessive marker as a special case, which, theoretically speaking, is very odd.

Moreover, his analysis will encounter some problems when TS applies to the groups of 'proclitic+host' in Ningbo dialect. Take a look at (52).

(52) a. 两 is used as approximate numeral, 'several'

	两 ω	个 c	人 ω
	several	MW	people
	'several people'		
base tone	LHL	LHL	LHL
*TS according to (48)	[[LH]	L]	LH
TS in reality	[L	[L	LH]]

b. 两 is used as a numeral word meaning 'two'

	两 ω	个 c	人 ω
	two	MW	people
	'two people'		
base tone	LHL	LHL	LHL
TS according to (48)	[[LH]	L]	LH
TS in reality	[LH]	[L	[LH]]

c.	牛 ω	搭 c	其 c	[踢	死] ϕ	嘞 c
	ox	PART	him	kick	dead	CRS
	'The ox kicked him to death.'					
base tone	LHL	H	LHL	H	H	LHL
*TS according to (48)	[[L]	H	L]	[[H	L]	L]
TS in reality	[LH]	[L	LH]	[[H	L]	L]
d.	[牛	肉] ω				
base tone	LHL	LHL				
LTS	[L	=	H]			

When 两 is used as an approximate numeral word, as shown in (52a), its tone sandhi pattern differs from when it is used as an exact numeral word meaning 'two', which, the CTS rule that Hu (2003) proposes as in (50) fails to account for. Moreover, it should be noted that, although there is no any other lexical item before them, the combination of the two clitics 两个 in (52a) should consistently be pronounced as low tones, which cannot be explained by Hu's theory either.

Moreover, as in (52d), 牛肉 is a typical prosodic word, and its TS pattern is L-H, which means, in LTS, the high tone feature of the base tone of 牛 will be assigned to the following syllable, 肉. However, this is not the case in the example of (52c). As shown in (52c), the *ba-* construction particle 搭 is a clitic. According to Hu's theory, it should form a clitic group domain

with the preceding lexical item 牛, thus, it may optionally gets assigned a H feature. However, in reality, 搭 is always pronounced as low tone. Therefore, the TS sandhi is blocked between the preceding lexical item 牛 and the following clitic 搭. In other words, the assignment of the high tonal feature of the preceding lexical item is not optional but is prohibited. Thus, Hu's proposal as shown in (49) is only correct that TS can apply in the domain formed by the group of 'host+enclitic(s)', but fails to explain why TS is obligately blocked between a proclitic and a lexical item on its right.

Moreover, Hu also fails the account for the different TS phenomena involving the two sets of possessive personal pronouns. According to his theory, in Ningbo dialect, when a personal pronoun serves as a possessive constituent by itself, it is a clitic, so it has to join with the preceding lexical item to form a clitic group for TS to apply, while TS is blocked when a personal pronoun is followed by a possessive marker [go?^{LH}] to form a possessive structure. However, such prediction is wrong, as shown in (53).

(53)	a.	查 _ω	我 _c	[成 绩] _ω
		receive	POSS	grade; score
		'to check my grade'		
	base tone	LHL	LHL	LHL H
	*TS according to (48)	[[L]	HL]	[L H]
	TS in reality	L	[L	[L H]]

b.	是 _c	我 _ω	个 _c	[成绩] _ω
	is	Pro.	POSS	grade; score
	'(It) is my grade'			
base tone	LHL	LHL	LHL	LHL H
*TS according to (49)	[LH]	# [LH	L]	[L H]
TS in reality	[L]	# [LH]	# [L	[L H]]

As shown in (53), according to (49), the combination of '查' and '我' forms one 'clitic group' domain, the disyllabic TS melody of a prosodic word starting with '查' should be 'L-HL', which is incorrect prediction in reality. Moreover, because '查' is a verb and '我成绩' is the object of the verb, instead of applying LTS, PTS should apply in (53a), thus, the possessive '我' cannot join the verb '查' to form a clitic group anyway.

On the other hand, although the blocking of TS before the pronoun '我' can be resolved by inserting a boundary. Since there is no other lexical item precedes the copula '是', Hu fails to explain why the copula '是' gets a low tone instead of its citation form or sandhi form. Meanwhile, theoretically speaking, Hu does not explain the necessity to particularly insert a boundary before a pronoun which is followed by a possessive marker.

By contrast, in my analysis, 我 in (53b) is not at the position of object so itself is a prosodic

word, while 的 is a proclitic so it is assigned a default low tone. Moreover, the copula 是 is in a VP relationship with the rest syllables in the string so PTS applies between the 是 and 我 so the H feature of 是 is deleted. The reason why 我 keeps its citation form LH, is because tone of 我 belongs to *yangping* tone in which the LH features are bound to assigned to the first syllable all the time.

Therefore, on the basis of my classification of the clitics in Ningbo dialect, namely, enclitics and proclitics, the assignment of low tone to '我' in (53a) and possessive '个' in (53b) can be accounted for since they are all proclitics, which not only block tone sandhi on its right edge, but also blocking TS on its left edge. Lexical tone sandhi is blocked between a proclitic and its host on the right is due to the direction of LTS in Ningbo dialect, which only applies from left to right, thus, the proclitics on the left side of the host all get assigned low tone. The tone sandhi is also blocked between a proclitic and the lexical item on its left because it is blocked by the left boundary of clitic group. In other words, the low tone is not assigned from the lexical item on the left across the boundary. The reason why many scholars think that there exists TS between proclitic and the lexical item on its left is because it looks similar to the LTS applied within the domain of prosodic word where the syllable on the right edge usually get assigned low tones. However, they are actually different. Otherwise, the odd cases such as (52) and (53) cannot be explained.

5.3.2 Phonological Tone Sandhi within Clitic Groups in the Ningbo Dialect

In Chapter IV, I have shown that the lexical tone sandhi rule applies within the domain of prosodic words. Generally speaking, the LTS applies in a way that the base tone of the leftmost syllable extends from the left to the right in the domain regardless of the tones of the rest syllables, as illustrated in (54).

(54) Application of LTS in prosodic word in Ningbo dialect

a. 北 京
 nortt captical
 'Beijing'

base tone H MHL

LTS H = L

b. 书 包
 book bag

'backpack'

base tone MHL MHL

LTS M = HL

This rule can also apply to a string at the higher level, i.e., clitic group. However, this rule only applies between a host and the enclitic on the right, but is blocked between the host and the proclitic

to its left, as exemplified as follows. Some of the examples I present below are those in which the base tone of the host item will assign a high tone feature to the following clitic(s) if there is TS so that it can be seen if TS really applies between a host and the clitic(s) attach to it. Application of TS in the groups of 'host+enclitics' are shown from (55) to (66), while the blocking cases are shown from (67) to (73).

(55) Application of TS in 'host+question markers'

a.	你	[去 ω 伐 c] _{CG?}	b.	你	[吃 ω 未 c] _{CG?}
	you	go Qu.		you	eat Qu.
		'Are you going?'			'Are you eating?'
BT	LHL	H	LHL	BT	LHL H LH
CTS	LH	[H L]		CTS	LH [H L]

(56) Application of TS in 'host+post-verbal durative aspect markers'

a.	其	[坐 ω 喋 c] _{CG}	b.	你	[坐 ω 仔 c] _{CG} 吃
	he	sit DUR		you	sit DUR eat
		'He is sitting.'			'You, eat while sitting down'
BT	LHL	LHL H	BT	LHL LHL H H	
CTS	LH	[L H]	CTS	LH [L H] H	

c. 窗 槛 [锁 ω 该 c]_{CG}

window lock DUR

'The window is locked.'

BT MHL H H H

CTS M HL [H L]

(57) Application of TS in 'host+perfective aspect markers'

a. 作业 [[做 好]φ 仔 c]_{CG} 去

homework do RC PERF go

'Finish the homework, then go'

BT H LH H H H H

CTS [H L] [[H L] L] [HL]

b. 我 [买]ω 勒 c]_{CG} [两 ω 瓶 c]_{CG} 酒 [送 ω 依 c]_{CG}

I buy PERF two MW wine give you

'I bought two bottles of wine to give to you as a gift.'

BT LHL LHL LHL LHL LHL H H LHL

CTS LH [LH L] [LH L] H [H L]

(58) Application of TS in 'host+experience aspect marker'

a.	[乘 ω 过 c]CG	火 车	b.	[吃 ω 过 c]CG	[西 餐]ω		
	ride	EXP	train	eat	EXP	western food	
			'have taken train'			'have eaten western food'	
BT	H	H	H H	BT	H	H MHL MHL	
CTS	[H	L]	H L	CTS	[H	L]	M HL

(59) Application of TS in 'host+ post-verbal Complementizer'

a.	[看 ω 勒 c]CG	清 爽	b.	[打 ω 了 c]CG	血 出 乌 拉		
	look	PVP	clear	beat	PVP	bleed	
			'look clearly'			'to beat to bleed'	
BT	H	LHL	MHL H	BT	H	LHL H H MHL MHL	
CTS	[H	L]	M HL	CTS	[H	L]	H L L L
or CTS	[H	H]	M HL	or CTS	[H	H]	H L L L

(60) Application of TS in 'host+adjective/verb reduplication marker'

a.	[[红 红]ω 个 c]CG	b.	[[轻 轻]ω 叫 c]CG				
	red	red	AdjR	gentle	gentle	AdjR	
			'quite red'			'in a state of being gentle'	
BT	LHL	LHL	LHL	BT	MHL	MHL	H
CTS	[[L	H]	L]	CTS	[[M	H]	L]

c. [[跳 跳]ω 动 c]CG

jump jump VR

'in a state of jumping'

BT H H LHL

CTS [[H L] L]

(61) Application of TS in 'host+localizers'

a. [庙 ω 里 c]CG

temple inside (LOC)

'in the temple'

BT LHL LHL

CTS [L HL]

b. [窗 ω 外 c]CG

window outside (LOC)

'outside of the window'

BT MHL LHL

CTS [M HL]

(62) Application of TS in 'host+directional particles'

a. [跑 ω [过 去]c]CG

run over there

'to run over there'

BT LHL H H

CTS [L H L]

b. [夺 ω [回 来]c]CG

take back

'to take back'

BT LHL LHL LHL

CTS [L H L]

(63) Application of TS in 'host+object pronoun'

a.	[送 ω 其 c] _{CG}	b.	[[恭 喜]ω 依 c] _{CG}
	give him		congratulate on
	'to give to him'		'to congratulate you'
BT	H LHL	BT	MHL H LHL
CTS	[H L]	CTS	[[M H] L]

(64) Application of TS in 'host+sentence-final particle '

a.	[吃 ω 嘞 c] _{CG}	b.	[困 ω 嘞 c] _{CG}
	eat CRS		sleep CRS
	'(I'm) about to eat.'		'(I'm) about to sleep.'
BT	H LHL	BT	H LHL
CTS	[H L]	CTS	[H] L]

(65) Application of TS in 'host+modification marker'

a.	[旧 ω 个 c] _{CG} 书	b.	[[老 实]ω 个 c] _{CG} 做 人
	old MOD book		honest MOD behave
	'old book'		'to behave honestly'
BT	LHL LH MHL	BT	LHL LH LH H LHL
CTS	[L H] HL	CTS	[[LH L] L] H LH

(66) Application of TS in 'number+measure word+noun'

a.	[一 ω 只 c] _{CG} 狗	b.	[两 ω 根 c] _{CG} 毛 巾
	one MW dog		two MW towel
	'one dog'		'two towels'
BT	H H H	BT	LHL MHL LHL MHL
CTS	[H L] H	CTS	[LH L] L HL

(67) Blocking of TS in 'possessive marker+host'

a.	我 [个 c [爸 爸]ω] _{CG}	b.	牛 [个 c [皮]ω] _{CG}
	I POSS dad dad		ox POSS skin
	'my dad'		'skin of ox'
BT	LHL LH H H	BT	LHL LH LHL
CTS	LH [L [H L]]	CTS	LH [L [LH]]

(68) Blocking of TS in 'Approximate quantifier+host'

a.	[两 c [个 c [朋 友]ω] _{CG}] _{CG}
	several MW friend
	'several friends'
BT	LHL LHL LHL LHL
CTS	[L [L [L HL]]]

b. 李 四 [个_c [几_c [本_c 书_ω]_{CG}]_{CG}]_{CG}

li sɿ [goʔ [tɛi [pəŋ [sq]]]]

Li Si POSS several MW book

'several books of Li Si's'

BT LHL H LHL H H MHL

CTS LH L [L [L [L HL]]]

(69) Blocking of TS in 'preverbal durative aspect marker+host'

a. 其 [勒_c [该_c [吃 饭]_φ]_{CG}]_{CG} b. 我 [勒_c [喋_c [看]_ω]_{CG}]_{CG}

he DUR DUR eat rice

I DUR DUR watch

'He is eating.'

'I am watching.'

BT LHL LHL MHL H LHL

BT LHLLHL H H

CTS LH [L [L [H LH]]]

CTS LH [L [L [HL]]]

(70) Blocking of TS in *ba*-construction and *bei*-construction

a. 我 [搭_c [其]_ω]_{CG} 弄 好 b. 我 [扒_c [其]_ω]_{CG} [[打]_ω 嘞_c]_{CG}

I *ba* it do good

I PASS he beat CRS

'I fixed it.'

'I was beaten by him.'

BT LHL H LHL LHL H

BT LHL H LHL H LHL

CTS LH [L [LH]] L HL

CTS LH [L [LH]] [[H] L]

(71) Blocking of TS in 'preposition+host'

a. 张 三 蹬 [勒_c [香 港]ω]_{CG}

Zhang San live at Hong Kong

'Zhang San lives in Hong Kong.'

BT MHL MHL LHL LHL MHL H

CTS M HL L [L [H L]]

b. [李 四]ω [困]ω [勒_c [[眠 床]ω [高 头]ω] φ]_{CG}

Li Si sleep at sleep bed top suffix

'Li Si sleeps on the bed.'

BT LHL H H LHL LHL LHL MHL LHL

CTS [LH L] [H] [L [[L HL] [M HL]]]

(72) Blocking of TS in 'possessive pronoun+host'

a. [[其 拉]_c [爸 爸]ω]_{CG}

their dad dad

'their dad'

BT LHL LHL H H

CTS [[L L] [H L]]

b. [[阿拉]_c [领 导]ω]_{CG}

our leader; boss

'our boss'

BT H LHL LHL LHL

CTS [[L L] [LH L]]

(73) Blocking of TS in conjunction structures

a.	我	[搭 _c	[依]ω] _{CG}	b.	猫	[搭 _c	[狗]ω] _{CG}
	I	CONJ	you		cat	CONJ	dog
	'I and you'				'cat and dog'		
BT	LHL	H	LHL	BT	LHL	H	H
CTS	LH	[L	[LH]]	CTS	LH	[L	[H]]

From examples in (55) to (66), we can see that tone sandhi rule consistently applies within the domain formed by clitic group type A, while it is blocked within the domain composed by 'proclitic+host' as shown from (67) to (73). Moreover, the TS is also blocked between the proclitic and its preceding lexical item, as shown from (67) to (73). Moreover, it should be noted that the third person singular pronoun 其 should be treated as a special case since, although it belongs to the A2, namely *yangping* tonal category, the first two toneal features L and H are always bound to assign to it if it stands alone. It seems that when it is the first member of the domain applied PTS, only the last tonal feature, namely the L feature at the end of its base tone, is deleted. In the Ningbo dialect, few words seem to change their tonal behavior to merge with another tonal category and 其 seem to be one of them.

5.3.3 Edge-based Theory and Relation-based Theory

As shown in Section 5.2.2.2, it is necessary to distinguish proclitics and enclitics in Ningbo dialect. Although they exhibit different TS behaviors, proclitics do not form clitic domain with the preceding lexical item. Thus, Hu's (2003) explanation under the framework of single-edge-based theory does not hold water.

As a matter of fact, the single-edge-based theory fails to explain many TS phenomena in the Ningbo dialect. For examples, it cannot account for the different TS phenomena as follows (cf. Hu 2003).

(75)a. 欢 喜 我 个 姐 姐
 like I POSS elder sister

'the sister who likes me' (NP)

BT MHL H LHL LH H H

SF M H L L H L

b. 欢 喜 我 个 姐 姐
 like I POSS elder sister

'like my elder sister' (VP)

BT MHL H LHL LH H H

SF M H LH L H L

Based on the single-edge-based theory, the two phrases should have the same phonological

output by inserting a boundary before two lexical items, namely, 欢喜 and 姐姐, respectively. However, their phonological realizations are different in reality.

On the other hand, such kind of problems can be easily solved under the framework of relation-based theory. According to my analysis, these two phrases are different due to the syntactic information that maps into phonology. Take a look at (76).

(76). a. 'the sister who like me' (NP)

[[欢喜] ω 我_c]_{CG} [个_c [姐姐] ω]_{CG}

b. 'like my elder sister' (VP)

[欢喜] ω [我] ω [个_c [姐姐] ω]_{CG}

As can be seen in (75a), 我 'I' is the object pronoun, thus it is an enclitic, which forms a clitic group together with its preceding verb, 欢喜 'like', while in (70b), 我 'I' is not in the position of object, thus, it is not a clitic. In addition, as discussed earlier, the possessive marker 个 is always a proclitic that attaches to its host on the right side according to the DP theory. It does not form a clitic domain with the preceding pronoun 我, thus, it only gets assigned a low tone.

Another problem about the clitic group in the Ningbo dialect comes from the possessive personal pronouns in the Ningbo dialect. As mentioned earlier, the possessive personal pronouns have two sets, while their phonological behaviors differ when TS applies, as shown in (77).

(77) a. 请 纳 哥 哥
 invite your elder brother

'to invite your elder brother'

BT H LH MHL MHL

CTS H L M HL

b. 邀 请 纳 哥 哥
 invite your elder brother

'to invite your elder brother'

BT MHL H LH H H

CT M H L M HL

c. 邀 请 依 个 哥 哥
 invite you POSS elder brother

'to invite your elder brother'

BT MHL H LH LH MHL MHL

CTS M H LH L M HL

When a personal pronoun combines with the possessive marker 个 to form a possessive structure, the TS is blocked between the pronoun and its preceding lexical item. However, when the pronoun itself is used as a possessive pronoun, it will change its tone to a low one.

By contrast, Hu's (2003) solution is to identify the 'pronoun+possessive marker' structure as a special case. Such kind of analysis seems very odd considering the main part of the analysis are simply based on the left/right edge of a lexical item. On the contrary, the problem can easily be solved by grouping the possessive personal pronouns into proclitic type, as shown in (78).

- (78)a. [[请]_ω 纳_c]_{CG} [哥哥]_ω
 b. [[邀请]_ω 纳_c]_{CG} [哥哥]_ω
 c. [邀请]_ω [依]_ω [个_c [哥哥]_ω]_{CG}

Similarly, the approximate numeral words and the particles in the *ba*-construction and the *bei*-construction, namely, 搭 and 扒, and the preposition 勒 should all be treated as proclitics, thus, they all lose their tones and get assigned default low tone, as illustrated in Section 5.2.2.2.

Moreover, as shown in (59a) and (59b), the clitic groups formed by 'host+complementizer' can have two readings. On the one hand, they can undergo the LTS, on the other hand, the clitic may simply assimilate the tone of the host word. It should be noted that both of the reading are only accepted when complement of the verb, which goes after the complementizer is descriptive complement or time duration complement, but can never be the potential complement, since in the latter one, the semantic meaning and syntactic function of the complementizer is similar to the auxiliary verb, 可以 'can; be allowed to; be able to' so it has a special reading which highlights the tone of verb but assigns default low tone to the following elements. Therefore, the motivation

of the assimilation in the descriptive and time duration complement structure, in which the tone of the complement is assimilated with the tone of the preceding syllable of the verb could be to distinguish two kinds of different structures. On the one hand, in the potential complement structure, LTS applies cross the whole verb-complement structure, while in other structures, assimilation of tone is adopted to distinguish it from the potential structure. The process of which is shown below.

(79) Descriptive verb complement structure

a. Normal TS

	[[跑]ω	勒 c]CG	[快]ω
BT	LH	LH	HL
CTS	[[L]	H]	[HL]

b. Assimilation

	[[跑]ω	勒 c]CG	[快]ω
BT	LH	LH	HL
step 1	[[L]]	[HL]
step 2	L		
	[L	L]	HL

(79) Time duration verb complement structure

a. Normal TS

	[[走]ω	勒 c]CG	[两]ω	[个 c	[钟	头]ω]CG
BT	H	LH	LH	LH	MHL	LH
CTS	[[H]	L]	[LH]	[L	[M	HL]]

b. Assimilation

	[[走]ω	勒 c]CG	[两]ω	[个 c	[钟	头]ω]CG
BT	H	LH	LH	LH	MHL	LH
step 1	[[H]]	[LH]	[L	[M	HL]]
step 2	H					
	[H	H]	[LH]	[L	[M	HL]]

5.3.4 合音词 *heyinci* 'Combined-pronunciation Word'

In Chapter II, I briefly introduced the 合音词, literal meaning of which is 'combined-pronunciation word' (hereafter CPW). It has been observed by many scholars that, in the Ningbo dialect, some disyllabic function words may combine to create a new word which has the same semantic meaning and morpho-syntactic (Chen 1992a, among others). The examples of the commonly used CPWs are provided as follows.

(80) Examples of commonly used CPW in Ningbo dialect

a. *ba*-construction particle 搭 [taʔ^H] + singular personal pronoun

搭+我 [taʔ^H] + [ŋo^{LH}] → [to^H]

搭+侬 [taʔ^H] + [nɛu^{LH}] → [tɛu^H]

搭+其 [taʔ^H] + [dzi^{LH}] → [ti^H]

b. preposition 搭 [taʔ^H] + singular personal pronoun

搭+我 [taʔ^H] + [ŋo^{LH}] → [to^H] 'for me'

搭+侬 [taʔ^H] + [nɛu^{LH}] → [tɛu^H] 'for you'

搭+其 [taʔ^H] + [dzi^{LH}] → [ti^H] 'for him'

c. passive construction particle 扒 [paʔ^H] + singular personal pronoun

扒+我 [paʔ^H] + [ŋo^{LH}] → [po^H] 'by me'

扒+侬 [paʔ^H] + [nɛu^{LH}] → [pɛu^H] 'by you'

扒+其 [paʔ^H] + [dzi^{LH}] → [pi^H] 'by him'

d. monosyllabic negation word+ monosyllabic auxiliary

勿=勿+要 [vaʔ^{LH}] + [jo^{HL}] → [vjo^H] → [fɛ^H]

NEG want to 'don't want to'

未=不会 [vaʔ^{LH}] + [uɛi^{LH}] → [vɛi^{LH}]

NEG. will 'won't'

匪=勿+要+其 [vaʔ^{LH}] + [jo^{HL}] + [dzi^{LH}] → [fɛ^H] + [dzi^{LH}] → [fi^H]

NEG want to him/her/it 'don't want him/her/it'

(80a-c) should belong to clitic groups since they share same properties with other clitics defined, which is well supported by their phonological TS in Ningbo dialect, as illustrated in (81a-c). However, the negation words, as discussed before, are the focus of the discourse so they cannot be treated as clitics.

(81). a. 我 [[搭+其]_c [打死]_φ_{CG} 嘞_c_{CG}

ŋo taʔ^H + dʒi^{LH} dā saʔ lɛi

CPW→ti^H

I PART him beatdeath CRS

'I have beaten him to death.

BT LHL H H H LHL

CTS LH [[L [H L]] L]

b. 其 [[[搭+我]_c [弄好]_φ_{CG} 嘞_c_{CG}

dʒi taʔ^H + ŋo^{LH} noŋ ho lɛi

CPW→to^H

he for me fix good CRS

'He has fixed it for me.

BT LHL H LHL H LHL

CTS LH [[L [L H]] L]

c.	我	[[[扒+其] _C	[看 见] _ω _{CG}	嘞 _C _{CG}
	ŋo	paʔ ^H +dzi ^{LH}	khi tei	lei
		CPW→pi ^H		
	I	by him	see	CRS
	'I was saw by him. (He saw me.)'			
BT	LHL	H	H H	LHL
CTS	LH	[[L	[H L]]	L]

5.4 Summary

In this chapter, I have discussed the morpho-syntactic function of two types of clitics in the Ningbo dialect, namely, enclitic and proclitic. I have shown that the single-edge-based theory fails to account for the phonological phenomena within the domain of clitic groups. I have also proved the necessity to establish clitic group as an independent domain for application of phonological tone sandhi which differs from the domain of prosodic word and phonological phrase, as well as distinguishing two types of clitic groups in order to account for their different phonological behaviors.

On the basis of the discussion in Section 5.2, we can find that, in the Ningbo dialect, LTS applies within the clitic group domain formed by the clitic group type A, namely, the clitic group

formed by 'host+enclitic(s)', while TS is blocked within the domain formed by another type of clitic group, namely, those formed by 'proclitic(s)+host'. On the other hand, TS is not only blocked between the proclitic(s) and their hosts, but is also blocked on the left edge of the proclitic(s), thus, it can be considered as solid evidence for the existence of the clitic group as a whole to be an independent domain within the prosodic hierarchy.

Therefore, the following properties of clitics and clitic groups in Ningbo dialect can be identified:

(82) Properties of clitics in Ningbo dialect

- a. The clitics in Ningbo dialect all belong to functional categories;
- b. The clitics in Ningbo dialect must attach to the adjacent constituent to their left or right as the host, and never occur alone as an utterance;
- c. The semantic meaning of the string of a clitic group is predictable from the combination of the meanings of the host plus its clitic;
- d. The clitics in Ningbo dialect can attach to a constituent which already contains affix or clitic;
- f. The clitics in Ningbo dialect are phonologically dependent in a way that the tone of enclitics is determined by their host on the left, while the proclitics are always assigned default low tone(s). In other words, TS obligated spreads from a host to its enclitic(s) on the right, while it is blocked between a proclitic and its host on the right.

Moreover, as we can see from the examples in Section 5.2, a clitic group cannot only dominate a prosodic word, but may also dominate another clitic group or a phonological phrase, which shows that the violation of recursivity is allowed in Ningbo dialect. Such violation can be explained by Zhang's (2014, 2017) stipulation of prosodic recursivity, in which, Zhang argues that prosodic recursivity is optionally allowed between the units of the same hierarchy. However, such violation cannot cross the dividing line between the morpho-syntactic-based hierarchy and the information/focus-based hierarchy that proposed by Zhang (2017).

Following Nespor & Vogel's definition of clitic group, the domain of clitic group in Ningbo dialect thus can be formulated as below.

(83) Clitic group formation in Ningbo dialect

The domain of the clitic group in Ningbo dialect consists of one independent (i.e., nonclitic) prosodic constituent in the morpho-syntactic-based hierarchy (i.e., prosodic word, clitic group, or phonological phrase) plus any adjacent

- a. directional clitic(s), or
- b. non-directional clitic(s) that there is no possible host with which it or they share(s) more category memberships.

So far, I have shown that the traditional consideration that, in Ningbo dialect, attaching a

proclitic to the lexical item on its left fails to account for the constant assignment of default low tone to the proclitics. On the basis of the observation in the Ningbo dialect, it is reasonable to question such kind of single-edge-based theory which is also applied in other Wu dialects. As a matter of fact, if the traditional analysis on clitic groups in Wu dialect is correct, there will be no difference between the domain of prosodic word and the domain of clitic group since, in such analysis, the TS always starts from the left edge of a lexical item until it is blocked before another lexical item.

Moreover, in the Ningbo dialect, although there are few seemingly disyllabic clitics, such as 勒仔, 勒其, they differ from the disyllabic prosodic words, because the so-called disyllabic clitics are actually combination of two monosyllabic clitics, while the disyllabic prosodic words cannot be parsed in the same way.

Chapter VI. The Phonological Phrase in the Ningbo Dialect

In this chapter, I will investigate the prosodic constituent immediately above the clitic group and below the intonational phrase in the prosodic hierarchy, namely, the phonological phrase, in the Ningbo dialect. The goal of this chapter is (a) to identify the phonological phrase domain in the Ningbo dialect and (b) to account for the phonological phenomena within this domain.

The chapter is organized as follows. Section 6.1 consists of the introductory remarks on the definition of the phonological phrase domain. Two major approaches have been developed within the framework of prosodic phonology, namely the Edge/End-Based Approach (EBA, cf. Selkirk 1986, among others) and the Relation-Based Approach (RBA, cf. Nespor & Vogel 1986, among others). After the naissence of the Optimality Theory (OT) in 1990s (McCarthy & Prince 1993, Prince & Smolensky 1993), the EBA has embraced the constraint-based approach, under the framework of which the mapping between phonology and syntax is operated by ranking different constraints. Both EBA and RBA can account for a number of phonological phenomena cross-linguistically. Because the phonological phrase in a particular language, as a prosodic constituent in the hierarchy, should be defined based on the investigation of relevant phonological phenomena, in Section 6.2, I will investigate application of TS in a number of phrasal-level structures, and then, on the basis of the observation and the review on the previous relevant analysis in the literature, I will show that the RBA is a better approach to define the phonological phrase domain in Ningbo

the dialect in order to account for application of TS at phrasal level in this dialect. Moreover, I will demonstrate that the so-called phrasal tone sandhi rule (PTS), as mentioned in Chapter II, is a phonological TS rule that operates between the phonological phrases that is immediately dominated by the intonational phrase (IPh), but never cross the boundary of an intonational phrase so that this rule is different from LTS since LTS can only apply within prosodic word, clitic group formed by 'host+enclitic' or phonological phrase, but never cross the boundary between two phonological phrases. A short conclusion is provided in Section 6.3.

6.1 Introduction

6.1.1 LTS and PTS in the Ningbo Dialect

As discussed in Chapter II, there are two major types of TS rules in the Ningbo dialect, namely the lexical tone sandhi rule (LTS) and the phrasal tone sandhi rule (PTS). The domain of LTS rule application, on the one hand, is the prosodic word (PW) which corresponds to the syntactic word with the exceptions of those restructured by the rhythm effect or by their internal morpho-syntactic structures if they are pentasyllabic or longer, while the domain of PTS rule application is considered to be in a larger domain in Wu language/dialect family (Zhang 2017, among others), as in (1d). Within the domain of a prosodic word, the internal morphosyntactic information is ignored, so LTS rules are applied iteratively from left to right, as in (1a). On the other hand, LTS also applies obligatorily between the host and its enclitic in the domain of clitic group type A, as

in (1b), while in the clitic group type B formed by 'proclitic+host', LTS is blocked and the proclitic is assigned default low tone, as in (1c).

- (1) a. [有 数]ω
 have number
 'comprehend'
 BT y^{LHL} su^{HL}
 LTS [y^{LH} su^L]ω
- b. [[欢 喜]ω 依 c]CG
 like you
 'to like you'
 BT hu^{MHL} ei^H nœu^{LHL}
 LTS [[hu^M ei^H nœu^L]CG
- c. [我]ω [个 c 书 ω]CG
 I POSS book
 'my book'
 BT ŋo^{LHL} ŋoʔ^{LHL} sɥ^{MHL}
 default low tone [ŋo^{LH}]ω [ŋoʔ^L sɥ^{HL}]CG

- d. [我]_ω [有]_ω [书]_ω
 I have book
 'have book'
- BT $\eta\text{o}^{\text{LHL}}$ y^{LHL} sq^{MHL}
- CT ηo^{LH} y^{LH} sq^{HL}
- PTS $[\eta\text{o}^{\text{LH}}]$ $[y^{\text{L}}]$ $[\text{sq}^{\text{HL}}]$
- e. [其]_ω 是]_ω [张 三]_ω
 he is Zhang San
 'He is Zhang San.'
- BT $\text{d}\text{z}\text{i}^{\text{LHL}}$ $\text{z}\text{l}^{\text{LHL}}$ $\text{t}\text{e}\text{j}\text{a}^{\text{MHL}}$ $\text{s}\text{e}^{\text{MHL}}$
- LTS $[\text{t}\text{e}\text{j}\text{a}^{\text{M}}$ $\text{s}\text{e}^{\text{HL}}]$
- PTS $[\text{d}\text{z}\text{i}^{\text{LH}}]$ $[\text{z}\text{l}^{\text{L}}]$ $[\text{t}\text{e}\text{j}\text{a}^{\text{M}}$ $\text{s}\text{e}^{\text{HL}}]$
- f. [我]_ω [会]_ω [去]_ω [北 京]_ω
 I will go Beijing
 'I will go to Beijing.'
- BT $\eta\text{o}^{\text{LHL}}$ $\text{w}\text{e}\text{i}^{\text{LHL}}$ $\text{t}\text{e}\text{h}\text{i}^{\text{H}}$ $\text{p}\text{o}\text{?}^{\text{H}}$ $\text{t}\text{e}\text{i}\eta^{\text{MHL}}$
- LTS $[\text{p}\text{o}\text{?}^{\text{H}}$ $\text{t}\text{e}\text{i}\eta^{\text{L}}]$
- PTS $[\eta\text{o}^{\text{LH}}]$ $[\text{w}\text{e}\text{i}^{\text{L}}]$ $[\text{t}\text{e}\text{h}\text{i}^{\text{H}}]$ $[\text{p}\text{o}\text{?}^{\text{H}}$ $\text{t}\text{e}\text{i}\eta^{\text{L}}]$

g.	[其]	[要] _ω	[唱] _ω	[歌] _ω
	he	want to	sing	song
	'He wants to sing.'			
BT	dʒi ^{LHL}	jo ^H	tsɔ̃ ^H	kɛu ^{MHL}
PTS	[dʒi ^{LH}]	[jo ^H]	[tsɔ̃ ^H]	[kɛu ^{HL}]
i.	[你] _ω	[好] _ω	[吃] _ω	嘞 c] _{CG}
	you	should	eat	CRS
	'You should eat now.'			
BT	nɛu ^{LHL}	hɔ̃ ^H	tɛhyoʔ ^H	lɛi ^{LHL}
CTS			[tɛhyoʔ ^H	lɛi ^L]
PTS	[nɛu ^{LH}]	[hɔ̃ ^H]	[tɛhyoʔ ^H	lɛi ^L]

As shown in (1a), within the domain of a PW, LTS applies from left to right iteratively, and, as presented in (1b), within the CG domain formed by the host plus an enclitic, LTS applies in the same way. However, within the CG domain formed by the proclitic plus its following host, LTS is blocked, but a default low tone is assigned to the proclitic, as in (1c). When there are several phonological constituents at the phrasal level, and neither of which can contain others within its domain to form a PW or CG, the PTS rule applies at the juncture between every two of such prosodic constituents, as demonstrated in (1d), in which, the prosodic constituents 我 'I', 有

'have' or 书 'book' cannot form a larger domain (within one intonational phrase) with the neighboring constituent(s). In other words, PTS rule is different from LTS in terms of the domain of rule application.

It should be noted that in Hu's (2003) analysis of the clitic group in the Ningbo dialect, he considers the tone of the auxiliaries such as 有 as a rising tone. However, based on my data, it shows that 有 only associates with the first tonal feature of its LH base tone, namely the L feature. In a sentence, the monosyllabic auxiliaries 有, 会, 是 all carry a L tone, which makes them look like proclitic, as exemplified in (1d-f). However, if an auxiliary has a H tone as its citation form, i.e., 要 'want to' or 好 'had better, should', it always bears a H tone in a sentence, as shown in (1g-i). Therefore, it is adequate to prove that the monosyllabic auxiliaries should be treated as prosodic words instead of proclitic ones. The L tone that these auxiliaries bear in a sentence should be analyzed as undergoing PTS instead of being assigned the default low tone.

Moreover, as discussed in Chapter II, when PTS applies to the juncture between two larger constituents, whether LTS applies within the domain of the second member of the group is purely dependent on the number of the syllable it contains. If the second member of such group only contains one syllable, then it keeps its citation tone; if it contains two or more syllables, then LTS applies, as shown by the comparison of (2a) and (2b). As for the first member of the group, LTS always applies. If the first member contains only one syllable, then this syllable only associates with the first part of its sandhi tone, if it contains two or more syllables, then the sandhi form of

the first syllable applies, as demonstrated in (2c-d). Moreover, if the last syllable of the first member has a HL tone, PTS will delete the second tonal feature, i.e., HL → L, as shown in (2d).

- (2) a. [吃]ω [饭]ω
 eat rice
 'to eat food'
- BT təhjo^H vɛ^{LHL}
 LTS [təhjo^H]ω [vɛ^{LH}]ω
 PTS [təhjo^H]ω [vɛ^{LH}]ω
- b. [吃]ω [牛 肉]ω
 eat ox skin
 'to eat ox skin'
- BT təhjo^H ɲəv^{LHL} nyoʔ^{LHL}
 LTS [təhjo^H]ω [ɲəv^L nyoʔ^H]ω
 PTS [təhjo^H]ω [ɲəv^L nyoʔ^H]ω

c.	[听]ω	[音	乐]ω	
	listen	music		
	'to listen to music'			
BT	tiŋ ^{MHL}	iŋ ^{MHL}	yoʔ ^{LH}	
LTS	[tiŋ ^{HL}]ω	[iŋ ^M	yoʔ ^H]ω	
PTS	[tiŋ ^M]ω	[iŋ ^M	yoʔ ^H]ω	
d.	[调	查]ω	[情	况]ω
	investigate	situation		
	'to investigate the situation'			
BT	dio ^{LHL}	zo ^{LHL}	dziŋ ^{LHL}	kuɕ ^H
LTS	[dio ^L	zo ^{HL}]ω	[dziŋ ^{LH}	kuɕ ^L]ω
PTS	[dio ^L	zo ^H]ω	[dziŋ ^{LH}	kuɕ ^L]ω

Furthermore, it has long been noticed that application of TS at the phrasal level is more complicated than that within prosodic words and clitic groups. As pointed out by Zhang (2017), LTS may apply to some phrasal-level constituents of the internal structure of adnominal MH, verb-complement (VC), as in (3b~c), while it is blocked in the phrases of the internal structure of adverbial MH, subject-predicate (SP), verb-object (VO) and some adnominal MH, as in (4) and (3a), so that PTS should be applied. As for the conjunction structures if it is a prosodic word, LTS

applies and if it contains the conjunction word 搭, then 搭 and the following lexical host form one clitic group. Moreover, the restructuring of IPh will insert a boundary between each member of the lists which will be discussed in Chapter VII.

(3) Application of LTS within Constructions at Phrasal level

a. Adnominal MH Structure (blocking LTS)

	[香] ω	个 _c] _{CG}	粉 ω
	'fragrant'	MOD	'powder'
	‘fragrant powder’		
BT	$\epsilon j\tilde{a}^{MHL}$	$go\eta^{LH}$	$f\epsilon\eta^H$
CTS	$\epsilon j\tilde{a}^M$	= $go\eta^H$	
PTS	$\epsilon j\tilde{a}^M$	$f\epsilon\eta^H$	# $f\epsilon\eta^H$

b. Adnominal MH Structure (application of LTS)

	[香		粉 ω] ω
	'fragrant'		'powder'
	‘fragrant powder’		
BT	$\epsilon j\tilde{a}^{MHL}$	$f\epsilon\eta^H$	
LTS	$\epsilon j\tilde{a}^M$	= $f\epsilon\eta^{HL}$	
*PTS	$\epsilon j\tilde{a}^M$	# $f\epsilon\eta^H$	

c. Verb-Complement structure

	[学] _ω	[会] _ω
	'study'	'master'
	'to study to master'	
BT	fio [?] LHL	wɛi ⁱ LHL
LTS	fio [?] L	= wɛi ⁱ HL

(4) Blocking of LTS within constructions at phrasal level (where PTS applies)

a. Subject-Predicate structure

	[天] _ω	[冷] _ω
	'sky'	'cold'
	'the weather is cold'	
BT	thi ⁱ MHL	lɛŋ ⁱ LHL
CT	thi ⁱ HL	lɛŋ ⁱ LH
* by LTS	thi ⁱ M	= lɛŋ ⁱ HL
ok by PTS	thi ⁱ M	# lɛŋ ⁱ LH

b. Verb-Object structure

	[养] _ω		[花] _ω
	'cultivate'		'flower'
	'to plant flowers'		
BT	jã ^H		ho ^{MHL}
CT	jã ^H		ho ^{HL}
* by LTS	jã ^H	=	ho ^L
ok by PTS	jã ^H	#	ho ^{HL}

c. Adverbial MH Structure

	[快] _ω		[跑] _ω
	'fast'		'run'
	'to run fast'		
BT	khua ^H		phɔ ^{LHL}
CT	khua ^{HL}		phɔ ^{LH}
* by LTS	khua ^H	=	phɔ ^L
ok by PTS	khua ^H	#	phɔ ^{LH}

Clearly, the question here is why PTS applies to some types of phrases in the Ningbo dialect

while LTS applies to other types. In other words, what is the motivation for such kind of classification of TS in this dialect?

6.1.2 Hypotheses on the TS Conditions at Phrasal Level in Wu

As mentioned earlier, two major approaches, namely, the Edge/End-Based Approach (EBA) and the Relation-Based Approach (RBA) have been proposed under the framework of prosodic phonology. Both of the approaches have been adopted by many scholars and have successfully accounted for a number of phonological phenomena cross-linguistically. Before moving further, let us revisit these two major approaches first, and see if they can account for the odd classification of TS patterns at the phrasal level in Ningbo dialect, namely, that LTS applies to the structures of some adnominal MH and VC, but is blocked within the structures of SP, VO, adverbial MH and some adnominal MH, where PTS applies.

Although there are no previous studies on the phrasal TS in Ningbo dialect in linguistic literature, a number of scholars have employed the above-mentioned approaches to study the phrasal TS in the Shanghai dialect, which shares the similar classification of TS patterns with the Ningbo dialect. Thus, I will review the two approaches on the basis of their analyses on the Shanghai dialect first.

6.1.2.1 Edge/End-Based Approach

Following Chen's (1985,1987) proposal for the tone sandhi domain in Xiamen dialect, Selkirk (1986) proposes the following parameters for mapping syntax to phonology at phrasal level.

(6) End parameter settings:

- i. a.] X_{max} b. X_{max} [
- ii. a.] X_{head} b. X_{head} [

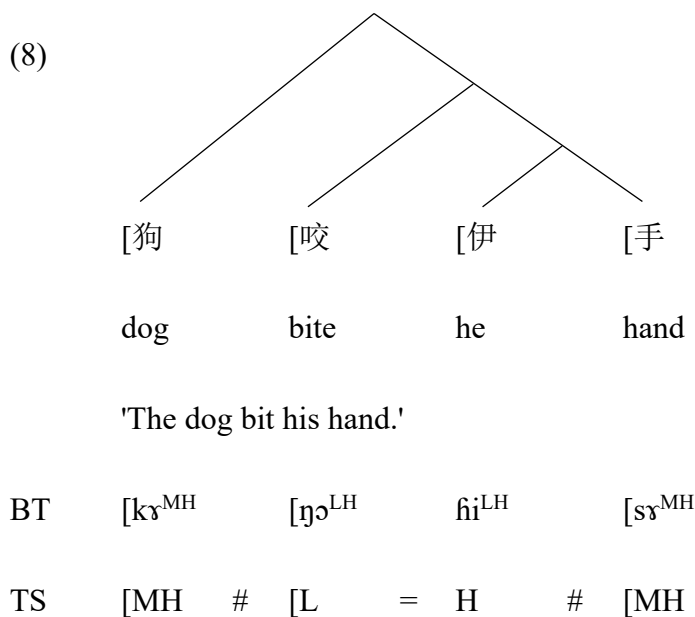
As discussed in Chapter II, the Edge/End-Based Approach makes reference to a single property of syntactic phrase structure, namely the left or right end of the lexical heads or their maximal projections. Therefore, the major phonological phrase is recognized to correspond to] X_{max} or X_{max} [], and the minor phonological phrase is defined corresponding to] X_{head} or X_{head} [],

By employing the end-setting X_{head} [in the definition of the phrasal TS domain in Shanghai dialect, Selkirk and Shen (1990) propose that the tonal domain in Shanghai Dialect is the ‘prosodic word’ that is defined in (7).

(7) Shanghai Dialect prosodic word rule

Prosodic word: {left, Lex^0 }

According to (7), a prosodic word starts from the left edge of a lexical word or compound and ends before the left edge of another lexical word (Lex^0), as exemplified in (8).



According to Selkirk and Shen (1990), *kr* 'dog', *ŋɔ* 'bite', and *sr* 'hand' are three lexical words, each starting a PW, while *fi* 'he' is a function word. Although, syntactically speaking, *fi* 'he' and *sr* 'hand' are immediate constituents (IC) and c-command each other, they do not form a TS domain. Instead, *fi* 'he' forms a TS domain with the preceding verb, *ŋɔ* 'bite'. Thus, Selkirk and Shen claim that the ascertaining of a phonological domain in Shanghai Dialect is not sensitive to syntactic structure but only to the edge of X^0 or X^{\max} .

It should be noted that Selkirk and Shen (1990) call such constituent 'prosodic word', while according to Zhang (2017), in the Shanghai dialect, the prosodic word corresponds to the morpho-syntactic word. As a matter of fact, the domain which Selkirk and Shen (1990) try to identify here actually is constitutently higher than the prosodic word in the hierarchy, i.e., clitic group.

Furthermore, as Zhang (2017) points out, such analyses have some problems in dealing with

the TS of possessive personal pronouns since the TS is blocked before a personal pronoun which precedes a possessive marker, while TS applies when a personal pronoun itself serves as a possessive word. By employing a single syntactic property, Selkirk and Shen fail to account for these two distinct TS phenomena. In Chapter V, I have demonstrated in the Ningbo dialect, which is similar to the case in the Shanghai dialect, that not only the notion of prosodic word which EBA defines is problematic, but that it also fails to distinguish the two subtypes of clitics, namely, the proclitics and enclitics, which have distinct phonological properties.

Moreover, Selkirk and Shen (1990) cannot explain why the TS behavior of VC and some adnominal MH differs from that of adverbial MH, SP and VO and other adnominal MH in the Shanghai dialect. Compare the examples in (9a) and (9b) from Shanghai dialect provided by Zhang (2017).

(9) Blocking and application of LTS at phrasal level in Shanghai dialect

a. Adverbial MH structure

	老	远
	old	far
	‘far away’	
BT	l ^{LH}	fy ^{LH}
* by LTS	L	= H
ok by PTS	LH	# LH

b. Adnominal MH structure

	老	树
	lo	zɿ
	old	tree
	'old tree'	
BT	lo ^{LH}	zɿ ^{LH}
ok by LTS	L	= H
* by PTS	LH	# LH

According to Zhang (2017), both of the examples in (9a) and (9b) are phrases, each of which is formed by two morpho-syntactic words in Shanghai dialect. Based on the hypothesis in (7), each of them should have two TS domains as well as two PWs. However, there is only one TS domain in (9b), while two in (9a). In other words, the hypothesis in (7) has difficulty to account for the classification of TS in the Shanghai dialect. It seems that the right edges of the subject in SP, the verb in VO and the modifier in adverbial MH and some adnominal MH should be marked in a way different from that of the verb in VC and some adnominal M.

Thus, we can find that the Edge/End-Based Approach fails to identify: (a) the clitic group domain, the left edge of which blocks TS spreading from the lexical item locating to the left of the

proclitics, (b) classification of enclitics and proclitics, which exhibit distinct properties, and (c) the right edge of V of VC and some adnominal M, which do not coincide with the right edge of a predicted tone sandhi domain. It seems that an additional condition should be proposed to deal with the obscure classification of the TS patterns at the phrasal level in the Shanghai dialect as well as that in the Ningbo dialect.

6.1.2.2 Duanmu's Metrical Analysis

Following the metrical theory proposed by Hall and Vergnaud (1987) and Hayes (1995), Duanmu (1992) proposes a metrical approach to analyze the domain of tonal association for Shanghai dialect. The rules and principles suggested by Duanmu are given in (10).

(10) Metrical rules in Shanghai

a. Morpheme level

Line 0: trochee, left to right, ignore degenerate foot

Line 1: left-headed, unbounded stress

b. Above the morpheme level

Assign cyclic left-headed stress

c. Stress reduction

Optionally delete line 1 stress

d. Clash resolution

Remove the stress column next to a higher column

e. Stress Equalization Convention

f. Contrastive stress

Add an asterisk to the given syllable

(11) Domain formation

An association domain starts from a stress syllable till just before the next stressed syllable.

The analysis of Shanghai TS examples based on metrical theory are adopted from Zhang (2017) as in (12). In (13), (14), application of the rules and principles in (10) and (11) are illustrated, adopted from Zhang (2017) as well.

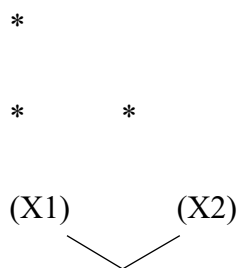
(12). TS in Shanghai dialect (adopted from Zhang (2017))

a.	老	树	
	lɔ	zɿ	
	old	tree	
	'old tree'		
BT	LH	LH	
ok	L	= H	one domain
*	LH	# LH	two domains

b.	老	房	子	
	lɔ	vã	--	tsɿ
	old	house		affix
	'old house'			
BT	LH	LH		MH
ok	L	=	H	= L one domain
*	LH	#	LH	= L two domains

(13) = (12a)

a. By (10a) and (10b)




b. By (10d)



c. By (11)

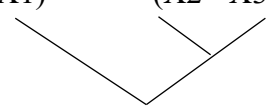
*

*

(X1 = X2) output
 one domain

(14) = (12b)

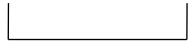
a. By (10a) and (10b)

*
 * *
 (X1) (X2 - X3)


b. By (10d)

*
 *
 (X1 X2 - X3)

c. By (11)

*
 *
 (X1 = X2 = X3) output
 one domain

Zhang (2017) points out that, Duanmu's (1992) approach can account for the cases in (12a)

and (12b), which Selkirk and Shen (1990) fail to account for. According to Selkirk and Shen's (1990) hypothesis, there are two domains in each case because '老', '树' and '房子' are all lexical items. However, Duanmu's metrical theory cannot account for the classification of TS patterns in Shanghai dialect and Ningbo dialect either. If Duanmu's analysis is correct, within a structure of adverbial MH, SP and VO, there should be only one domain. Thus, LTS would apply iteratively, which is a wrong prediction.

Moreover, the nature of stress is a problem worth to be discussed. As a matter of fact, it is still an open question whether or not there is word stress in Chinese (Lin 1985; Zhang 2014; Ma 2015). Even among those who argue for the existence of stress in Chinese, the views are greatly divergent concerning the question regarding how to precisely perceive or define stress.

6.1.2.3 Relation-Based Approach (RBA)

In contrast to EBA, instead of making reference to a single property of syntactic phrase structure, RBA makes crucial reference to the recursive and nonrecursive sides of a lexical head. According to Nespor and Vogel (1986), a phonological phrase includes a syntactic head and elements on its non-recursive side which are not themselves syntactic heads. The following phonological phrase formation is formulated by Nespor and Vogel (1986). As Nespor and Vogel (1986) argue, the intended interpretation of (15) is that in which only V, N and A are considered lexical heads.

(15) Phonological Phrase Formation

The domain of φ consists of a clitic group which contains a lexical head (X) and all clitic groups on the non-recursive side up to the clitic group that contain another head outside of the maximal projection of X.

Moreover, Nespor and Vogel (1986) also propose an optional rule for restructuring of PPh that has the effect of eliminating nonbranching PPhs, as shown in (16). This rule offers the possibility of restructuring a PPh which consists of a single clitic group when certain syntactic conditions are met.

(16) φ *reconstructing* (optional)

A nonbranching φ which is the first complement of X on its recursive side is joined into the φ that contains X.

We can find that an amount of data in Ningbo dialect can be accounted for by adopting (15) and (16). For example, the rule in (15) separates the pre-head argument from its head in SP since the pre-head argument does not belong to the maximal projection of the head of the predicate, as in (17), thus, LTS is blocked between two phonological phrases defined by (15). The rule also separates the head from the post-head argument in VO since the post-head argument is always on the recursive side of the head in Ningbo dialect, as in (18), thus, LTS is also blocked. Moreover,

the post-head arguments are syntactic head themselves, which also causes separation of V and O.

Similarly, we can separate the pre-head adjunct with its head in the adverbial MH structure since the pre-head adjunct is not a complement and it always sits on the recursive side of the head, as in (19). Moreover, by adopting the restructuring rule in (16), the verb head and a non-branching complement can be grouped into one phonological phrase domain, while the head and a branching complement should be separated, as exemplified in (20a) and (20b), respectively.

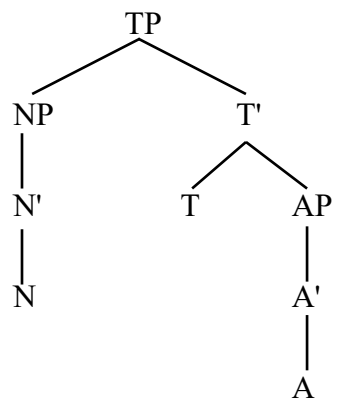
Now the problem is accounting for the classification of LTS on the adnominal MH. As shown in (3a) and (3b), LTS is blocked within 香个粉 'fragrant powder', as in (3a), while it applies within 香粉 'fragrant powder', as in (3b). According to the RBA, 香 is the adjunct that sits on the recursive side of the noun head so it is separated from the head to form its own phonological phrase. However, 香粉 in (3b) has the similar syntactic structure as 香的粉, but their respective tone sandhi behaviors differ from each other.

As a matter of fact, many scholars have talked about the syntactic status of structures such as 香粉, 小白鸽, etc. (cf. Zhu 1956, Shih 1986, Sproat and Shih 1991, Hsiao 1991, Duanmu 1993, Chen 2001, among others). Shih (1986) and Sproat and Shih (1991) have argued that Mandarin Chinese has two types of adnominal MH constructions: (1) direct modification MH, such as 旧书 'old book, 瓷砖 'ceramic tile', 小乳鸽 'small squab', where the modifier is juxtaposed with head; (2) indirect modification [M+的(MOD)+N], where the modifier is linked to the head by the subordinator 的 *de*, such as 红的花 'red flower', 很凶的狼狗 'very ferocious wolfhound'.

There is no question that the second type of MH is phrase in syntax. However, as argued by Chen (2000), there are good reasons to consider the first type of MH as syntactic words or nominal compounds. Firstly, as Zhu (1956) points out, the first type of MH is not full productive, but usually represent frozen collocation of items to some degree. Secondly, the first type of MH is often non-compositional in meaning according to Chen (2000). Finally, Chen argues that neither of M and N in the first type should be a phrasal category, for otherwise we will get the anomaly of X⁰-internal phrases: [M NP]N⁰ or [XP N]N⁰.

If we adopt the classification of the adnominal structures in Mandarin Chinese to the Ningbo dialect, the classification of TS can also be successfully accounted for. That is, the structures such as 香粉 in the Ningbo dialect should be considered as syntactic words, and thus they are prosodic words while those with the modification 个 are syntactic phrases. According to the definition of PW proposed in Chapter IV, LTS applies within PW iteratively. By contrast, in a [M 个 N] structure, the modifier and the modification 个 together form one clitic group first, and since they are sitting on the recursive side of the noun head and they are adjunct instead of complement, the definition in (15) and (16) will separate the M+个 and the following noun head to two different phonological phrases, thus, LTS is blocked here. The blocking case of LTS within adnominal MH is exemplified in (21).

(17) SP



天 晴
 sky clear

'The sky is clear.'

thi dʒiŋ

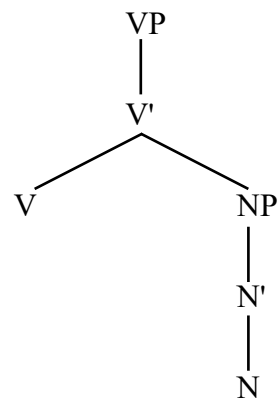
BT MHL LHL

CT HL LH

TS [M] # [LH]

(LTS is blocked)

(18) VO



养 花
 cultivate flower

'to plant flower'

jǎ ho

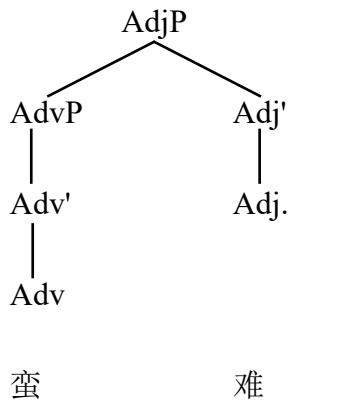
BT H MHL

CT H HL

TS [H] # [HL]

(LTS is blocked)

(19) Adverbial MH



quite difficult
 'quite difficult'

mɛ nɛ

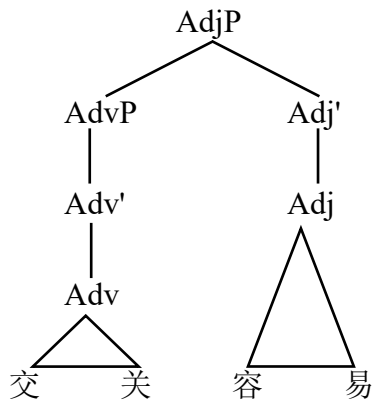
BT H LHL

CT HL LH

TS [H] # [LH]

*by (16) [H = L]

(LTS is blocked)



very easy
 'very easy'

tejo kuɛ yon i

BT MHL MHL LHL H

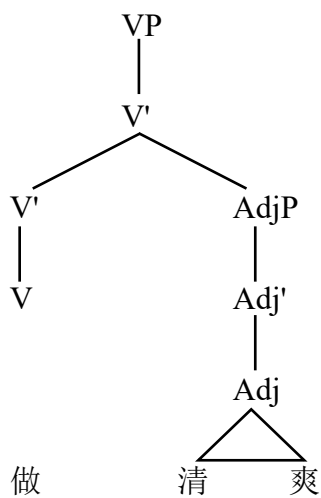
CT HL HL LH HL

TS [H L] # [L HL]

(LTS is blocked)

(20) Verb-complement

a.



do

clean

'to do it clean'

tsəu

tɕhiŋ s̃

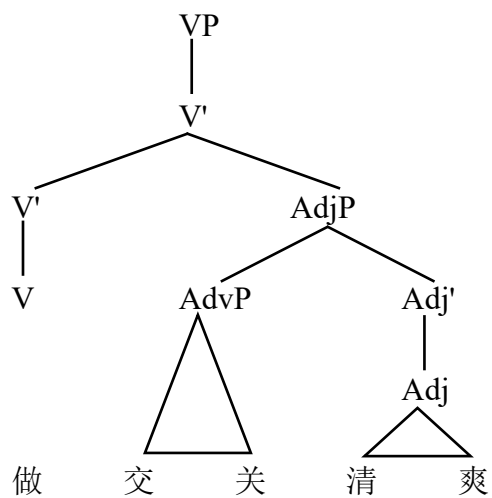
BT H MHL H

CT HL HL H

LTS [H = L L]

(LTS applies)

b.



do

very

clean

'to do it very clean'

tsəu tɕjo kue tɕhiŋ s̃

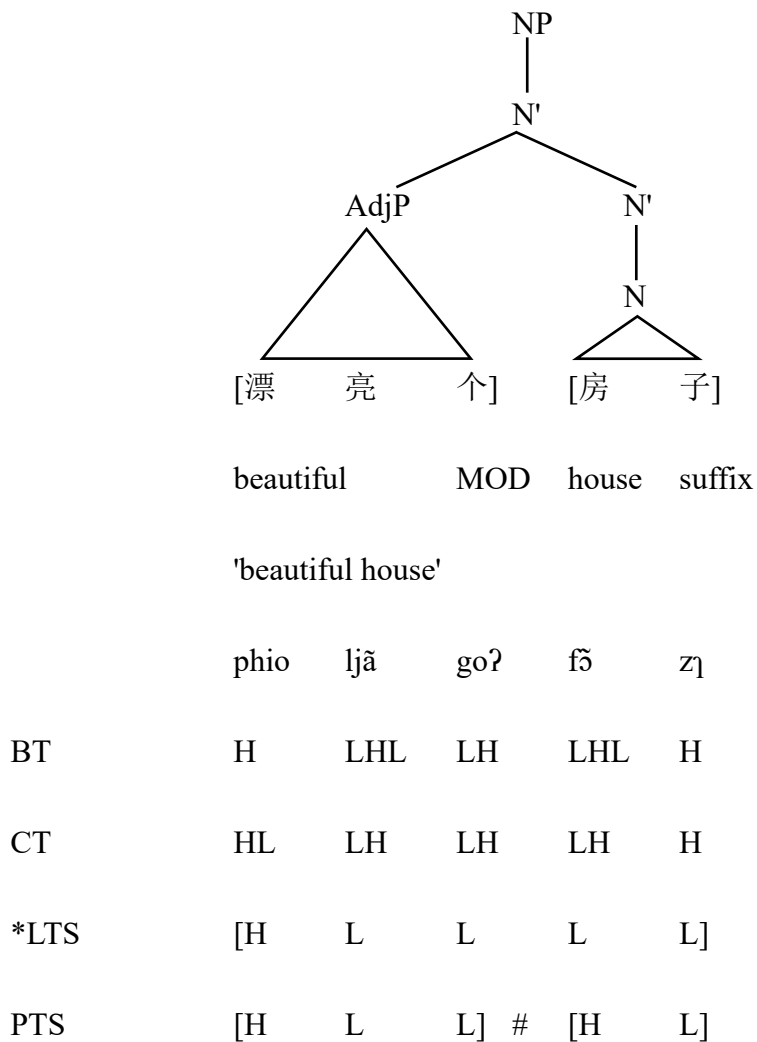
BT H MHL MHL MHL H

CT HL HL HL HL H

LTS [H] # [M H] # [M HL]

(LTS is blocked)

(21) Adnominal MH



(LTS is blocked)

As shown in (17-21), on the one hand, the structures of SP, VO and adverbial/adnominal MH consistently block LTS, on the other hand, the application of LTS to VC depends on the syntactic branching. If the complement after the head is a non-branching one, then LTS applies, otherwise, LTS is blocked. Therefore, we have successfully accounted for the TS on the basic syntactic

structures in the Ningbo dialect.

6.1.2.4 Zhang's Analysis on Phrasal TS in the Shanghai Dialect

Different from the Ningbo dialect, according to Zhang (2017), the LTS always applies to the adnominal MH in the Shanghai dialect. In other words, in the Shanghai dialect, LTS always applies to adnominal MH and VC, while blocked within SP, VO and adverbial MH.

Zhang (2017) argues that there are three factors determining the TS domains in Shanghai dialect: a) the status of word-hood; b) functional relations; c) syntactic conditions. Shanghai dialect, like Ningbo dialect, is a word-tone-sensitive language, and roughly speaking, all of the lexical items, i.e., syntactic words, must undergo TS no matter what internal structures they possess. As for the function words and syntactic phrases, the situation gets a bit more complicated. Zhang points out that the TS domain in Shanghai at phrasal level is decided by the functional relation and the syntactic condition that a syntactic phrase belongs to.

The principle that Zhang proposes for Shanghai TS at the phrasal level is stated in (22), which is demonstrated by the examples in (23) from Shanghai dialect, cited by Zhang (2017) as well.

(22) TS condition in Shanghai dialect at phrasal level

The TS rule is applied iff

the adjunct is c-commanded by its head.

(23) a. Adnominal MH

老 树

old tree

'old tree'

lɔ zɿ

adjunct head

BT LH LH

ok L = H

* LH # LH

b. Adverbial MH

老 远

old far

'far away'

lɔ fɿ

adjunct head

BT LH LH

* L = H

ok LH # LH

c. SP

天 晴

sky clear

'The sky is clear.'

thi zɿŋ

argument head

BT HL LH

* H = L

ok HL # LH

d. VO

搬 书

move book

'to move books'

bø sɿ

head argument

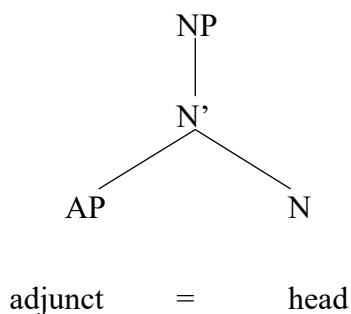
BT HL HL

* H = L

ok HL # HL

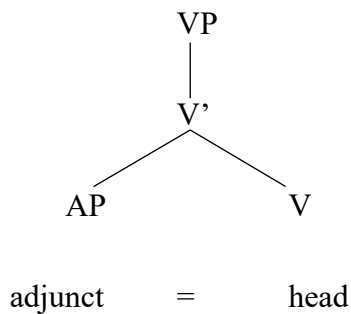
As seen in (23), the TS rule is applied to adnominal MH structures, while blocked in adverbial MH, SP and VO structures in Shanghai dialect, which is the same as that in Ningbo dialect. Zhang argues the TS rule cannot be applied to SP and VO structures because they involve an argument-head relation instead of an adjunct-head relation required by the principle in (22), which is similar to my argument for Ningbo dialect. The TS rule is applied to adnominal MH structure because it has both the functional condition, i.e. an adjunct-head relation, and the syntactic condition (the adjunct is c-command by its head), which is illustrated as below.

(24) Adnominal MH structure



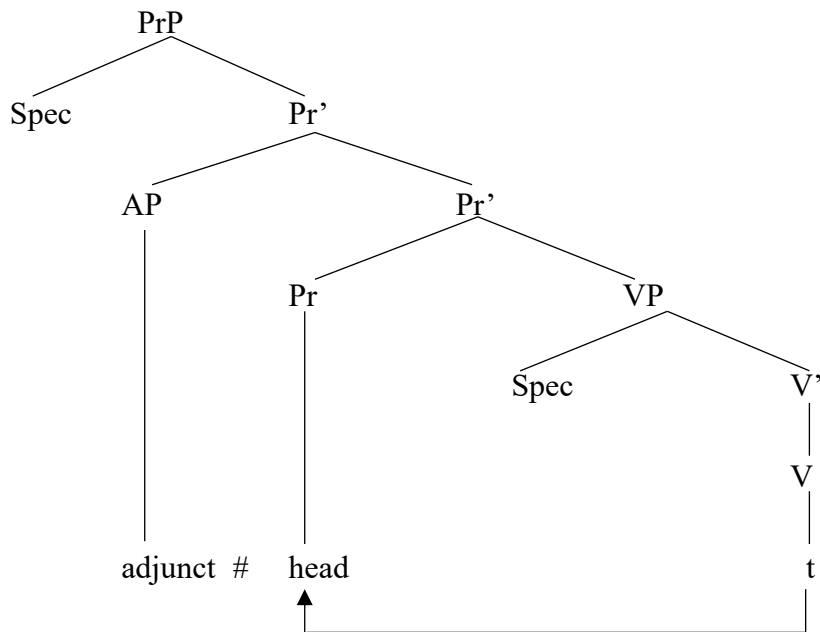
While this analysis successfully explains the TS for adnominal MH, it still causes some trouble for adverbial MH. According to the traditional analysis, an adverbial MH structure conforms to the principle in (22) in both functional and syntactic conditions, as shown in (25).

(25) Traditional analysis of adverbial MH structure



However, Zhang (2017) argues that it actually is a verb-movement to result in the difference of the syntactic structures between adverbial MH and adnominal MH, as seen in (26).

(26) Adverbial MH structure with verb-movement



As illustrated in (26), the TS rule is blocked between the adjunct and the head in the adverbial

MH structure because the adjunct in this case is not c-commanded by its head. The seemingly immediate adjacency is caused by verb-movement. In other words, the adverbial modifier in (26) is not even within the maximal projection of verb. Thus, it not only violates the syntactic condition required by the principle in (22), but also, the adverbial modifier cannot be grouped together with the verb within the same phonological phrase according to the rule in (15).

Although it seems that Ningbo and Shanghai have different TS patterns regarding the adnominal MH, Zhang's analysis of the syntactic structure of adverbial MH can also be used to explain the blocking of LTS in the Ningbo dialect. By assuming Zhang's analysis is correct, in an adverbial MH structure, the adverbial modifier is still not the complement of the head even if it is now on the non-recursive side of the head. Therefore, the adverbial M and the head will form two phonological phrases, respectively. Thus, LTS is blocked between them.

6.1.2.5 Summary

In Section 6.1.2, I have introduced the Edge-End-Based Approach and the Relation-Based theory on the basis of their analysis on Shanghai dialect and Ningbo dialect. We can see that while the EBA can account for some TS phenomena, it fails to explain other TS phenomena at the phrasal level in Shanghai dialect and Ningbo dialect. On the other hand, the definition of the phonological phrase in RBA, together with Zhang's insight about the verb-movement in adverbial MH structure, are able to account for the odd classification of TS patterns in both dialects. Therefore, following

these insights, I here provide the formation of the phonological phrase in Ningbo dialect as follows.

(27) Phonological Phrase (PPh) Formation

a. the basic definition of PPh

The domain of φ consists of a clitic group which contains a lexical head (X) and all clitic groups on the non-recursive side up to the clitic group that contains another head outside of the maximal projection of X.

b. PPh reconstructing

A nonbranching φ which is the first complement of X on its recursive side is joined into the φ that contains X.

Different from Zhang's (2017) proposal for the phrasal TS condition in Shanghai dialect, the LTS only applies within one phonological phrase domain.

6.2 Phonological Phrasing in Ningbo Dialect

6.2.1 Recursivity or Non-recursivity?

In Section 6.1.2.4, I have discussed that within the framework of RBA, the blocking of LTS can be accounted for by establishing the notion of phonological phrase according to the rule proposed by Nespor and Vogel (1986) as well as Zhang's (2017) insight about the verb-movement in adverbial MH structures. However, the condition where PTS occurs needs further discussion.

If we compare the four cases where PTS applies, namely, the structures of SP, VO and adverbial and adnominal MH, we can find that, in these three cases, PTS only applies at position of the juncture between two phonological phrases identified by Nespor and Vogel's (1986) definition of phonological phrase as well as its restructuring rule. More importantly, it never crosses the boundary between two even larger domains, namely the intonational phrases. The example of the blocking of PTS can be seen as follows. The tones in question are marked in bold and underlined.

(29) Blocking of PTS in Ningbo dialect

	[[天 ω]φ[要 ω]φ[落 ω]φ [雨 ω]φ]ι				[[娘 ω]φ [要 ω]φ [嫁 ω]φ [人 ω]φ]ι				
	sky	will	drop	rain	mom	want to	marry	people	
	'The sky is about to rain, the mother is about to remarry other man.'								
	thi	jo	lo?	jy	njã	jo	teja	niŋ	
BT	MHL	H	LHL	LHL	LHL	H	H	LHL	
LTS	[HL]	[HL]	[LH]	[LH]	[LH]	[HL]	[HL]	[LH]	
PTS	[[M]	[H]	[L]	[LH]	#	[[LH]	[H]	[H]	[LH]]

As shown in (29), PTS never crosses the boundary between two root sentences (each of one is not dominated by the other one), which corresponds to the boundary between two intonational phrases. Therefore, it is clear that PTS only applies within the same intonational phrase.

However, sometimes it seems that PTS can not only operate between PPhs, but can also apply between constituents of lower levels, i.e., prosodic word, clitic group. Let's take a look at the examples in (30). The segments and tones in question are marked in bold and underlined.

(30) a.	[张	三]ω	[个 _c	书 ω] _{CG}	
	Zhang	San	POSS	book	
	'Zhang San's book'				
BT	tejã ^{MHL}	se ^{MHL}	ŋoʔ ^{LHL}	sq ^{MHL}	
CT	tejã ^{HL}	se ^{HL}	ŋoʔ ^{LH}	sq ^{HL}	
LTS	[tejã ^M	se ^{HL}]ω			
CTS	[tejã ^M	se ^{HL}]ω	[ŋoʔ ^L	sq ^{HL}] _{CG}	
PTS	[tejã ^M	<u>se^H</u>]ω	[ŋoʔ ^L	sq ^{HL}] _{CG}	
b.	[我]ω	[的 _c	汤 ω] _{CG}	[坏 ω	嘞 _c] _{CG}
	I	POSS	soup	decay	CRS
	'my soup has gone bad.'				
BT	ŋo ^{LHL}	goʔ ^{LHL}	thɔ̃ ^{MHL}	wɛi ^{LHL}	lɛi ^{LHL}
CT	ŋo ^{LH}	goʔ ^{LH}	thɔ̃ ^{HL}	wɛi ^{LH}	lɛi ^{LH}
LTS	[ŋo ^{LH}]ω		[thɔ̃ ^{HL}]ω	[wɛi ^{LH}]ω	
CTS	[ŋo ^{LH}]ω	[goʔ ^L	thɔ̃ ^{HL}] _{CG}	[wɛi ^L	lɛi ^{HL}] _{CG}
PTS	<u>[ŋo^{LH}]ω</u>	[goʔ ^L	<u>thɔ̃^H</u>] _{CG}	[wɛi ^L	lɛi ^{HL}] _{CG}

c. [大 树]ω [倒 ω 嘞 c]_{CG}

big tree fall CRS

'The big tree has fallen.'

BT dɛu^{LHL} zɥ^{LHL} tɔ^H lɛi^{LHL}

CT dɛu^{LH} zɥ^{LH} tɔ^H lɛi^{LH}

LTS [dɛu^{LH}]ω [zɥ^{LH}]ω [tɔ^H]ω at PW level

CTS [tɔ^H lɛi^L]ω

LTS [dɛu^L zɥ^H]ω [tɔ^H lɛi^L]ω at PPh level

PTS [dɛu^L zɥ^H]ω [tɔ^H lɛi^L]ω

d. [花]ω [倒 ω 嘞 c]_{CG}

flower fall CRS

'The flower has fallen.'

BT ho^{MHL} tɔ^H lɛi^{LHL}

CT ho^{HL} tɔ^H lɛi^{LH}

LTS [ho^{HL}]ω [tɔ^H]ω

CTS [tɔ^H lɛi^L]ω

PTS [ho^H]ω [tɔ^H lɛi^L]ω

As presented in (30), PTS seems to be able to apply between any two members within one root sentence (or IPh). These members can be prosodic words, as in (30a, c & d), or clitic groups, as in (30b). However, we may not draw conclusion so quickly. If PTS can actually apply between any constituents within one sentence, then the problem is why it doesn't apply to the first PW in (20b), namely the verb 做 'to do', but applies to the PW in (30d), namely the noun 树 'tree'.

In my opinion, the paradox caused by the seemingly contradicted examples above-mentioned could have two alternative explanations.

On the one hand, as discussed in previous chapters, by assuming Zhang's (2017) stipulation of the prosodic hierarchy, the Non-recursivity principle is violable within the morpho-syntactic-based hierarchy. That is, a constituent at higher level within this hierarchy can optionally be dominated by a constituent at lower level within the same hierarchy, i.e., a phonological phrase may be dominated by a clitic group. Therefore, we can claim that the lower constituents in the morpho-syntactic-based hierarchy can actually be directly dominated by IPh, and then define the condition of application PTS as this rule only operates between the constituents immediately dominated by IPh, as exemplified as follows.

- (31) a. [张 三]_ω [个 c 书 _ω]_{CG}
 b. [我]_ω [的 c 汤 _ω]_{CG} [坏 _ω 嘞 c]_{CG}
 c. [大 树]_ω [倒 _ω 嘞 c]_{CG}
 d. [花]_ω [倒 _ω 嘞 c]_{CG}

As demonstrated in (31), if PTS is defined as applying between the constituents immediately dominated by IPh, the blocking of PTS in (20c) can be explained by that 做 'to do' and 清爽 'clean' are not directly dominated by IPh while the PW 花 'flower' in (31d) is so that PTS applies to it.

However, on the other hand, we can also propose a hypothesis that all the lower constituents in the morpho-syntactic-based hierarchy, namely, the prosodic word and the clitic group, must upgrade to the phonological phrase when they are dominated by the same intonational phrase, as exemplified in (32). Therefore, we can also propose the condition where PTS applies: PTS only applies at the position of the juncture between two phonological phrases defined by (27) in Ningbo dialect.

- (32) a. [[张 三]ω]φ [[个 c 书 ω]CG]φ
- b. [我 ω]φ [[的 c 汤 ω]CG]φ [[坏 ω 嘞 c]CG]φ
- c. [[大 树]ω]φ [[倒 ω 嘞 c]CG]φ
- d. [花 ω]φ [[倒 ω 嘞 c]CG]φ

As shown in (32), all the lower constituents, namely, PW and CG, must upgrade to PPh before they are dominated by IPh which corresponds to a root sentence. Therefore, the reason 花 'flower' in (32d) undergoes PTS is not because PTS can apply to PW, but because this PW has 'silently'

upgraded to 'PPh', thus it provides condition for PTS to apply. Similarly, as in shown in (32b), the host 汤 'soup' in the CG '的汤' undergoes PTS because it also silently upgrades to PPh. As a matter of fact, based on my definition of the clitic group as in Chapter V and the definition of PPh in section 7.2.1 in this chapter, a PW can naturally upgrade to a CG and a CG can also naturally upgrade to a PPh. Therefore, this hypothesis can also account for the paradox of (30) as well.

While it seems that both hypotheses, namely IPh can or cannot immediately dominate the constituents at lower levels, are able to account for the TS phenomena in at the phrasal level in Ningbo dialect, for sake of the simplicity of the theory, I consider the second hypothesis, that claims the lower constituents must upgrade to PPh, is more favorable since no matter what, the lower constituents, by the definition in (27), automatically upgrade to phonological phrases. Moreover, by assuming the obligatory upgrade in Ningbo dialect, the condition of application of LTS and PTS become clear as the former one only applies within PPh while the latter one operates between two PPhs within the same IPh.

Furthermore, if we consider what makes recursivity violable within the morpho-syntactic-based hierarchy in Ningbo dialect, we can see it is the clitic group that violates the SLH. On the one hand, in Ningbo dialect, PW is defined as locating at the terminal node of the syntax tree, thus, PW is always the lowest constituent in this middle hierarchy, while PPh is always the highest constituent in this middle hierarchy because it is defined with respect to the maximal projection of the head X. Therefore, PPh always dominates PW in Ningbo dialect. On the other hand, the

formation of the clitic is based on the observation that it has to phonologically dependent on the neighbouring host, which does not strongly rely on the X' theory, and it makes CG violate the SLH. Nevertheless, as discussed in Chapter V, the clitic group must be analyzed as a dispensable constituent since there are certain phonological phenomena making crucial reference to this domain. Therefore, we can see that the CG sometimes can dominate the PW while in other cases, the CG may dominate the PPh. Even so, allowing the violation caused by CG does not mean it can be directly dominated by IPh.

6.2.2 Application of LTS and PTS in the Ningbo Dialect

As discussed in Section 6.1, the formation of the phonological phrase in Ningbo dialect can be expressed as follows.

(35) Phonological Phrase (PPh) Formation

a. the basic definition of PPh

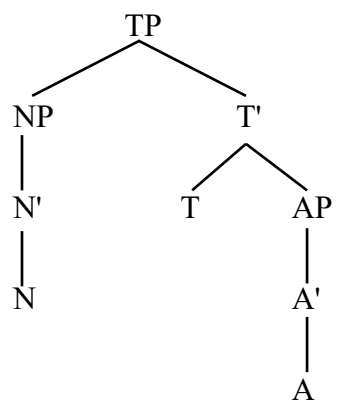
The domain of φ consists of a clitic group which contains a lexical head (X) and all clitic groups on the non-recursive side up to the clitic group that contains another head outside of the maximal projection of X.

b. PPh reconstructing

A nonbranching φ which is the first complement of X on its recursive side is joined into the φ that contains X.

The definition of the phonological phrase domain in Ningbo dialect can be well supported by most of the data discussed in previous sections, as reproduced below.

(36) SP



天 晴
sky clear

'The sky is clear.'

thi dʒiŋ

BT MHL

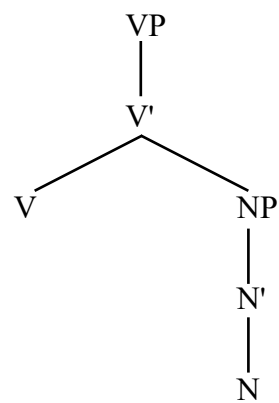
LHL

LTS [HL]

[HL]

PTS [M]φ = [LH]φ

(37) VO



养 花
cultivate flower

'to plant flower'

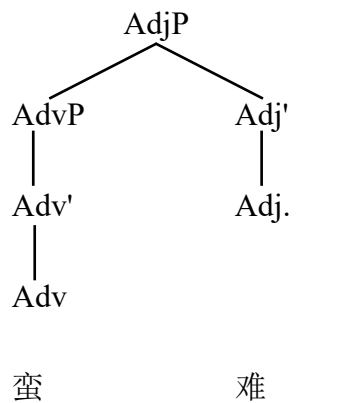
jã ho

BT H MHL

LTS [H] [HL]

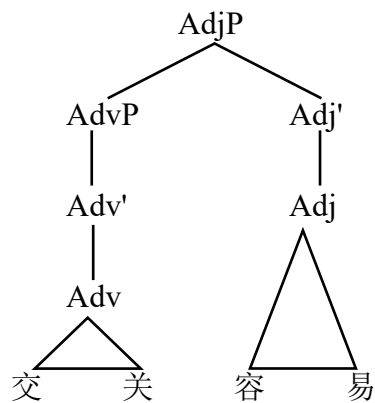
PTS [H]φ = [HL]φ

(38) Adverbial MH



quite difficult
 'quite difficult'

mɛ nɛ



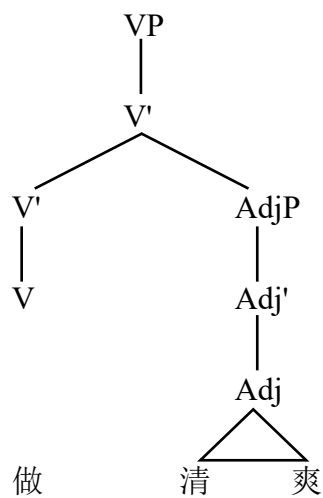
very easy
 'very easy'

tejo kuɛ yoŋ i

BT	H	LHL	BT	MHL	MHL	LHL	H	
LTS	[H]	[LH]	LTS	[M	HL]	[L	HL]	
PTS	[H]φ	=	[LH]φ	PTS	[M	H]φ=	[L	HL]φ

(39) Verb-complement

a.



do

clean

'to do it clean'

tsəu

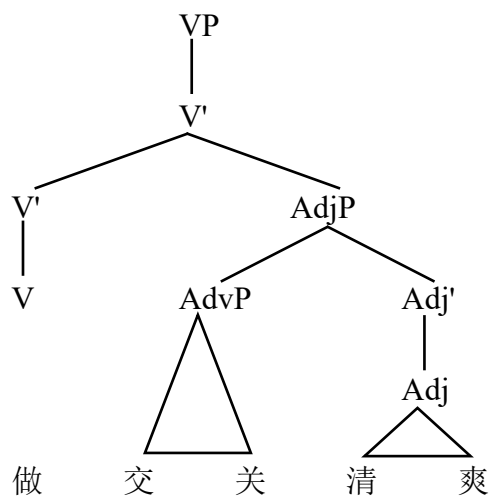
tɕhiŋ s̃

BT H MHL H

LTS [HL] [M = HL]

LTS [H L L]φ

b.



do

very

clean

'to do it very clean'

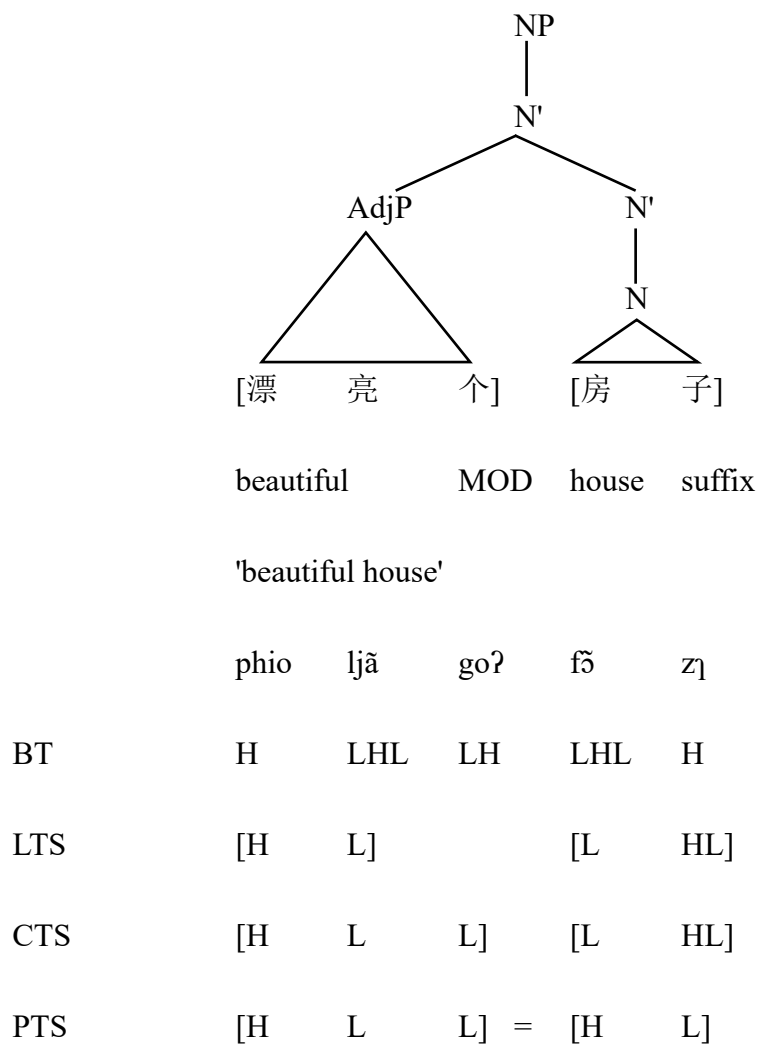
tsəu tɕjo kuɛ tɕhiŋ s̃

BT H MHL MHL MHL H

LTS [HL] [M = HL] [M = HL]

PTS [H]φ = [M H]φ = [M HL]φ

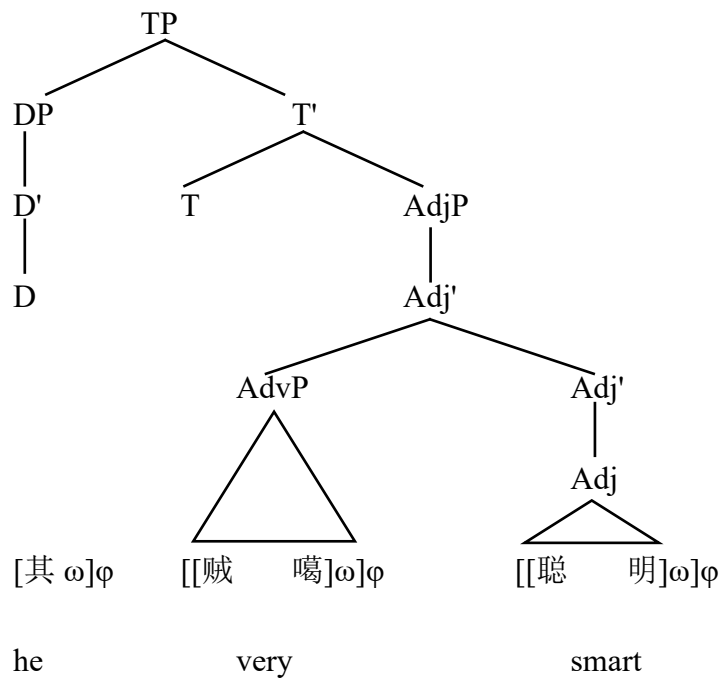
(40) Adnominal MH



As can be seen in the above cases, after application of LTS within the domain of each prosodic word, LTS may re-apply within each phonological phrase domain, and PTS will apply between two phonological phrases.

The definition of the phonological phrase domain in Ningbo dialect as in (35) can be supported by more complicated structures as well, as presented in (41).

(41)a. SP



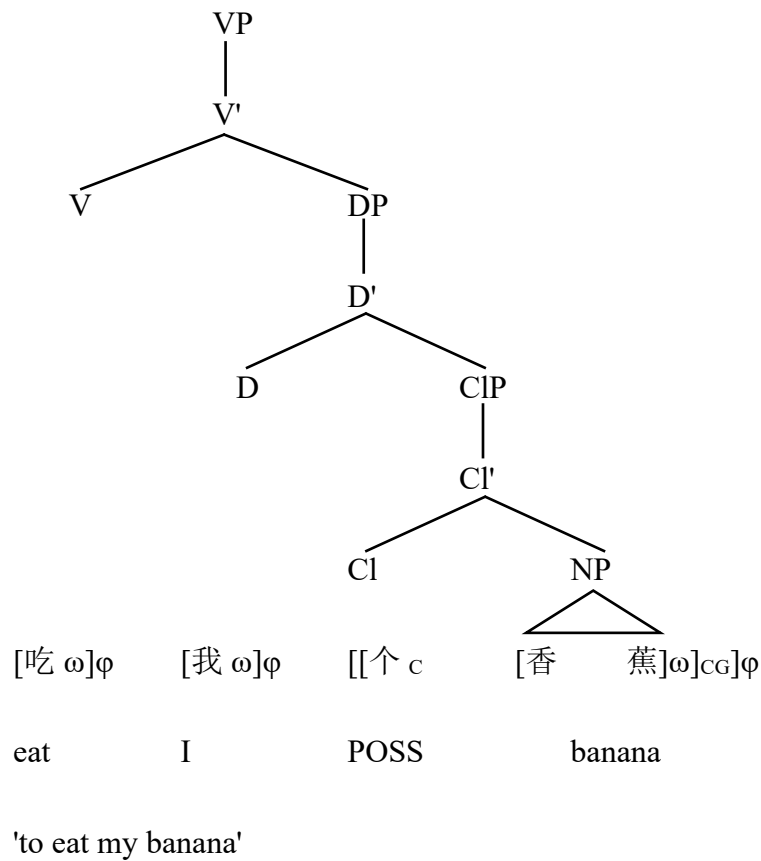
'He is very smart.'

BT LHL LHL H MHL LHL

LTS [LH] [LH = L] [M = HL]

PTS [LH] ϕ = [LH L] ϕ = [M HL] ϕ

b. determiner+classifier+noun

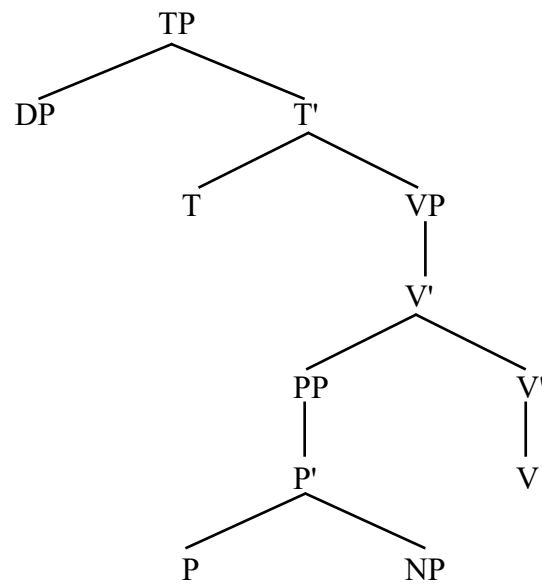


BT	H	LHL	LH	MHL	MHL
LTS	[H]	[LH]		[M = HL]	
CTS	[H]	[LH]	[L	[M	HL]]
PTS	[H]]φ	[LH]]φ	[L	M	HL]]φ

As discussed earlier, the adverb 贼噶 'very' in (41a) is the adjunct of the following adjective 聪明 'smart' due to verb-movement, so they cannot form one phonological phrase domain. Similar in (41b), the clitic group of 'classifier+noun host' is not non-branching so it cannot

join the non-object pronoun 我 'I' to form one phonological phrase domain. Thus, in both cases, LTS at the phrasal level is blocked.

(42) Prepositional structure



[其 ω]φ [[朝 c [西]ω]CG]φ [走 ω]φ

he towards west walk

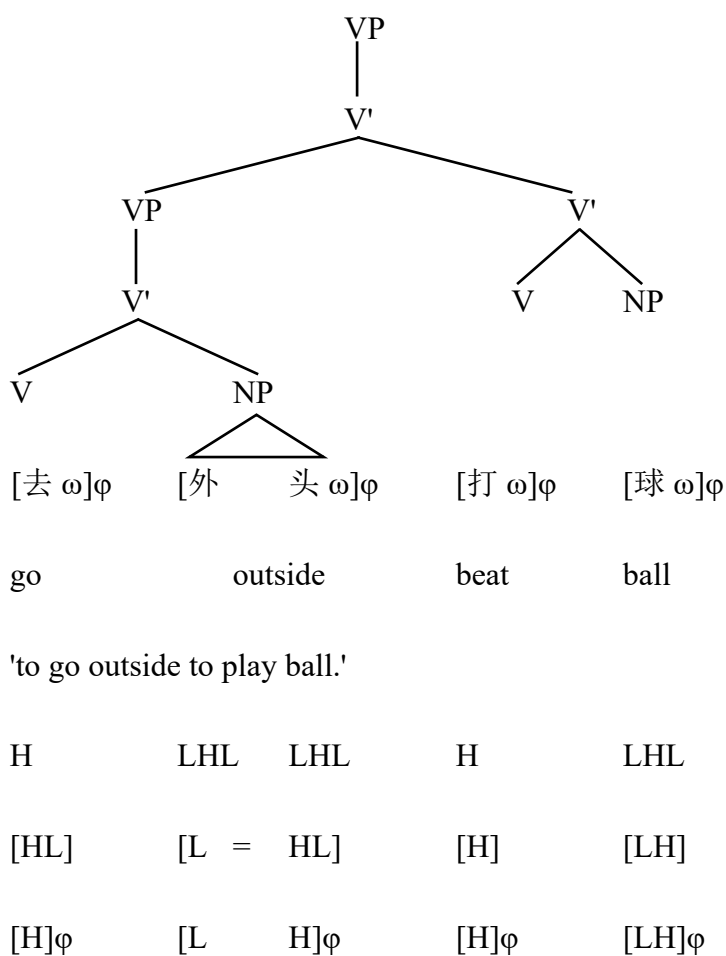
'He walks towards the west.'

BT	LHL	LHL	MHL	H
LTS	[LH]		[HL]	[H ²]
CTS	[LH]	[L	[HL]]	[H ²]
PTS	[L]φ	[L	H]φ	[H ²]φ

As shown in (42), 朝 'towards' is the proclitic that attaches to its host 西 'west'. Although

the clitic group is located on the recursive side of the head verb 走 'walk', it is not non-branching so it cannot join the head to form a phonological phrase. Moreover, the tone of 西 'west' changes from HL to H by applying the PTS because it sits at the juncture between the two phonological phrases, namely, 朝西 'towards the west' and 走 'walk'.

(43) Serial verb structure

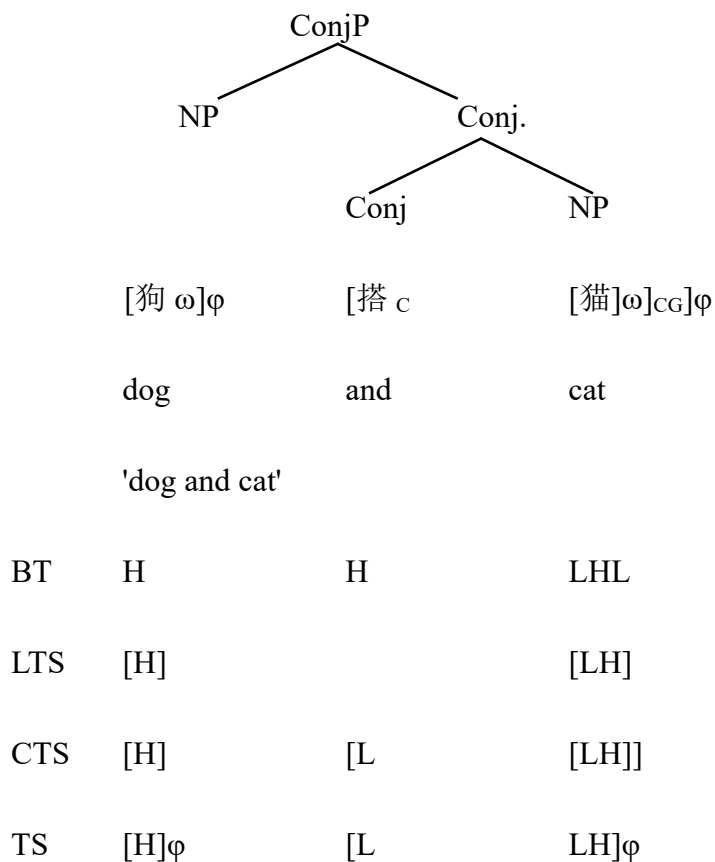


As shown in (43), each of the prosodic word (first forms a domain of clitic group, then) forms a domain of phonological phrase. LTS is blocked between each phonological phrase, but PTS

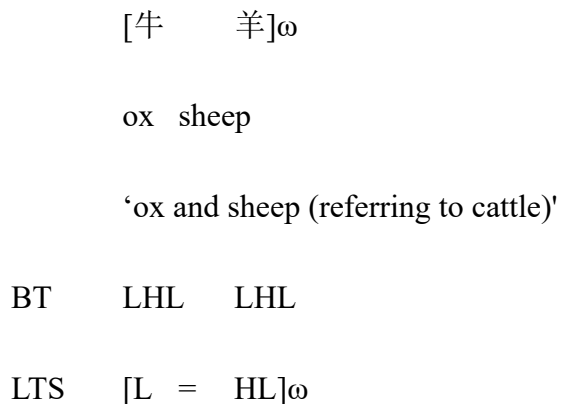
applies within the whole VP, i.e., the tone of 外头 'outside' changes from [L=HL] to [L=H].

(44) Conjunction structure

a. with conjunction clitic



b. conjunction prosodic word



As shown in (44a), LTS is blocked between two members of the conjunction structures due to the branchingness. However, as shown in (44b), if it is a prosodic word of conjunction structure, LTS applies from left to right.

By now, I have demonstrated that the RBA can account for a great amount of TS phenomena at the phrasal level in the Ningbo dialect. Before moving to the conclusion, I would like to talk about few other relevant issues.

6.2.3 Violation of Strict Layer Hypothesis

As discussed in Chapter V, by assuming Zhang's (2017) stipulation on Strict Layer Hypothesis, the data in Ningbo dialect have shown that the violation of the four principles are allowed, as demonstrated below.

(45) a. [[李四]ω]φ [[个 c [[两]ω 本 c]CG]CG]φ [[书]ω]φ

Li Si POSS two MW book

'two books of Li Si's'

b. [[李四]ω]φ [[困]ω]φ [[勒 c [[眠 床]ω [高 头]ω]φ]CG]φ

Li Si sleep at sleep bed top suffix

'Li Si sleeps on the bed.'

As shown in (45a), 两 first is identified as a prosodic word, then combining with the measure word to form a clitic group, after which, according to the DP theory, its proclitic, the possessive marker will join in to form a larger clitic group, thus, the principle of Nonrecursivity is violated. Moreover, although 两本 is the modifier of 书 'book', since the clitic group is on 书's 'book' recursive side and it is not non-branching, the prosodic word 书 'book' will form a phonological phrase domain by itself, thus, the principles of Exhaustivity and Headedness are both violated. Also, as shown in (45b), the clitic complement '勒眠床高头' 'on the top of the bed' cannot join the preceding verb head so itself forms a phonological phrase domain. However, one phonological phrase 眠床高头 'top of the bed' has already embedded in the clitic group, thus, not only the Non-recursivity principle is violated, but the principle of Layerdeness is also violated.

Nevertheless, as discussed in Section 6.2.1, the violation of the SLH actually is caused by the clitic group, while the prosodic word always sits at the bottom of the morpho-syntactic-based hierarchy while the phonological phrase always locates at the top. Therefore, before the lower constituents dominated by IPh, they should upgrade to PPh first.

6.3 Summary

In this chapter, I have investigated the phrasal TS phenomena in Ningbo dialect as well as discussing the previous studies on Shanghai dialect on the basis of EBA and RBA. By carefully

examining the two approaches, I have reached a conclusion that RBA is a better approach which can correctly define the phonological phrase as a prosodic domain in Ningbo dialect as well as correctly predicting the TS phenomena at phrasal level in this language. The phonological phrase formation in Ningbo dialect is again provided as follows.

(41) Phonological Phrase Formation in Ningbo dialect

a. The domain of φ consists of a clitic group which contains a lexical head (X) and all clitic groups on the non-recursive side up to the clitic group that contains another head outside of the maximal projection of X.

b. φ reconstructing

A nonbranching φ which is the first complement of X on its recursive side is joined into the φ that contains X.

Moreover, I have shown that the impression that LTS and PTS are the tone sandhi rule both applying within the phonological phrase level is not correct. As a matter of fact, LTS applies within phonological word, clitic group and phonological phrase if certain condition requirement is met, while PTS applies between two phonological phrase and never across the boundary of intonational phrase, which will be the topic of the next chapter.

Finally, I have demonstrated that all the lower prosodic constituents in the morpho-syntactic-based hierarchy must upgrade to phonological phrase when they are dominated by intonational

phrase so that the difference between the conditions of application of LTS and PTS can simply be defined as the former one applies within PPh, while the latter one applies between PPhs.

Chapter VII. The Intonational Phrase in the Ningbo Dialect

Now that the phonological phrase (PPh) in the Ningbo dialect has been constructed, this chapter will examine the domain of intonational phrase (IPh) in the prosodic hierarchy, which is the last constituent in Ningbo Dialect discussed in this dissertation. Section 7.1 is dedicated to providing an introduction to the basic definition and the restructuring of the intonational phrase under the framework of relation-based approach (RBA) assumed in this dissertation as well as the phonological phenomena in a variety of languages which are adequate in themselves as the motivation for the construction and restructuring of the intonational phrase in prosodic phonology. Section 7.2 will discuss the basic definition and the restructuring of the intonational phrase in the Ningbo dialect on the basis of the discussion in Section 7.1. Section 7.3 will examine the phonological phenomena that are relevant to the domain of the intonational phrase in the Ningbo dialect. A short conclusion will be provided at the end of this chapter.

7.1 Introduction

In this section, I will discuss the formation of the intonational phrase under the framework of the relation-based approach in the prosodic phonology proposed by Nespor and Vogel (1986). The Section 7.1.1 will discuss the basic rules for the IPh formation. Section 7.1.2 will talk about the restructuring of the intonational phrase as well as some relevant syntactic restrictions and non-

syntactic constraints. Section 7.1.3 will demonstrate some segmental phonological rules that have IPh as their domain of rule application. Section 7.1.4 will provide a short summary.

7.1.1 Definition of the Intonational Phrase

The intonational phrase refers to the prosodic constituent that is immediately above the domain of phonological phrase. According to Nespor and Vogel (1986), the nature of the intonational phrase is more general than what is necessary for the definition of the lower constituents, such as the phonological phrase domain, which indicates that the higher a constituent is in the hierarchy, the more flexible in nature it will be as an entity.

As Nespor and Vogel (1986) point out, the intonational phrase is the domain of an intonation contour, and the edges of intonational phrases match up with the positions in which the grammar-related pauses may be inserted in a sentence. Therefore, a root sentence (S), defined by Emonds (1976), which is not dominated by a node other than S corresponds to an intonational phrase, as illustrated in (1a) below.

In addition to root sentences, as exemplified as follows, certain types of constructions will obligatorily form intonational domains as their own, which include parenthetical expressions, nonrestrictive relative clauses, tag questions, vocatives, expletives, appositives and certain moved elements (cf. Bing 1979, Downing 1970, Ladd 1980, Selkirk 1978, 1984, Nespor and Vogel 1986, Jensen 1993, among others). Intonational phrases are marked within brackets and labeled with 'I'

in this chapter.

(1) Examples of intonation domains in English (adapted from Nespor and Vogel 1986)

- a. [Zhang San is a student.]_t (root sentence)
- b. Snow leopards [as you know]_t are rare. (parenthetical expression)
- c. My classmates [who absolutely loves Chinese]_t just bought himself a Chinese antique.
(nonrestrictive relative clauses)
- d. That's Zhang San's book [isn't it]_t? (tag questions)
- e. [Lv]_t I'd like you to meet Mr Zhang. (vocative)
- f. [My goodness,]_t there is lion in our backyard. (expletive)
- g. They are so lovely [those pandas]_t. (right dislocation)
- i. Zhang and Li [our lovely neighbors]_t just got a new baby. (appositive)

As Safir (1985) suggests, the constructions in (1b-i) are all elements that, at the level of the surface structure (s-structure), are linearly represented but not hierarchically attached by the syntax trees. Those types of constructions obligatorily form intonational phrases no matter where they appear in a sentence, as presented in (2), adapted from Nespor and Vogel (1986).

- (2) a. [As you know]_t I love her.
- b. I [as you know]_t love you.
- c. I love her [as you know]_t.

Thus, it seems that, besides the specific types of constructions that obligatorily form IPhs, the syntactic information that is relevant for the formation of intonational phrase is the root sentence. In other words, the boundaries of a root sentence delimit an intonational phrase, while non-root sentences do not, as demonstrated by the pair of the sentence in (3).

- (3) a. [Bill thought his father was a merchant]_ι [and his father was a secret agent]_ι
 b. [Bill thought his father was a merchant and his mother was a secret agent]_ι.

The sentence in (3b) is a root sentence, but a root sentence can be interrupted by one of the constructions seen in (1b-i) which must obligatorily form an intonational phrase by itself, as exemplified in (4).

- (4) a. [Snow leopards]_ι [as you know]_ι [are rare]_ι. (parenthetical expression)
 b. [My classmates]_ι [who absolutely loves Chinese]_ι [just bought himself a Chinese antique]_ι. (nonrestrictive relative clauses)
 c. [That's Zhang San's book]_ι [isn't it]_ι? (tag questions)
 d. [Lv]_ι [I'd like you to meet Mr Zhang]_ι. (vocative)
 e. [My goodness]_ι [there is lion in our backyard]_ι. (expletive)
 f. [They are so lovely]_ι [those pandas]_ι. (right dislocation)
 g. [Zhang and Li]_ι [our lovely neighbors]_ι [just got a new baby]. (appositive)

On the basis of the criteria discussed above, Nespor and Vogel (1986) propose the basic definition of the intonational phrase as follows:

(5) Intonational Phrase (IPh) formation

An IPh domain may consist of

- a. all the phonological phrases in a string that is not structurally attached to the sentence tree at the level of s-structure, or
- b. any remaining sequence of adjacent phonological phrase in a root sentence.

It should be noted that, although, the IPh domain often corresponds to a root sentence, it may not be the case when a root sentence is interrupted by an obligatory IPh, and the strings on one or both sides of this intervening IPh may not be isomorphic to any constituent in syntax, which are illustrated in the examples in (6) (cited from Nespor and Vogel 1986). In each example below, the left part of a sentence that is delimited by the obligatorily intervening IPh does not match up with any syntactic constituent.

- (6) a. [They have]_ι [as you know]_ι [been living together for years]_ι.
- b. [He will never]_ι [as I said]_ι [accept your proposal]_ι.
- c. [Charles wouldn't]_ι [I imagine]_ι [have done such as thing]_ι.
- d. [That's the tortoise that]_ι [as you know]_ι [inhabits the Galapagos Islands]_ι.

Nespor and Vogel (1986) also point out that, while the prominence of any of the constituents below IPh may be determined structurally, the stronger node under IPh is determined on the basis of semantic factors such as focus or the contrast between the given and new information, as exemplified in (7), in which, an indefinite article is opposed to a definite article. In other cases, the assignment of the stress within an IPs is flexible depending on the materials found in previous utterance or shared knowledge in a given context.

- (7) a. [[Leonard] φ_w [found] φ_w [a package] φ_s [on the doorstep] φ_w] ι
 b. [[Leonard] φ_w [found] φ_w [the package] φ_w [on the doorstep] φ_s] ι

On the basis of these observations, Nespor and Vogel (1986) propose a maximal rule for the relative prominence relations within IPh as below.

(8) Intonational Phrase Relative Prominence

Within IPh, a node is labeled strong on the basis of its semantic prominence; all other nodes are labeled as weak.

For example, any sub-constituents below the PPhs in the sentence *I like Wisconsin cheese* could be potentially labeled strong, as shown in (9) (adapted from Nespor and Vogel 1986), depending on which element is the most prominent semantically or representing the focused

element of the sentence.

- (9) a. [My sister] ϕ_s [sells] ϕ_w [cheese] ϕ_w [at the market] ϕ_w [tomorrow] ϕ_w .
 b. [My sister] ϕ_w [sells] ϕ_s [cheese] ϕ_w [at the market] ϕ_w [tomorrow] ϕ_w .
 c. [My sister] ϕ_w [sells] ϕ_w [cheese] ϕ_s [at the market] ϕ_w [tomorrow] ϕ_w .
 d. [My sister] ϕ_w [sells] ϕ_w [cheese] ϕ_w [at the market] ϕ_s [tomorrow] ϕ_w .
 e. [My sister] ϕ_w [sells] ϕ_w [cheese] ϕ_w [at the market] ϕ_w [tomorrow] ϕ_s .

Nevertheless, the assignment of relative prominence within an IPs is not totally free, according to Nespor and Vogel (1986). There are certain possibilities which is marked with respect to others. For example, in the patterns presented in (9), the first two represent contrastive patterns seem to be marked while the last one is the least marked pattern.

7.1.2 Restructuring of the Intonational Phrase

As have discussed for other prosodic constituents in the hierarchy, in some languages, a number of factors play crucial roles in determining the division of a string into certain prosodic constituents, including length, rate and style of speech as well as contrastive prominence. For example, in Italian, a short phonological phrase (i.e., nonbranching) may be restructured to form a single larger phonological phrase with an adjacent phonological phrase. The intonational phrase, on the other hand, may also undergo a process of restructuring.

As observed by Nespor and Vogel (1986), in English, it seems that the longer the original IPh is, the more likely it is divided into smaller IPhs, as exemplified in (10). Compare (10b, c) and (10e, f), the former two seem less acceptable than the analogous structures in the latter two.

- (10) a. [The hamster eats seeds all day]_ι.
 b. [The hamster]_ι [eats seeds all day]_ι.
 c. [The hamster]_ι [eats seeds]_ι [all day]_ι.
 d. [My friend's baby hamster always look for food in the corners of its cage]_ι.
 e. [My friend's baby hamster]_ι [always look for food in the corners of its cage].
 f. [My friend's baby hamster]_ι [always look for food]_ι [in the corners of its cage].

Different from Selkirk's (1978) suggestion, which claims that IPhs may be parsed into as many shorter IPhs as there are phonological phrases in the string, Nespor and Vogel (1986) argue that there seem to be a tendency to avoid series of very short IPhs and sequences of IPhs of various lengths. In other words, there is a tendency to establish IPhs of an average reasonable length. Thus, a long IPh could be broken down to smaller IPhs as in (10e) and (10f), while the division in (10b) and (10c) are less acceptable.

In addition to length, the style of speech may also be a factor to determine the restructuring of an IPh into smaller IPhs. It is observed by Nespor and Vogel (1986) that there is a tendency that the more formal or pedantic the style, the more likely it is for a long IPh to be broken down into a

series of shorter IPhs. Thus, if a sentence in (10d) is uttered in an informal colloquial way, it will most likely consist of a single intonation contour, as in (10d), while in a formal presentation, it may be parsed into two or three intonation contours, as in (10e) and (10f), respectively.

Moreover, rate of speech may also play a crucial role in determining the restructuring of a given IPhs. Usually, the slower a string is uttered, the more likely it is to be divided into smaller IPhs, as in (10e) and (10f). By contrast, the faster the rate of speech is, the longer the IPhs of a given utterance tend to be, as in (10d).

Finally, contrastive prominence of a particular part of an utterance is also a key non-syntactic factor in the determination of IPh restructuring. Bing (1979) distinguishes contrastive stress and contrastive prominence in a way that the former one does not change the IPh structure while the latter one adds an intonation contour within a string, as exemplified as follows.

- (11) a. [Paul called Paula before Carla called Carl]_t
 b. [Paul called Paula before she called him]_t
 c. [Paul called Paula]_t [before *she*]_t [called *him*]_t
 d. [Our mother *likes* Chinese antique furniture]_t

As seen in (11), on the one hand, (11d) can be read with contrastive stress on the word *likes*, as indicated by the italics in the sentence, but it does not result in restructuring IPh into smaller ones. On the other hand, the sentence (11a) is assigned one IPh since it is one single root sentence,

same as the sentence in (11b). By contrast, the presence of the pronouns in (11b) may make the interpretation of (11c) be uttered by placing the prominence on the pronouns, which causes the single IPh to be restructured as in (11c).

As discussed for the examples in (9), the flexibility seen in the restructuring of IPhs is not completely arbitrary. Because the Strict Layer Hypothesis requires IPh to immediately dominate one or more PPhs, wherever IPh restructures, it must coincide with the juncture between two PPhs. As Nespor and Vogel (1986) suggest, there are certain syntactic constraints on where an IPh may be divided into short IPhs, the most important factor of which seems to be the tendency to avoid restructuring an IPh in any position other than at the end of a noun phrase. The sentence in (12a) contains five PPhs, but there are only four possible ways to restructure it, as seen in (12b-d), while IPhs restructuring is not likely to happen after the verb *eat*, or after the noun *type* since it is not the end of a noun phrase.

- (12)a. [[The giant panda] φ [eats] φ [only one type] φ [of bamboo] φ [in its natural habitat] φ] ι
- b. [The giant panda] ι [eats only one type of bamboo] ι [in its natural habitat] ι
- c. [The giant panda] ι [eats only one type of bamboo in its natural habitat] ι
- d. [The giant panda eats only one type of bamboo] ι [in its natural habitat] ι

The NP constraint can further get support from the embedded possessive constructions such

as in (13) since the only possible place where the long IPh can be divided into two smaller IPhs is after *mother*.

- (13)a. [[My friend's] φ [neighbor's] φ [aunt's] φ [mother] φ [knows] φ
 [a famous writer] φ] ι
- b. [My friend's neighbor's aunt's mother] ι [knows a famous writer] ι

Nespor and Vogel (1986) point out that the NP restructuring provides further evidence for the non-isomorphism between phonological and syntactical structures in certain cases since the restructuring with respect to NP restriction may form prosodic structures that do not match up with any syntactic structures, as exemplified in (14), in which the first IPh created by the process of restructuring is not isomorphic to any syntactic constituent.

- (14)a. [I would never have believed the children of John and Mary to be able to become so
 ill-mannered] ι .
- b. [I would never have believed the children of John and Mary] ι
 [to be able to become so ill-mannered] ι .

Nespor and Vogel (1986) argue that the NP restriction reflects a general restriction to avoid separating an obligatory argument from its verb even if such division conforms to the NP restriction, as exemplified in (15). On the other hand, optional NP arguments seem not be restricted

by the constraints, as in (16).

- (15)a. [That lady always gives meat to the stray cats that live in the park]_t
 b. ?*[That lady always gives meat]_t [to the stray cats that live in the park]_t
- (16)a. [That lady always buys meat for the stray cats that live in the park]_t
 b. [That lady always buys meat]_t [for the stray cats that live in the park]_t

Nespor and Vogel (1986) also notice that restructuring of IPh may also occur right before the beginning of a new relative clause if only the division does not interrupt an NP. For example, (17a) can be divided into smaller IPhs as (17b), while (18b) as the restructuring of (18a) is not legitimate.

- (17) a. [I though you already knew that he was moving to southern Italy]_t
 b. [I though you already knew]_t [that he was moving to southern Italy]_t
- (18) a. [I though you knew the family that was moving to southern Italy]_t
 b. * [I though you knew the family]_t [that was moving to southern Italy]_t

Furthermore, the beginning of a relative clause may start restructuring even if it is in conflict with the restriction to avoid separating an obligatory argument from its verb, as exemplified in (19), in which the division in (19b) is more acceptable than (19d).

- (19) a. [Our next door neighbor truly believes that black cats bring bad luck]_t
 b. [Our next door neighbor truly believes]_t [that black cats bring bad luck]_t

- c. [Our next door neighbor truly believes the myth about black cats and bad luck]_t
- d. * [Our next door neighbor truly believes]_t [the myth about black cats and bad luck]

On the basis of the above discussions, Nespor and Vogel conclude that there exists a hierarchy among these three factors. The strongest constraint is the NP restriction, as can be seen in (17-18), which may not be broken by restructuring. The weakest one is the restriction against separating an internal argument from its verb, while the factor in the middle is the relative clause constraint, which allows formation of a new IPh, as shown in (19).

Moreover, in addition to the major constraints discussed above, there are several special cases which violate the principles proposed above, as give below, cited from Nespor and Vogel (1986).

- (20) a. [The big]_t [fat]_t [ugly]_t [nasty beast]_t [scared away the children]_t
- b. [That mountain road is long]_t [narrow]_t [windy]_t [and bumpy]_t
- c. [Everyone at the party ate]_t [talked]_t [sang]_t [and danced]_t
- d. [Ducks]_t [geese]_t [swans]_t [and coots]_t [inhabit this lake]_t
- e. [They own two cats]_t [three dogs]_t [four parakeets]_t [and a turtle]_t
- f. [Let's invite]_t: [Arnold]_t [Arthur]_t [Archibald]_t [and Zachary]_t
- g. [We were told to buy the following]_t: [milk]_t [eggs]_t [bread]_t [and cheese]_t

In order to account for these optional restructuring cases, Nespor and Vogel (1986) formulate

a special rule as follows. They also point out that the word 'repetition' refers only to the subsequent nodes that are the same as X except the first X.

(21) List Restructuring (optional)

In a sequence of more than two constituents of the same type, i.e., x_1, x_2, \dots, x_n , an intonation break may be inserted before each repetition of the node X.

Other cases where optional restructuring violates the general NP constraints are the embedded structures, as presented in (22). In each of the restructuring cases, an NP is divided into smaller IPhs, which is contrary to the claims made above.

- (22) a. [The book in the bag]_t [in the box]_t [on the table]_t [in the study]_t [belongs to Albert]_t
- b. [This is the cat]_t [that ate the rat]_t [that ate the cheese]_t
- c. [The woman]_t [that represents the company]_t [that owns the stores]_t [that sell the machines]_t [that brew coffee automatically]_t [is a friend of mine]_t

Even though the embedded structures, as shown in (22a-c), syntactically differ from those in (20a-g), as claimed by Nespor and Vogel (1986), the two types of the constructions could be considered similar to each other in a way that they all contain sequences of a given node of X.

Furthermore, in some cases above, more than one type of nodes could appear in a repeating

pattern so that we should determine which of the nodes is considered as the repeating X for the purposes of IPh restructuring. Take (22b) as an example, we can say the repeating node is NP as in (23a), or we may also possibly say that it is the relative clause which is repeating.

- (23)a. This is [_{NP} the cat that ate [_{NP} the rat that ate [_{NP} the cheese...
 b. This is the cat [_S that ate the rat [_S that ate the cheese...

However, according to Nespor and Vogel (1986), the decision is not optionally made. Only the case in (23b) matches up with the repetition pattern in (22b). Thus, as they conclude, in the cases where more than one types of X could be taken into consideration of the repeating node, the division of an IPs always coincides with where IPhs ends in a noun.

In addition, Nespor and Vogel also argue that not all the cases can be analyzed as repetition as above since there is not always a periodic repetition of the same elements in each case, as illustrated as in (24), where the result of a division based on the three \bar{S} s is not legitimate.

- (24)* [I know the artist]_ι [that painted the picture of the woman]_ι [that wrote the book]_ι
 [that won the acclaim of many]_ι.

To conclude, Nespor and Vogel have shown that there is relatively larger degree of flexibility of reconstructing an IPh into shorter ones, which distinguishes IPh from the other prosodic units in the hierarchy. A number of principles are crucial in the process of restructuring of IPh, including

the length of the intonational, the speech rate and style as well as the contrastive prominence. In addition, some above-mentioned syntactic restrictions also play important roles, including the NP constraint which acts as the strongest constraint, the relative clause constraint sitting in the middle, and the obligatory argument constraint is the weakest constraint in the ranking. In the cases of the lists and embedded structures that seem to violate the NP constraints, the problem can be solved by the optional List Restructuring Rule, as provided in (21), proposed by Nespor and Vogel (1986). Therefore, the prosodic structure discussed above provide evidence that the phonological structure is not isomorphic to the syntactic structure.

7.1.3 Segmental Rules in the Intonational Phrase across Languages

By now, we have examined the intonational phrase from the perspectives of intonation contour, potential pauses and relative prominence. As Nespor and Vogel (1986) point out, there are also segmental phonological rules that have IPh as their domains of application in Italian, Spanish and Greek.

The first example that Nespor and Vogel (1986) demonstrate is the Gorgia Toscana (GT) rule in Italian, which changes the voiceless stops /p, t, k/ into the corresponding fricatives [[ϕ , θ , h] between two [-consonantal] segments within and across words. They discover that the domain of application of this rule is the IPh as formed by the basic definition of IPh and the restructuring rules discussed above, and the rule does not cross the boundary of IPhs, as demonstrated in (24),

in which '_' means that GT applies while '#' denotes that the rule does not apply.

- (24) a. [Hanno catturato sette canguiri appena nati]_ι
 'They have captured seven newly born kangaroos.'
- b. [Certe tartarughe]_ι # [come si sa]_ι [vivono fino a duecento anni]_ι
 'Certain turtles, as you know, live up to two hundred years.'

As illustrated above, in each case, an IPh is determined by the basic IPh formation rule, while it may be divided into smaller IPhs after an NP, as presented in (25), in which the segmental context of the GT rules is undermined so that it does not apply to *corre* in (25b).

- (25) a. [Il pericolosissimo struzzo nigeriano corre più velocemente di quello siriano]_ι.
 'The extremely dangerous Nigerian ostrich runs faster than the Syrian one.'
- b. [Il pericolosissimo struzzo nigeriano]_ι # [corre più velocemente di quello siriano]_ι.

The fact that the GT rule applies within IPhs but never crosses IPhs indicates that IPh is the domain of its rule application. Therefore, a pure syntactic information is not adequate to determine the domain of IPh.

The second rule, discussed by Nespor and Vogel (1986), is the Italian Intervocalic Spirantization (IS) rule, which alters the affricates /tʃ/ and /dʒ/ into the corresponding fricatives [ʃ] and [ʒ]. respectively, between [-consonantal] segments within and across words, as exemplified in

(26).

(26)a. [Il mio criceto cerca il suo cibo negli angoli della gabbia]t

'My hamster looks for its food in the corners of the cage.'

b. [Eleonora]t # [giudice da ani]t # [gioca spesso a carte]t

'Eleonora, a judge for years, often plays cards.'

The same behavior can be seen in the comparison of the two sentences in (26). While IS applies throughout a single IPh defined by the basic definition of IPh, it will be blocked between the short IPhs broken down by the restructuring rule, as exemplified in (27).

(27) a. [Gli ho detto cìò che pensavo dell'affare circa il quale Cinzia mi ha parlato ieri]t.

I told him that what I thought about the affair about which Cinzia spoke to me yesterday.'

b. [Gli ho detto cìò che pensavo dell'affare]t # [circa il quale Cinzia mi ha parlato ieri]t.

Another rule that exhibits a certain degree of flexibility is the Nasal Assimilation (NA) rule in Spanish. While the rule, as discussed by Nespor and Vogel (1986), applies within word, and crosses words in an IPh, it never crosses the boundaries between two IPhs, as shown as follows.

(28)a. [Un grann balcón]t [como saben]t [puede ofrecer mucho placer]t

- b. [Carmen]ᵢ # [cántanos una nueva canción]ᵢ # [por favor]ᵢ

'Carmen, sing us a new song, please.'

However, by comparing the two examples in (29), we can see that the NA rule does not apply to longer VPs and sentences when the restructuring of IPhs destroys the context for NA to apply, as in (29b), while it can still apply within a shorter VP and between the subject and the predicate of a sentence in (29a).

- (29) a. [Muchos estudios sobre el comportamiento del deflín concluyen que algunos tipos de deflines son más inteligentes que otros]ᵢ
 'Many studies about the behavior of dolphins conclude that some types of dolphins are more intelligent than others.'
- b. [Muchos estudios sobre el comportamiento del deflín] # [concluyen que algunos tipos de deflines son más inteligentes que otros]ᵢ

If there is sentence uttered in a fast rate of speech, NA would apply as shown in (29).

The last rule discussed by Nespor and Vogel (1986) is the *s*-Voicing (SV) rule in Greek, by which /s/ is voiced when it precedes a voiced [+consonantal] segment. This rule applies both within words and across words within the same IPh, as shown below.

- (30)a. κόσμος [kóssmos] 'people'

- b. *Θέλεις να πάς* [θélis na pas] 'Do you want to go?'

Same as the above-mentioned rules in Italian and Spanish, SV is blocked between two words that belong to different IPhs while it applies in the segmental context within the same IPh, as exemplified in (31).

(31) *Ο άνδρας αυτός, μουν φαίνεται, είναι πολύ έξυπνος.*

[o ándras aftós]ι # [mu fénete]ι [íne polí éksipnos]ι

'This man, it seems to me, is very bright.'

As we can see in the examples in this section so far, rules such as Gorgia Toscana and Intervocalic Spirantization in Tuscan Italian, Nasal Assimilation in Spanish as well as the *s*-Voicing (SV) rule in Greek apply within a root sentence, within the types of constructions that form obligatory IPhs as well as the sister node of such IPhs. Furthermore, these rules are also sensitive to the nonsyntactic factors such as the rate of speech which may have an alternative effect to restructure a sentence into smaller IPhs. Finally, as suggested by Nespor and Vogel (1986), the phonological constituents that created by the basic IPh formation rule and the restructuring rule may result in structures that do not correspond to any syntactic structures so that it can provide further evidence for the flexibility of IPh different from other prosodic constituent in the hierarchy.

7.1.4 Summary

In Section 7.1.1, I have presented the basic rules for IPh formation proposed by Nespor and Vogel (1986), including the basic formation rule and the restructuring rule. Section 7.1.2 has discussed the restructuring of the intonational phrase as well as some relevant syntactic and non-syntactic constraints and restrictions. In Section 7.1.3, I have examined some phonological rules that have IPhs and smaller IPhs formed by the restructuring rule as their domain of application cross languages, which provide further evidence to support IPhs as an indispensable but flexible constituent in the prosodic hierarchy.

7.2 The Intonational Phrase in the Ningbo Dialect

7.2.1 Basic Intonational Phrase in the Ningbo Dialect

As mentioned previously in Section 7.1, the intonational phrase is the domain of an intonation contour and the edges of intonational phrases match up with the positions where the grammar-related pauses may be inserted in a sentence. As the languages discussed in Section 7.1, such as English, Italian, Spanish and Greek, in Ningbo dialect, a root sentence like those in (32) can form their own intonational phrase domain since they are related to intonation contour.

(32)a. [我 讨 厌 依]t

I hate you

'I hate you.'

CT ηo^{LH} $\text{t}\text{o}^{\text{H}}$ i^{HL} $\text{n}\text{e}\text{u}^{\text{LH}}$

TS $[\eta\text{o}^{\text{LH}}$ $\text{t}\text{o}^{\text{H}}$ i^{L} $\text{n}\text{e}\text{u}^{\text{L}}]\text{t}$

b. [其 拉 老 公 交 关 聪 明]t

she husband very smart

'Her husband is very smart.'

CT $\text{d}\text{z}\text{j}\text{e}\text{?}^{\text{LH}}$ $\text{l}\text{a}\text{?}^{\text{LH}}$ $\text{l}\text{e}\text{u}^{\text{LH}}$ $\text{k}\text{o}\text{ŋ}^{\text{HL}}$ $\text{t}\text{e}\text{i}\text{o}^{\text{HL}}$ $\text{k}\text{u}\text{e}^{\text{HL}}$ $\text{t}\text{s}\text{o}\text{ŋ}^{\text{HL}}$ $\text{m}\text{i}\text{ŋ}^{\text{LH}}$

TS $[\text{d}\text{z}\text{j}\text{e}\text{?}^{\text{L}}$ $\text{l}\text{a}\text{?}^{\text{H}}$ $\text{l}\text{e}\text{u}^{\text{LH}}$ $\text{k}\text{o}\text{ŋ}^{\text{L}}$ $\text{t}\text{e}\text{i}\text{o}^{\text{M}}$ $\text{k}\text{u}\text{e}^{\text{H}}$ $\text{t}\text{s}\text{o}\text{ŋ}^{\text{M}}$ $\text{m}\text{i}\text{ŋ}^{\text{HL}}]\text{t}$

c. [我 有 两 个 好 朋 友]t

I have two MW good friend

'I have two good friends.'

CT ηo^{LH} y^{LH} $\text{l}\text{j}\tilde{\text{a}}^{\text{LH}}$ $\text{g}\text{o}\text{?}^{\text{LH}}$ $\text{h}\text{o}^{\text{H}}$ $\text{b}\tilde{\text{a}}^{\text{LH}}$ y^{LH}

TS $[\eta\text{o}^{\text{LH}}$ y^{L} $\text{l}\text{j}\tilde{\text{a}}^{\text{LH}}$ $\text{g}\text{o}\text{?}^{\text{L}}$ $\text{h}\text{o}^{\text{H}}$ $\text{b}\tilde{\text{a}}^{\text{H}}$ $\text{y}^{\text{H}}]\text{t}$

- d. [该 是 我 的 书]t
 this is I POSS book
 'This is my book.'
- CT kjeʔ^H zɿ^{LH} ŋo^{LH} goʔ^{LH} sq^{HL}
 TS [kjeʔ^H zɿ^L ŋo^{LH} goʔ^L sq^{HL}]t

In addition to the root sentence as exemplified in (32a-d), certain types of constructions may form in intonational domain as their own in Ningbo dialect, which include nonrestrictive relative clauses, parenthetical expressions, tag questions, vocatives, expletives, appositives and certain moved elements, as illustrated in (33).

- (33) a. [该 东 西,]t [我 搭 侬 讲,]t [是 其 个]t
 this thing I to you speak is he POSS
 'This thing, let me tell you, is his.' (Parenthetical expression)
- CT kjeʔ^H toŋ^{HL}ɕi^{HL} ŋo^{LH}taʔ^Hnɛu^{LH} koŋ^H zɿ^{LH}ɕzi^{LH}goʔ^{LH}
 TS [kjeʔ^Htoŋ^Lɕi^L]t [ŋo^{LH}taʔ^Lnɛu^{LH} koŋ^H]t [zɿ^Lɕzi^{LH}goʔ^L]t

b. [其 拉 老 公,]t [张 先 生,]t [交 关 聪 明]t

her husband Zhang sir very smart

'Her husband, Mr. Zhang, is very smart.' (appositive)

CT dʒjeʔ^{LH} laʔ^{LH} lɛu^{LH}koŋ^{HL} tɛjã^{HL}ɛi^{HL}sã^{HL} tɛio^{HL}kue^{HL} tsoŋ^{HL}miŋ^{LH}

TS [dʒjeʔ^L laʔ^H lɛu^{LH}koŋ^L]t [tɛjã^Mɛi^Hsã^L]t [tɛio^Mkue^Htsoŋ^Mmiŋ^{HL}]t

c. [依 是 张 三,]t [是 伐?]t

you are Zhang San is Que.

'You are Zhang San, isn't it?' (tag question)

CT nɛu^{LH} zɿ^{LH} tɛjã^{HL} sɛ^{HL} zɿ^{LH} vaʔ^{LH}

TS [nɛu^{LH} zɿ^L tɛjã^M sɛ^{HL}]t [zɿ^{LH} vaʔ^L]t

d. [张 三,]t [这 是 李 四]t

Zhang San this is Li Si

'Zhang San, this is Li Si.' (vocative)

BT tɛjã^{HL} sɛ^{HL} kjeʔ^H zɿ^{LH} li^{LH} sɿ^{HL}

TS [tɛjã^M sɛ^{HL}]t [kjeʔ^H zɿ^L li^{LH} sɿ^L]t

e. [啊 呀,]t [我 忘 记 嘞]t

halloa I forget CRS

'Halloa, I forgot it!' (expletive)

CT aʔ^H ja^{LH} ŋo^{LH} mɔ̃^{LH} tɛi^{HL} lɛi^{LH}

TS [aʔ^Hja^L]t [ŋo^{LH} mɔ̃^L tɛi^H lɛi^L]t

f. [吃 饭 勒 伐,]t [侬?]t

eat rice CRS Qu. you

'Have eaten yet, you?' (right dislocation)

CT tɛhyoʔ^H vɛ^{LH} laʔ^{LH} vaʔ^{LH} nɛu^{LH}

TS [tɛhyoʔ^Mvɛ^{LH} laʔ^L vaʔ^L]t [nɛu^{LH}]t

TS [tɛhyoʔ^Mvɛ^{LH} laʔ^L vaʔ^L]t [nɛu^L]t (alternative reading)

In the examples in (33), we can find that the constructions interrupting a root sentence must obligatorily form an intonational phrase by themselves as do the strings that are adjacent to these constructions. In other words, the boundaries of such constructions delimit a string into several intonational phrases. Therefore, the boundary will block the PTS will normally applies between phonological phrases within the same IPh. Compare (33b) with (33d), in (33b). The last IPh, 交关聪明 'very smart' consists of two phonological phrases, 交关 'very' and 聪明 'smart', thus,

PTS applies at the juncture between them and changes the tone of 交关 'very' from M-HL to M-H. By contrast, in (33d), a IPh boundary is introduced to the right of the first IPh 张三 'Zhang San' so that its tonal pattern remains as M-HL.

Moreover, it should be noted that the right dislocation of the subject 依 'you' in (33f) has an alternative reading in which its tone changes to a default low tone, the phonological behavior of which is different from that of other shorter intonational phrases formed by other constructions, I will discuss it in Section 7.2.

On the basis of the observation of the above examples, following Nespor and Vogel's (1986) definition about intonational phrase, the basic formation rule of the intonational phrase in the Ningbo dialect can be adopted and is given in (34).

(34) Intonational Phrase (IPh) formation in Ningbo dialect

An IPh domain may consist of

- a. all the phonological phrases in a string that is not structurally attached to the sentence tree at the level of s-structure, or
- b. any remaining sequence of adjacent phonological phrase in a root sentence.

7.2.2 Restructuring of the Intonational Phrase in the Ningbo Dialect

Similar to the languages examined by Nespor and Vogel (1986), such as English, Spanish, Italian and Greek, the restructuring of the intonational phrase may also occur in Ningbo dialect

affecting by some non-syntactic factors including length, rate and style of speech as well as contrastive prominence.

First, the longer an IPh is, the more likely IPh restructuring occurs to yield somewhat shorter IPhs for the logical reasons such as having to do with breath capacity. Consider the sentences in (36a) and (37a). Although the sentence in (36a) and (37a) can form a long intonational phrase by themselves, as in (36b) and (37b), respectively, they sounds more acceptable to break down into shorter IPhs in natural conversation, as in (36c) and (37c), respectively.

(36)	a.	该	面	该	个	忘	记	带	电	脑
		that	side	that	MW	forget	bring	computer		
	CT	kjeʔ ^H	mi ^{LH}	kjeʔ ^H	goʔ ^{LH}	mɔ̃ ^{LH}	tei ^{HL}	ta ^{HL}	di ^{LH}	neu ^{LH}
	TS	kjeʔ ^H	mi ^L	kjeʔ ^H	goʔ ^L	mɔ̃ ^L	tei ^{HL}	ta ^H	di ^{LH}	neu ^L
		的	学	生	昨	天	被	其	拉	
		Part.	student		yesterday	PASS.	his			
	CT	goʔ ^{LH}	foʔ ^{LH}	sã ^H	zɔ̃ ^{LH}	maʔ ^H	paʔ ^H	dʒjeʔ ^{LH}	laʔ ^H	
	TS	goʔ ^L	foʔ ^L	sã ^H	zɔ̃ ^L	maʔ ^H	paʔ ^L	dʒjeʔ ^L	laʔ ^L	
		电	脑	课	个	老	师	整	整	骂
		computer	class	PART	teacher		totally	scold		
	CT	di ^{LH}	neu ^{LH}	kɛu ^{HL}	goʔ ^{LH}	lɔ̃ ^{LH}	sɿ ^H	teinj ^H	teinj ^H	zoʔ ^{LH}
	TS	di ^{LH}	neu ^L	kɛu ^L	goʔ ^L	lɔ̃ ^{LH}	sɿ ^L	teinj ^H	teinj ^L	zoʔ ^L

勒 一 个 钟 头

PART one MW class

CT laʔ^{LH} jeʔ^H goʔ^{LH} tsoŋ^{HL} dəY^{LH}

TS laʔ^L jeʔ^H goʔ^L tsoŋ^M dəY^{HL}

'The student there who forgot to bring the computer was scolded by his teacher of the computer class for the entire whole class.'

b. [该面该个忘记带电脑的学生昨天被其拉电脑课个老师整整骂了一个钟头]_i

c. [该面该个忘记带电脑的学生]_i [昨天]_i [被其拉电脑课个老师]_i [整整骂了一个钟头]_i

(37)a. 今 箴 夜 到 阿 拉 爸 爸 的

today evening my father POSS

CT tɛjeʔ^H mjeʔ^{LH} ja^{LH} tɔ^{HL} aʔ^H laʔ^{LH} pa^{HL} pa^H goʔ^{LH}

TS tɛjeʔ^H mjeʔ^L ja^L tɔ^L aʔ^H laʔ^L pa^H pa^L goʔ^L

同 事 要 到 阿 拉 屋 里 来

colleague will to our house inside to

CT doŋ^{LH} sɿ^{LH} jo^{HL} tɔ^{HL} aʔ^H laʔ^{LH} oʔ^H li^{LH} le^{LH}

TS doŋ^L sɿ^H jo^H tɔ^L aʔ^L laʔ^L oʔ^H li^L le^L

	搭	阿	拉	修	冰	箱
	for	us	fix	refrigerator		
CT	taʔ ^H	aʔ ^H	laʔ ^{LH}	ɛy ^{HL}	piŋ ^{HL}	ɛjã ^H
TS	taʔ ^L	aʔ ^L	laʔ ^L	ɛy ^M	piŋ ^M	ɛjã ^{HL}

'My father's colleague is coming to our house to fix the refrigerator for us this evening'

- b. [今 夙 夜 到 阿 拉 爸 爸 的 同 事 要 到 阿 拉 屋 里 来 搭 阿 拉 修 冰 箱]ᵀ
- c. [今 夙 夜 到]ᵀ [阿 拉 爸 爸 的 同 事]ᵀ [要 到 阿 拉 屋 里]ᵀ [来 搭 阿 拉 修 冰 箱]ᵀ

In addition to length, the rate and the style of speech also plays important roles in determining the restructuring of an IPh. A long sentence maybe divided into several short ones in formal or slow speech, while more colloquial styles tend to correspond to a fast rate of speech, which will contain one single intonational phrase. Therefore, according to my informants, when a sentence is uttered in a formal or slow way, it may be divided into several short IPhs, as shown in (38b). By contrast, when it is uttered an informal colloquial way, it can form a single IPh, as in (38c). Moreover, a formal sentence can be divided into shorter IPhs, as in (39a), while a sentence with similar length and syntactic structure may remain as one single IPh in an informal colloquial speech.

(38) a. [我 觉 得 这 个 小 娘 交 关 聪 明]ᵀ

I think this MW girl very smart

CT ɲo^{LH} tɛyoʔ^H taʔ^H kjeʔ^H goʔ^{LH} ɛjo^H ɲjã^{LH} tɛjo^{HL} kuɛ^{HL} tsoŋ^{HL} miŋ^{LH}

TS [ɲo^{LH} tɛyoʔ^H taʔ^L kjeʔ^H goʔ^L ɛjo^H ɲjã^H tɛjo^M kuɛ^{HL} tsoŋ^M miŋ^{HL}]ᵀ

b. [我觉得]ᵀ [这个小娘]ᵀ [交关聪明]ᵀ

c. [我觉得这个小娘交关聪明]ᵀ

'Your soup has gone bad.'

(39) a. [我 祝 愿 大 家 万 事 如 意]ᵀ

I wish everyone all the best (idiom)

'I wish everyone all the best.'

CT ɲo^{LH} tsoʔ^H y^{HL} da^{LH} tɛja^{HL} vɛ^{LH} zɿ^{LH} zu^{LH} i^{HL}

TS [ɲo^{LH} tsoʔ^H y^L]ᵀ [da^L tɛja^{HL}]ᵀ [vɛ^L zɿ^H zu^L i^L]ᵀ

b. 其 觉 得 老 师 呆 大 刮 气

he think teacher stupid suffix

'He thinks that the teacher is very stupid.'

CT dʒi^{LH} tɛyoʔ^H taʔ^H lo^{LH} sɿ^H ɲe^{LH} dɛu^{LH} kuaʔ^H tɛhi^{HL}

TS [dʒi^{LH} tɛyoʔ^H taʔ^L lo^{LH} sɿ^L ɲe^L dɛu^H kuaʔ^L tɛhi^L]ᵀ

Finally, semantic related consideration, namely the contrastive prominence, will make an utterance break into several smaller ones in the Ningbo dialect as well. For instance, the sentence in (40a) can be treated as one single IPh. By contrast, if 其 'he' is emphasized, or if the prominence is attributed to the pronoun 其, then the IPh will be modified into two IPhs, as in (40b). However, if the prominence is placed on the adjective 聪明 'smart', which requires the listener to interpret the sentence in a specific way that is different from the interpretation of (40a) and (40b), the single IPh is restructured in another way, as shown in (40c).

- (40) a. [我 觉 得 其 顶 聪 明]_t
 I think he the most smart
 'I think he is the smartest.'
- CT ɲo^{LH} teyoʔ^H taʔ^H dʒi^{LH} tiŋ^H tsoŋ^{HL} miŋ^{LH}
 TS [ɲo^{LH} teyoʔ^H taʔ^L dʒi^{LH} tiŋ^H tsoŋ^M miŋ^{HL}]_t
- b. [我觉得]_t [其顶聪明]_t
 c. [我觉得其顶]_t [聪明]_t

Furthermore, certain syntactic constraints may have influence on where a single IPh should break into smaller ones, just like the languages discussed in Section 7.1. The first syntactic factor that may affect the IPh restructuring is the tendency to dividing an IPh at the end of a noun phrase.

As illustrated in (36), for instance, the whole sentence by itself can form one IPh as in (36b), while it can also be broken down into shorter IPhs as in (36c), in which the IPh restructuring occurs after the nouns, 学生 'student' and 老师 'teacher', but it is not likely to happen after the verbs, 忘记 'forget' and 骂 'scold', since they are not at the end of a noun phrase.

As pointed out by Nespor and Vogel (1986), the IPh restructuring only occurs after an NP, but not after a noun within a noun phrase. For example, in the examples in (36), the IPh restructuring is not possible to occur after the 电脑 'computer', which is embedded within the whole NP 该面该个忘记带电脑个学生 'the student who forgot to bring the computer there', nor is it likely to happen after the 电脑课 'computer class' within 其拉电脑课个老师 'his teacher of the computer class', as shown below in (41b) and (41c) respectively.

- (41) a. [该面该个忘记带电脑的学生昨天被其拉电脑课个老师整整骂了一个钟头]_t
 b. *[该面该个忘记带电脑]_t
 [的学生昨天被其拉电脑课个老师整整骂了一个钟头]_t
 c. *[该面该个忘记带电脑的学生昨天被其拉电脑课]_t
 [个老师整整骂了一个钟头]_t

Moreover, according to Nespor and Vogel (1986), it should be noted that the NP restriction is not likely to apply after every NPs. Instead, it is likely to avoid to apply to separate an obligatory argument and its predicate. In Ningbo dialect, we can also find evidence to support such general

preference, as exemplified in (42) and (43).

(42) a. [这个 老女人 是价 搭猫 去买 肉]ᵢ

this MW old woman always for cat to buy meat

'This old woman always goes to buy meat for cat.'

CT kjeʔ^Hkoʔ^{LH} lo^{LH}ny^{LH}niŋ^{LH} sɿ^{LH}kaʔ^H taʔ^Hmɛ^{LH} tɕhi^{HL}ma^{LH} nyoʔ^{LH}

TS [kjeʔ^Hkoʔ^L lo^{LH}ny^Hniŋ^H sɿ^{LH}kaʔ^L taʔ^Lmɛ^{LH} tɕhi^Lma^L nyoʔ^{LH}]ᵢ

b. *[这个老女人是价搭猫去买]ᵢ [肉]ᵢ

'This old woman always goes for cat to buy, meat.'

(43) a. [我 想 送 本书 扒 依]ᵢ

I want to give MW book to you

'I want to give you a book as present.'

CT ŋo^{LH} ɕjã^H soŋ^{HL} pəŋ^H sø^{HL} paʔ^H nəu^{LH}

TS [ŋo^{LH} ɕjã^L soŋ^H pəŋ^L sø^{HL} paʔ^L nəu^L]ᵢ

b. *[我想送本书]ᵢ [扒依]ᵢ

'I want to give a book, to you.'

As shown in (42b), it is unlikely to insert a break to separate the verb from its obligatory object NP so that the sentence in (42b) is less acceptable. Similarly, in a double-object structure, the IPh

boundary is less acceptable to be inserted after the first argument, as in (43b), but is more likely to be assigned after the second argument, as in (43a). By contrast, an IPh can usually break into smaller IPhs by inserting a boundary before the subject and its following predicate in the Ningbo dialect.

In addition, the restructuring of IPh may also take place when the argument following a verb is a sentence, as exemplified in (44), in which is sentence in (44b) is acceptable. However, such restructuring may not be legitimate when it happens within an NP, as shown in (45).

(44)a. [我 觉 得 其 是 张 三]ᵀ

I think he is Zhang San

'I think he is Zhang San.'

CT ɲo^{LH} tɛyo^{ʔH} ta^{ʔH} dʒi^{LH} sɿ^{LH} tɛjã^{HL} sɛ^{HL}

TS [ɲo^{LH} tɛyo^{ʔH} ta^{ʔL} dʒi^{LH} sɿ^L tɛjã^M sɛ^{HL}]ᵀ

b. [我觉得]ᵀ [其是张三]ᵀ

'I think, he is Zhang San.'

(45)a. [该 边 有 个 人 勒 该 唱 歌]ᵀ

There have MW person DUR DUR sing song

'There is a person who is singing.'

CT kje^{ʔH} pi^{HL} y^{LH} go^{ʔLH} niŋ^{LH} lje^{ʔLH} kje^{ʔHL} tsɿ̃^{HL} vuk^{HL}

BT [kjeʔ^H pi^L y^L goʔ^L niŋ^{LH} ljeʔ^L kjeʔ^L tsɔ̃^M euk^{HL}]t

b. *[该边有个人]t [勒该唱歌]t

It should be noted that, in (45b), the IPh boundary cannot be assigned at the beginning of the relative clause '勒该唱歌' '(who) is singing' because it is embedded within the NP '人勒该唱歌' 'a person who is singing', which provides further evidence to support Nespor and Vogel's (1986) proposal about the degree of the three syntactic constraints. The strongest one is the NP constraint, which cannot be broken by IPh restructuring, while the relative clause constraint is at the lower ranking. Therefore, as shown in (45b), the NP cannot be broken even if there is a relative clause within the structure. Moreover, Nespor and Vogel (1986) claims that the obligatory argument constraint is at the bottom of the degree hierarchy of the constraints since it can be violated when the object argument is a relative clause. Therefore, the hierarchy of the syntactic constraints in Ningbo dialect is provided as follows: NP constraints > relative clause constraints > obligatory argument constraints.

Furthermore, the above-mentioned three syntactic constraints are actually violable since besides these three syntactic constraints, there are other nonsyntactic factors including rate and style of speech as well as the contrastive prominence. Therefore, if a sentence is slowly uttered or a particular part of the sentence was assigned prominence, the IPh restructured may not be isomorphic to any syntactic structure. For example, for the sentence in (42a), if the speaker wants

to emphasize that it is meat that the old woman buys, not anything else, the restructuring as in (42b) maybe acceptable.

The lists and complexly embedded structures may have particular intonational patterns in Ningbo dialect. As can be seen in the following examples, new intonational phrases can be created by assigning pauses between two items.

- (46)a. [老 师 交 关 喜 欢 这 个
 teacher very like this MW
 CT ləu^{LH} sɿ^{HL} tɛio^{HL} kue^{HL} ɛi^H hu^{HL} kjeʔ^H goʔ^{LH}
 TS [ləu^{LH} sɿ^L tɛio^M kue^{HL} ɛi^H hu^L kjeʔ^H goʔ^L
 聪 明]ᵀ [漂 亮]ᵀ [可 爱 个 学 生]ᵀ
 smart pretty cute PART. student
 CT tsoŋ^{HL} miŋ^{LH} phjo^{HL} ljã^{LH} khəu^H e^{HL} goʔ^{LH} fiəʔ^{LH} sã^{HL}
 TS [tsoŋ^M miŋ^{HL}]ᵀ [phjo^H ljã^L]ᵀ [khəu^H e^L goʔ^L fiəʔ^L sã^H]ᵀ
 'Teachers like this smart, pretty, cute student very much.'

- b. [这 个 聪 明]ᵀ [漂 亮]ᵀ [可 爱 个
 this MW smart pretty cute PART.
 CT kjeʔ^H goʔ^{LH} tsoŋ^{HL} miŋ^{LH} phjo^{HL} ljã^{LH} khəu^H e^{HL} goʔ^{LH}
 TS [kjeʔ^H goʔ^L tsoŋ^M miŋ^{HL}]ᵀ [phjo^H ljã^L]ᵀ [khəu^M e^{HL} goʔ^L

学 生 是 阿 拉 囡]t

student is my daughter

CT foʔ^{LH} sā^{HL} sɿ^{LH} aʔ^H laʔ^{LH} nø^{LH}

TS foʔ^L sā^H sɿ^L aʔ^L laʔ^L nø^{LH}]t

'This smart, pretty and cute student is my daughter.'

c. [其 拉 勒 该 唱 歌]t [跳 舞]t [喝 酒]t

they DUR DUR sing song jump dance drink wine

CT dʒjeʔ^{LH} laʔ^{LH}ljeʔ^{LH} kjeʔ^{HL} tsɔ̃^{HL} gœu^{HL} thjo^{HL} wu^{LH} haʔ^H tɛy^H

TS [dʒjeʔ^L laʔ^Hljeʔ^L kjeʔ^L tsɔ̃^H gœu^{HL}]t [thjo^H wu^{LH}]t [haʔ^H tɛy^H]t

'They are singing, dancing and drinking.'

d. 桌 凳 上 有 三 本 书

table on exist three MW book

CT tsoʔ^H tɛŋ^{HL} zɔ̃^{LH} y^{LH} se^{HL} pɛŋ^H sq^{HL}

TS [tsoʔ^H tɛŋ^L zɔ̃^L y^L se^M pɛŋ^{HL} sq^{HL}]t

两 支 笔 搭 一 台 电 脑

two MW pen and one MW computer

CT [ljā^{LH} tsq^L pjeʔ^H]t [taʔ^L jeʔ^H te^L di^{LH} nœu^L]t

'There are three books, two pens and one computer on the table.'

Similar to the languages analyzed in Section 7.1.3, these violations of the NP constraint can be explained by the List Restructuring rule proposed by Nespor and Vogel (1986), in which a single (complex) NP is broken down by inserting a boundary before each of the repeated item, except the first item.

7.2.3 Summary

In this section, I have examined the intonational phrase that is formed by intonation contours and potential pauses position, as well as the restructuring of IPhs in Ningbo dialect. I have demonstrated the IPh in the Ningbo dialect exhibits the similar behaviors as those discussed by Nespor & Vogel (1986) in Section 7.1.3.

On the one hand, root sentences and certain syntactic constraints, such as parenthetical expressions, nonrestrictive relative clauses, tag questions, vocatives, expletives, appositives, right dislocation, and certain moved elements, can create their own IPhs in the Ningbo dialect so that the basic formation of IPh in this language has been proposed following Nespor and Vogel's (1986) definition for cross-linguistic phenomena.

On the other hand, the restructuring of IPh also depends on non-syntactic factors including length, rate and style of speech as well as contrastive prominence. Moreover, three syntactic

restrictions, namely, NP constraint, relative clause constraint and obligatory argument constraint will put restriction on the restructuring of IPh. Similar as Nespor and Vogel's (1986) proposal for the hierarchy of the three constraints, the NP constrain is the strongest one, and the obligatory argument constraint ranks lowest while the relative constraint sits in the middle of the hierarchy.

Finally, I have shown that the rule of List Restructuring proposed by Nespor and Vogel (1986) can also account for the restructuring of the lists in Ningbo dialect.

7.3 Phonological Phenomena Related to the Intonational Phrase in the Ningbo Dialect

While the basic definition of the intonational phrase in the Ningbo dialect is defined as the domain where an intonation contour spreads, the intonational phrase also provides domain of application for certain phonological phenomena. On the one hand, most of the major tone sandhi phenomena cannot cross the boundaries between intonational phrases with few exceptions, as will be discussed in Section 7.3.3. Therefore, the tone sandhi that normally will apply within a phonological phrase or a clitic group, or the PTS rule that applies between two phonological phrases within the same intonational phrase will be blocked if the condition for application of TS is destroyed by the restructuring of intonational phrase. However, since there are several non-syntactic factors which can affect the intonational phrase restructuring, such as the rate and style of speech, if a single intonational phrase is uttered in a rapid speed or in a colloquial style, the phonological rule normally blocked under certain circumstance may be triggered. Moreover, there

are few tone sandhi rules which makes crucial reference to the intonational phrase in the Ningbo dialect so that it can provide further evidence for the intonational phrase as an independent constituent in the hierarchy in the Ningbo dialect. Let us begin with these special tone sandhi rule, as in Section 7.3.1.

7.3.1 Default Low Tone Assignment

As discussed in previous chapters, the default low tone may be assigned in two situations. First, when LTS applies within certain domain, all the syllables except the leftmost one will delete their tones, then the tone association convention will link the tonal features of the underlying form of the first syllable to the syllables within the domain in a one-to-one fashion. Moreover, because the number of the tonal features of the first syllable is limited, if there are floating syllable(s) which do not get assigned tone by the association convention, a default low tone will be assigned to each of them. On the one hand, default low tone can be assigned to the syllables of a proclitic that attaches to the host on the right side.

Moreover, default low tone may also be assigned within the domain of intonational phrase. As shown (33f), in the case of right dislocation, the right-dislocated item may have two alternative readings. On the one hand, it may keep its tone, while on the other hand, it could receive a default low tone.

However, the nature of these two TS phenomena are different since, in the former case, two

IPhs are formed by the right dislocation, the post-located item forms its own IPh domain, as in (47b), while in the latter case, the contrastive prominence is introduced to the pre-located item, which restructures the two IPhs into one IPh, as in (47c).

(47)a. [依 吃 饭 勒 伐?]t

you eat rice CRS Qu.

'Do you want to eat?'

TS [nɛu^{LH} tɛhyo^{ʔH} vɛ^{LH} la^{ʔL} va^{ʔL}]t

b. [吃 饭 勒 伐,]t [依?]t

eat rice CRS Qu. **you**

'Want to eat, you?' (right dislocation)

TS [tɛhyo^{ʔH}vɛ^{LH} la^{ʔL} va^{ʔL}]t [nɛu^{LH}]t (normal right-dislocation)

b. [吃 饭 勒 伐, 依?]t

eat rice CRS Qu. **you**

'Want to eat, you?' (right dislocation)

TS [tɛhyo^{ʔH}vɛ^{LH} la^{ʔL} va^{ʔL} nɛu^L]t (prominence on 吃饭了伐)

As shown in (47b), the post-located 依 'you' receives a default low tone. If 依 forms its own

IPh, there is no way for a default low tone be passed across the boundary between two IPh, thus, as shown in (47a), 依 'you' remains its tone. More examples can show the assignment of default low tone caused by restructuring two IPhs into one IPh in the Ningbo dialect as below.

(48) a. [其 勒 该 吃 饭]_t

he DUR DUR eat rice

'He is eating.'

TS [dzi^{LH} lje^{ʔL} kje^{ʔL} tɛhyo^{ʔH} vɛ^{LH}]_t

b. 勒 该 吃 饭 其

DUR DUR eat rice he

'(He) is eating, he.'

TS [lje^{ʔL} kje^{ʔL} tɛhyo^{ʔH} vɛ^{LH}]_t [dzi^{LH}]_t reading one

TS [lje^{ʔL} kje^{ʔL} tɛhyo^{ʔH} vɛ^{LH} dzi^L]_t reading two

c. 其 吃 饭 勒 该

he eat rice DUR DUR

'He eats, be doing.'

TS [dzi^{LH} tɛhyo^{ʔH} vɛ^{LH} lje^{ʔL} kie^{ʔL}]_t

d. 吃 饭 其 勒 该

eat rice he DUR DUR

'eat, (that is what) he is doing.'

TS [tɕhyoʔ^H_{vɛ^{LH}}]t [ɖzi^{LH} ljeʔ^L kjeʔ^L]t reading one

TS [tɕhyoʔ^H_{vɛ^{LH}} ɖzi^L ljeʔ^L kjeʔ^L]t reading one

(49) a. [我 勒 该 搭 其 买 肉]t

I DUR DUR for him buy meat

'I am buying meat for him.'

TS [ŋo^{LH} ljeʔ^L kjeʔ^L taʔ^L ɖzi^{LH} ma^L nyoʔ^{LH}]t

b. [我 搭 其 买 肉 勒 该]t

I for him buy meat DUR DUR

'I, buy meat for him, be doing.'

TS [ŋo^{LH} taʔ^L ɖzi^{LH} ma^L nyoʔ^{LH} ljeʔ^L kjeʔ^L]t

c. [我 勒 该 买 肉] 搭 其ᵀ

I DUR DUR buy meat for him

'I am buying meat, for him.'

TS [ŋo^{LH} lje^L kje^L ma^Lnyo^{LH}]ᵀ [ta^L dzi^{LH}]ᵀ reading one

TS [ŋo^{LH} lje^L kje^L ma^Lnyo^{LH} ta^L dzi^L]ᵀ reading two

d. [勒 该 搭 其 买 肉] 我ᵀ

DUR DUR for him buy meat I

'buying meat for him, I'

TS [lje^L kje^L ta^L dzi^{LH} ma^L nyo^{LH}]ᵀ [no^{LH}]ᵀ reading one

TS [lje^L kje^L ta^L dzi^{LH} ma^L nyo^{LH} no^L]ᵀ reading two

As shown in (47b), the pronoun, which originally was the subject of the root sentence in (47a), is assigned a default low tone. According to my informants, the prominence of the sentence falls onto the first newly created IPh, namely, the verb phrase, 吃饭了伐 'want to eat?'. Therefore, the left IPh receives the contrastive prominence and the IPh restructuring combines these two IPh into one, and assign a default low tone to the post-located subject 依.

Similarly, in the example in (48b), which is a declarative sentence, the pronoun is relocated to the end of the whole sentence and then optionally gets assigned a default low tone. As presented

in (48c), constituents other than subject can also be right-dislocated, such as the durative aspect makers, 勒 and 该. However, it should be noted that, even if the clitic(s) form a IPh by themselves, they are still unable to be treated as prosodic word so that they remain low tone. Moreover, as shown in (48c), the string which does not match any syntactic constituent may also be right-dislocated, i.e., 其勒该 'he is doing'.

Furthermore, the sentence in (49a) is changed to three sentences by the right dislocation, as seen in (40b-d), respectively. All the right-dislocated items, regardless of their original tone in (49a), can optionally change to default low tone. As for the right-located clitic(s), no matter of forming their own IPh or not, they always receive default low tone.

On the basis of the above observations, we can find there is a rule to assign default low tone to the items in an intonational phrase that do not receive contrastive prominence regardless of their syntactic structure or semantic meaning. The assignment of the contrastive prominence may also restructure two IPhs into one new IPh. The domain of application of this rule correspond to the intonational phrase in Ningbo dialect, which provides further evidence to support IPh as an indispensable domain of rule application in this language.

Another case of the assignment of default low tone comes from the sentence final 嘞 [lɛi^{LH}]. As mentioned in Chapter V, the sentence-final 嘞 [lɛi^{LH}] has two optional readings in a sentence. It either gets assigned a default low tone, as in (50a) or undergoes CTS when it is identified as an enclitic to form a clitic group with its preceding host, as in (50b). While the second reading is the

regular reading, the first reading is actually affected by IPh restructuring, which puts the contrastive prominence on the host, 大 'big'. Since 大 is the focus of the sentence, not only an IPh boundary is inserted before 大 'big' so that the original long single IPh is broken down into two IPhs, the LTS that is supposed to apply between 大 and its following element, the sentence-final 嘞 [lɛi^{LH}], is blocked also, as exemplified as in (50). The 大, which is contrastively prominent, is in bold and underlined.

(50)a. [[[[生 意]ω]φ [[做 ω 勒 c]CG]φ [[交 关]ω]φ [[大 ω 嘞 c]CG]φ]t

sã yi [[zɛu] laʔ] teio kue [[dɛu] lɛi]

business do PVP very big CRS

'The business has become very big!'

BT MHL H H LHL MHL MHL LHL LHL

LTS [M HL] [HL] [M HL] [LH]

CTS [M HL] [H L] [M HL] [L H]

PTS [M H] [H L] [M H] [L H]

b. [[[[生 意]ω]φ [[做]ω 勒 C]CG]φ [[交 关]ω]φ]t [[大]ω]φ 嘞]t

[[sã yi] [[zɛu] laʔ] [teio kue] [dɛu]] lɛi

business do PVP very **big** CRS

'The business has become very big!'

TS [M H H L M H]t [LH L]t

As shown above, while 大 is emphasized, it keeps its citation tone while the rest syllable(s) in the same IPh domain that is formed by IPh restructuring get assigned a default low tone.

This type of default low tone assignment also happens to longer IPhs, as demonstrated as follows. Compare the pair of sentences in (51-52). The emphasized item is in bold and underlined.

(51) a. [其 勒 该 吃 饭]_t

he DUR DUR eat rice

'He is eating.'

TS [dzi^{LH} lje^{ɔL} kje^{ɔL} tɛhyo^{ɔH} vɛ^{LH}]_t (regular speech)

b. [其 勒 该 吃 饭]_t

he DUR DUR eat rice

'He is eating.'

TS [dzi^{LH} lje^{ɔL} kje^{ɔL} tɛhyo^{ɔL} vɛ^L]_t (emphasize 其 'he')

(52) a. [该 是 我 的 书]_t

this is I POSS book

'This is my book.'

TS [kje^{ɔH} zɿ^L ŋo^{LH} go^{ɔL} sq^H]_t (regular speech)

b. [该 是 我 的 书]t

this is I POSS book

'This is my book.'

TS [**kjeʔ^H** z]L ηo^L goʔ^L sq^L]t (regular speech)

As shown above, when certain part of a sentence is emphasized, it will get contrastive prominence and start forming one IPh, all the syllables on its right side will change to low tone, which also explains the two optional readings in (50). Furthermore, the default low tone can also account for the irregular TS pattern of potential verb-complement phrases, which will be discussed in Section 7.3.2.

To conclude, in Section 7.3.1, I have discussed the default low tone assignment that make crucial reference to the IPh, which provides further evidence for the IPh as an dispensable constituent in the prosodic hierarchy of the Ningbo dialect.

7.3.2 Blocking and Application of TS Caused by IPh Restructuring

First, let's talk about the blocking cases resulted from the IPh restructuring in the Ningbo dialect. On the basis of the data collected from my informants, when a string is uttered in a very slow or formal speed or a particular part of a string is emphasized in Ningbo dialect, application of TS rules at certain positions will show a tendency to be blocked, as exemplified as follows.

Segments and tones in question are in bold and underlined.

(51) a. 我 要 打 其

I want to beat him

'I want to beat him.'

CT ηo^{LH} $\text{j}\text{o}^{\text{HL}}$ $\text{t}\tilde{\text{a}}^{\text{H}}$ $\text{d}\underline{\text{z}}\text{i}^{\text{LH}}$

TS $[\eta\text{o}^{\text{LH}}$ $\text{j}\text{o}^{\text{H}}$ $\text{t}\tilde{\text{a}}^{\text{H}}$ $\text{d}\underline{\text{z}}\text{i}^{\text{L}}]_{\text{t}}$ without emphasis

TS $[\eta\text{o}^{\text{LH}}$ $\text{j}\text{o}^{\text{H}}$ $\text{t}\tilde{\text{a}}^{\text{H}}]_{\text{t}}$ **$[\text{d}\underline{\text{z}}\text{i}^{\text{LH}}]_{\text{t}}$** emphasize on 其 'him'

b. 其 勒 教 室 里

he is at classroom inside

'He is in the classroom.'

CT $\text{d}\underline{\text{z}}\text{i}^{\text{LH}}$ $\text{l}\text{j}\text{e}^{\text{LH}}$ $\text{t}\text{e}\text{j}\text{o}^{\text{HL}}$ $\text{s}\text{o}^{\text{H}}$ $\text{l}\text{i}^{\text{LH}}$

TS $[\text{d}\underline{\text{z}}\text{i}^{\text{LH}}$ $\text{l}\text{j}\text{e}^{\text{L}}$ $\text{t}\text{e}\text{j}\text{o}^{\text{H}}$ $\text{s}\text{o}^{\text{L}}$ $\text{l}\text{i}^{\text{L}}]_{\text{t}}$ without emphasis

TS $[\text{d}\underline{\text{z}}\text{i}^{\text{LH}}$ $\text{l}\text{j}\text{e}^{\text{L}}$ $\text{t}\text{e}\text{j}\text{o}^{\text{H}}$ $\text{s}\text{o}^{\text{L}}]_{\text{t}}$ **$[\text{l}\text{i}^{\text{LH}}]_{\text{t}}$** emphasize on 里 'inside'

c. 我 要 走 上 去

I want to walk go up (directional complement)

'I want to go up.'

CT ηo^{LH} $\text{j}\text{o}^{\text{HL}}$ $\text{ts}\text{ə}\text{Y}^{\text{H}}$ $\text{s}\tilde{\text{o}}^{\text{LH}}$ $\text{t}\text{e}\text{i}^{\text{HL}}$

TS $[\eta\text{o}^{\text{LH}}$ $\text{j}\text{o}^{\text{H}}$ $\text{ts}\text{ə}\text{Y}^{\text{H}}$ $\text{s}\tilde{\text{o}}^{\text{L}}$ $\text{t}\text{e}\text{i}^{\text{L}}]_{\text{t}}$ without emphasis

TS [ŋo^{LH} jo^H tsəy^L]_t [sɔ̃^L tɛi^{HL}]_t emphasize on 上去 'go up'

TS [ŋo^{LH}]_t [jo^{HL} tsəy^L sɔ̃^L tɛi^L]_t slow rate of speech

We can find that each example in (51) may have two readings on the surface. In (51a), while the monosyllabic enclitic 其 'he/him' is not emphasized, it get assigned low tone spread from the preceding host, 打 'to beat' since they together form a clitic group type A ('host+enclitic'). By contrast, when it is assigned prominence, it is read in its citation tone since an IPh boundary is introduced right before it. Similarly, in (51b), when the sentence is uttered in a normal speech, the locative 里 'inside' undergoes LTS with its preceding host 教室 'classroom' since it is an enclitic. By contrast, if it is stressed, then an IPh will be assigned before it, thus, it remains its citation tone. Similar behavior can also be seen in (51c), where the LTS is blocked before the locative when it is emphasized. Moreover, when sentence in (51c) is uttered in a slow speed or the monosyllabic auxiliary 要 'want to' becomes the focus, PTS is blocked, thus, is remains its citation tone. Therefore, the examples in (51) can be considered as evidence to support that the IPh caused by non-syntactic factors including rate of speech and contrastive prominence, which play important roles in IPh restructuring across languages, also happens to the Ningbo dialect.

In Chapter VI, I have demonstrated that the domain for application of PTS is within the same IPh. As a matter of fact, neither of PTS or LTS rules, as well as assimilation, can cross the boundary of IPh, as exemplified as follows, in which the blocking of TS is marked by '#' and the sandhi form

ins question are in bold and underlined.

- (52) a. 天 要 落 雨 娘 要 嫁 人
 sky will drop rain mom want to marry people

'The sky is about to rain, the mother is about to remarry other man.'

CT thi^{HL} jo^{HL} loʔ^{LH} y^{LH} njã^{LH} jo^{HL} teia^{HL} niŋ^{LH}
 TS [thi^M jo^H loʔ^L y^{LH}]t # [njã^{LH} jo^H teia^H niŋ^{LH}]t

- b. 天, 漆 漆 黑, 风, 呼 呼 响
 sky lacquer lacquer black thunder mimetic word to sound

'The sky, is extremely black, and the wind, is making loud sounds.'

CT thi^{HL} tsaʔ^H tsaʔ^H haʔ^H foŋ^{HL} vu^{HL} vu^{HL} ɛjã^H
 TS [thi^{HL}]t [tsaʔ^H tsaʔ^H haʔ^H]t [foŋ^{HL}]t [vu^H vu^H ɛjã^H]t (slow speech)

Now, let's move to the other distinct phonological property of intonational phrase, which can trigger TS which are normally blocked in certain context. In the examples as presented below, when a constituent is emphasized, it begins a new shorter IPh by the IPh restructuring, the syllables staying in the same domain will all lose their original tones but undergoes LTS. The emphasized constituent is in bold and underlined.

(53) a. 我 要 喝 茶

I want to drink tea

'I want to drink tea.'

CT ηo^{LH} $\text{j}\text{o}^{\text{HL}}$ ha^{H} zo^{LH}

TS $[\eta\text{o}^{\text{LH}}$ $\text{j}\text{o}^{\text{H}}$ ha^{H} $\text{zo}^{\text{LH}}\text{t}]$ without emphasis

TS $[\eta\text{o}^{\text{LH}}\text{t}]$ $[\text{j}\text{o}^{\text{HL}}$ zo^{L} $\text{zo}^{\text{L}}\text{t}]$ emphasize on 要 'want to'

b. 其 是 依 爸 爸

he is your father

'He is your father.'

CT $\text{d}\text{z}\text{i}^{\text{LH}}$ $\text{z}\text{l}^{\text{LH}}$ $\text{n}\text{e}\text{u}^{\text{LH}}$ pa^{HL} pa^{HL}

TS $[\text{d}\text{z}\text{i}^{\text{LH}}$ $\text{z}\text{l}^{\text{L}}$ $\text{n}\text{e}\text{u}^{\text{L}}$ pa^{H} $\text{pa}^{\text{L}}\text{t}]$ without emphasis

TS $[\text{d}\text{z}\text{i}^{\text{LH}}$ $\text{z}\text{l}^{\text{L}}\text{t}]$ $[\underline{\text{n}\text{e}\text{u}^{\text{LH}}}$ pa^{L} $\text{pa}^{\text{L}}\text{t}]$ emphasize on 依 'your'

TS $[\text{d}\text{z}\text{i}^{\text{LH}}\text{t}]$ $[\underline{\text{z}\text{l}^{\text{LH}}}$ $\text{n}\text{e}\text{u}^{\text{L}}$ pa^{L} $\text{pa}^{\text{L}}\text{t}]$ emphasize on 是 'is'

c. 可 乐 我 喝 过 嘞

cola I drink EXP CRS

'I have drunk the cola.'

CT $\text{k}\text{h}\text{e}\text{u}^{\text{H}}$ $\text{l}\text{o}^{\text{LH}}$ ηo^{LH} ha^{H} $\text{k}\text{e}\text{u}^{\text{HL}}$ $\text{l}\text{e}\text{i}^{\text{LH}}$

TS $[\text{k}\text{h}\text{e}\text{u}^{\text{H}}$ $\text{l}\text{o}^{\text{L}}$ ηo^{LH} ha^{H} $\text{k}\text{e}\text{u}^{\text{L}}$ $\text{l}\text{e}\text{i}^{\text{L}}\text{t}]$ without emphasis

TS $[\text{k}\text{h}\text{e}\text{u}^{\text{H}}$ $\text{l}\text{o}^{\text{L}}\text{t}]$ $[\eta\text{o}^{\text{LH}}$ ha^{H} $\text{k}\text{e}\text{u}^{\text{L}}$ $\text{l}\text{e}\text{i}^{\text{L}}\text{t}]$ slow rate of speech

TS [kheu^H loʔ^L]t [ŋo^{LH} haʔ^L keu^L lei^L]t emphasize on 我 'your'

As we can see in (52a), when IPh is uttered without assigning any particular prominence, the monosyllabic auxiliary 要 'want to' is assigned a high tone by PTS. However, when the contrastive prominence is assigned to 要, an IPh boundary will be introduced right before it, and within the IPh domain starting with 要, 要 will remain its tone but the rest syllables in the domain get default low tone. Similarly, in (52b), when the auxiliary 是 'is' or the personal possessive pronoun 依 'your' is stressed respectively, they will start a IPh, respectively. The more interesting case is (52c), different from the examples in (52a) and (52b), the pronoun 我 'I', as the subject of the embedded sentence, remains its citation tone when uttered normally. Even when it is uttered in a slow speed, the tones of the syllables will not change. However, when 我 is emphasized to express the meaning like 'it is me who did this, not anyone else', 我 remains its tone and the rest syllables in the domain get default low tone.

Furthermore, the examples in (48) and (49) also show that the assignment of the contrastive prominence will combine two IPhs into one so that default low tone sandhi is triggered within this newly formed IPh.

Moreover, the assignment of contrastive prominence can also explain the TS pattern of potential verb-complement phrase which is distinct from that of the other verb-complement structures, as exemplified below.

- (53) a. 其 奔 勒 快
 he run PVP fast
 CT dʒi^{LH} pɛŋ^{HL} la^{LH} khua^{HL}
 TS $[\text{dʒi}^{\text{LH}}$ pɛŋ^{M} la^{H} khua^{HL}]_t descriptive resultative complement
 'He runs fast' (emphasize 快 'fast')
 TS $[\text{dʒi}^{\text{LH}}]_t$ [pɛŋ^{M} la^{H} khua^{L}]_t potential complement
 'He is able to run fast.' (emphasize 奔 'run')
- b. 其 学 勒 好
 he study PVP good
 CT dʒi^{LH} fio^{LH} la^{LH} ho^{H}
 TS $[\text{dʒi}^{\text{LH}}$ fio^{L} la^{H} ho^{H}]_t descriptive resultative complement
 'He studies well' (emphasize 好 'good')
- c. 其 学 勒 会
 he study PVP can; master
 CT dʒi^{LH} fio^{LH} la^{LH} wei^{LH}
 TS $[\text{dʒi}^{\text{LH}}]_t$ [fio^{L} la^{H} wei^{L}]_t potential complement
 'He is able to master.' (emphasize 学 'study')

Compare the pair of sentences in (53), when the verb phrase is a descriptive verb-complement, '奔勒' is one phonological phrase, within which LTS applies, and 快 is another phonological phrase which is another independent domain. However, when it is a potential complement phrase, although the surface syntactic structure is the same, the semantic meaning has changed, then the prominence is not assigned to the adjective 快 'fast' now. Similarly, as a resultative verb-complement phrase in (53b), 学勒 and 好 form two phonological phrases respectively, while in (53c), as a potential complement phrase, 学勒会 'be able to learn to master' as a whole forms one IPh.

Another case where the IPh restructuring results in different readings of a sentence is provided as follows.

- (54) 其 还 信 佛 教
 he also/still VP Buddhism
 CT dʒi^{LH} wa^{LH} eiŋ^{HL} vo^{LH} tejo^{HL}
 TS $[\text{dʒi}^{\text{LH}}]_{\text{t}}$ $[\text{wa}^{\text{L}} \text{eiŋ}^{\text{H}}]$ vo^{L} $[\text{tejo}^{\text{L}}]_{\text{t}}$ emphasize on 还信 'still believe'
 first reading 'He still believe Buddhism.'
 TS $[\text{dʒi}^{\text{LH}}$ wa^{L} $\text{eiŋ}^{\text{H}}]_{\text{t}}$ $[\text{vo}^{\text{L}}$ $\text{tejo}^{\text{HL}}]_{\text{t}}$ emphasize on 佛教 'Buddhism'
 second reading 'He also believe Buddhism.'
 TS $[\text{dʒi}^{\text{LH}}$ wa^{L} eiŋ^{H} vo^{L} $\text{tejo}^{\text{HL}}]_{\text{t}}$ without emphasis

As we can see in (54), in the first reading, 其 and 还信佛教 form two domains for LTS rule application, respectively, while in the second reading, 其还信 forms one domain while 佛教 forms the other. By contrast, when the sentence is uttered in normal speed, both readings may be possible. As provided in the glossary, the auxiliary 还 has two meanings, 'still' or 'also'. When it means 'still', semantically, it is modifying the action 'to believe Buddhism', on the other hand, when it mean 'also', it is referring to the object 佛教 'Buddhism', meaning besides believing one religion, he also believes Buddhism. Therefore, putting the prominence on different constituents in the sentence resulting in different shorter IPhs can trigger the selection of the semantic meanings that restored in the lexicon.

To conclude, in Section 7.3.2, I have shown that the IPh restructuring may result in blocking or application of phonological phenomena in the Ningbo dialect. Moreover, by using the contrastive prominence, not only can similar syntactic structures of different meanings be distinguished, it may also distinguish different semantic meanings that restored in the same lexicon.

7.4 Summary

In this chapter, I have examined the last prosodic constituent discussed in this dissertation, namely, the intonational phrase, in Ningbo dialect, including its definition, restructuring possibilities depending on syntactic and non-syntactic factors, as well as the phonological phenomena related to this domain. On the basis of Nespor & Vogel's proposal, as presented in

section 7.1, the intonational phrase in Ningbo dialect has been examined in Section 7.2 and 7.3. On the one hand, root sentences, and some certain types of constructions may form intonational domains as their own including parenthetical expressions, nonrestrictive relative clauses, tag questions, vocatives, expletives, appositives and certain moved elements. On the other hand, some non-syntactic factors, including length, rate and style of speech as well as semantic contrastive prominence play important role in IPh restructuring in the Ningbo dialect. In addition, the restructuring of IPh in Ningbo dialect is also restricted by NP constraints, relative clause constraints as well as the obligatory argument constraints, the three of which exhibit a degree of restriction. Finally, the cases of restructuring of lists in Ningbo dialect can also be solved by Nespor & Vogel's (1986) List Restructuring rule.

Therefore, the formation of the intonational phrase in Ningbo dialect is formulated as follows.

(55) Intonational Phrase (IPh) formation in Ningbo dialect

An IPh domain may consist of

- a. all the phonological phrases in a string that is not structurally attached to the sentence tree at the level of s-structure, or
- b. any remaining sequence of adjacent phonological phrase in a root sentence.
- c. IPh restructuring rule: an IPh formed by *a* or *b* can be broken down into smaller IPhs factors such as length, rate or style of speech, contrastive prominence, NP constraints, relative clause constraints, the obligatory argument constraints as well as

items included in a list are involved.

In Section 7.3, I have examined some phonological phenomena that make crucial reference to the IPh as their domains. On the one hand, all the TS rules are blocked cross the boundaries between IPhs. On the other hand, the non-syntactic factors, such as contrastive prominence, may violate some syntactic constraint to break down to smaller constituents and result in blocking of TS. However, these non-syntactic factors may also group constituents which is nonisomorphic to syntactic structure and TS will be triggered within the newly created IPhs. I also discussed the default low tone assignment caused by right-dislocation and contrastive prominence. Moreover, by using the contrastive prominence, the ambiguity of some sentences can also be made clear.

Chapter VIII. Final Remarks

This dissertation is dedicated to the study of the prosodic phonology of Ningbo dialect within the framework of the Relation-Based Approach (RBA). It not only provides a detailed description and analysis of the phonological system of Ningbo dialect in order to account for the deeply complex nature of its phonological structures may be accounted for, , but also contributes further evidence for use in the debate surrounding various theories within the framework of prosodic phonology.

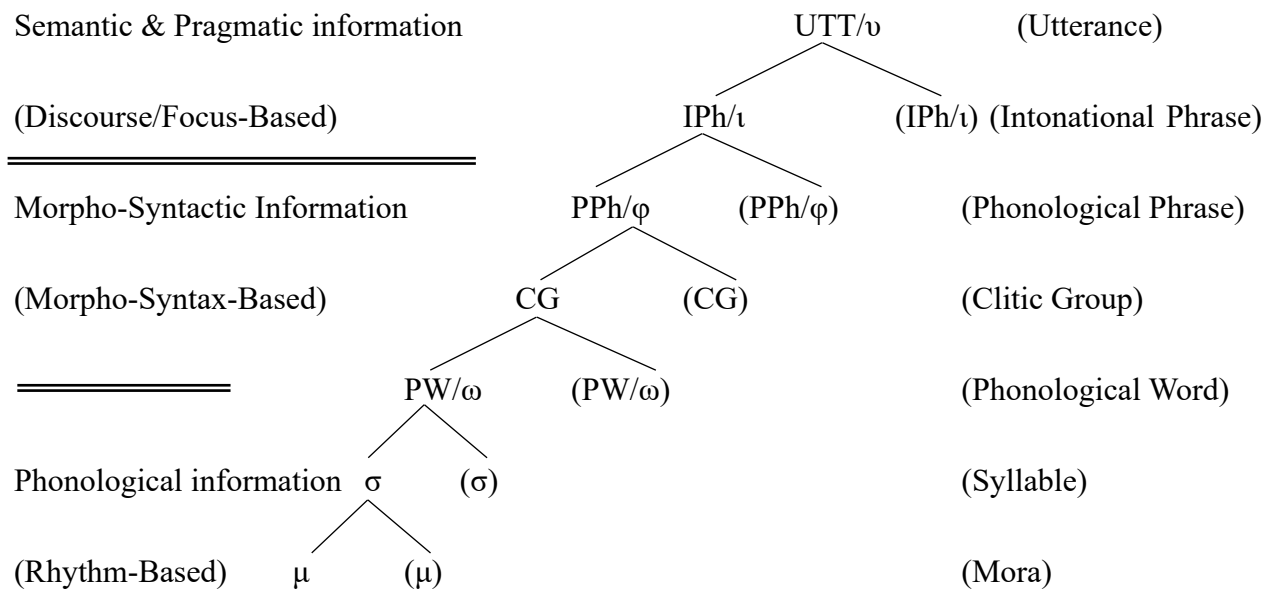
In order to fulfill these goals, I have studied most of the constituents in the prosodic hierarchy in Ningbo dialect, including syllable, foot, prosodic word, clitic group, phonological phrase as well as intonational phrase from the perspectives of their definitions, formations of each domain, and relevant phonological phenomena that make crucial references to the domain of each level. While most of the prosodic constituents should be established as independent domains in Ningbo dialect on the basis of the examination of relevant phonological phenomena, the foot, due to a lack of metrical binary contrast, does not play a role in this language. As Zhang (2017) argues, it does not make much sense to argue whether a particular prosodic unit, i.e., foot, does or does not exist in the prosodic hierarchy of a particular language because if a particular unit is not found in one language, i.e., Ningbo dialect, it does not mean that this unit does not exist in other human languages nor does it indicate the disqualification of this unit to be included in the universal

prosodic hierarchy of human languages.

Moreover, I have to make it clear that the main focus of this study is the interface between phonology and morpho-syntax, thus, it does not draw any attention to smallest and the largest units in the prosodic hierarchy in Ningbo dialect, namely the mora and the utterance.. Because, on the one hand, there is no phonological evidence reported to support the idea that mora plays an important role in application of any phonological phenomena in Ningbo dialect while Chinese languages, including Ningbo dialect, have been considered as non-quantifier-sensitive languages (cf. Chan 1985, Zhang 2014, 2017, among others). On the other hand, utterance, as argued by Zhang (2017), is merely a phonological counterpart of X^n since it can incorporate two or more sentences within its domain and the information that it makes use of is pragmatic information.

On the basis of the discussion of the prosodic constituents in Ningbo dialect from Chapter III through Chapter VII, following Zhang's (2017) proposal of the trisected universal prosodic hierarchy, I hereby provide the complete hierarchy in this language as follows:

Figure 9. Prosodic Hierarchy in Ningbo dialect



The definition and domain formation of each major prosodic constituent in Ningbo dialect discussed in this dissertation are provided as follows:

Prosodic domain	Formation rules and relevant phonological phenomena
Syllable (σ) (Discussed in Chapter III)	Formation rules: the domain of σ is a syllable Phonological Phenomena: Application of citation tone
Prosodic Word (PW/ ω) (Discussed in Chapter IV)	Formation rules: the domain of prosodic word in Ningbo dialect (a) The domain of prosodic word in Ningbo dialect is the terminal node of the syntactic tree if it contains four or fewer syllables, or

	<p>(b) Restructuring rules</p> <p>A syntactic word containing more than four syllables will be further divided:</p> <ul style="list-style-type: none"> i. based on on the rhythm effect if it is a monomoephenic word, or ii. based on the internal morpho-syntactic structure if it is a compound iii. the restructured domain must meet the minimal disyllabic word requirement. <p>Phonological Phenomena:</p> <ul style="list-style-type: none"> a. Application of LTS (lexical tone sandhi rule) b. Application of DTS (diminutive tonal sandhi rules) c. Rhythm effect
<p>Clitic Group (CG) (Discussed in Chapter V)</p>	<p><u>Formation rules:</u> the domain of the clitic group in Ningbo dialect consists of one independent (i.e., nonclitic) prosodic constituent in the morpho-syntactic-based hierarchy (i.e., prosodic word, clitic group, or phonological phrase) plus any adjacent</p>

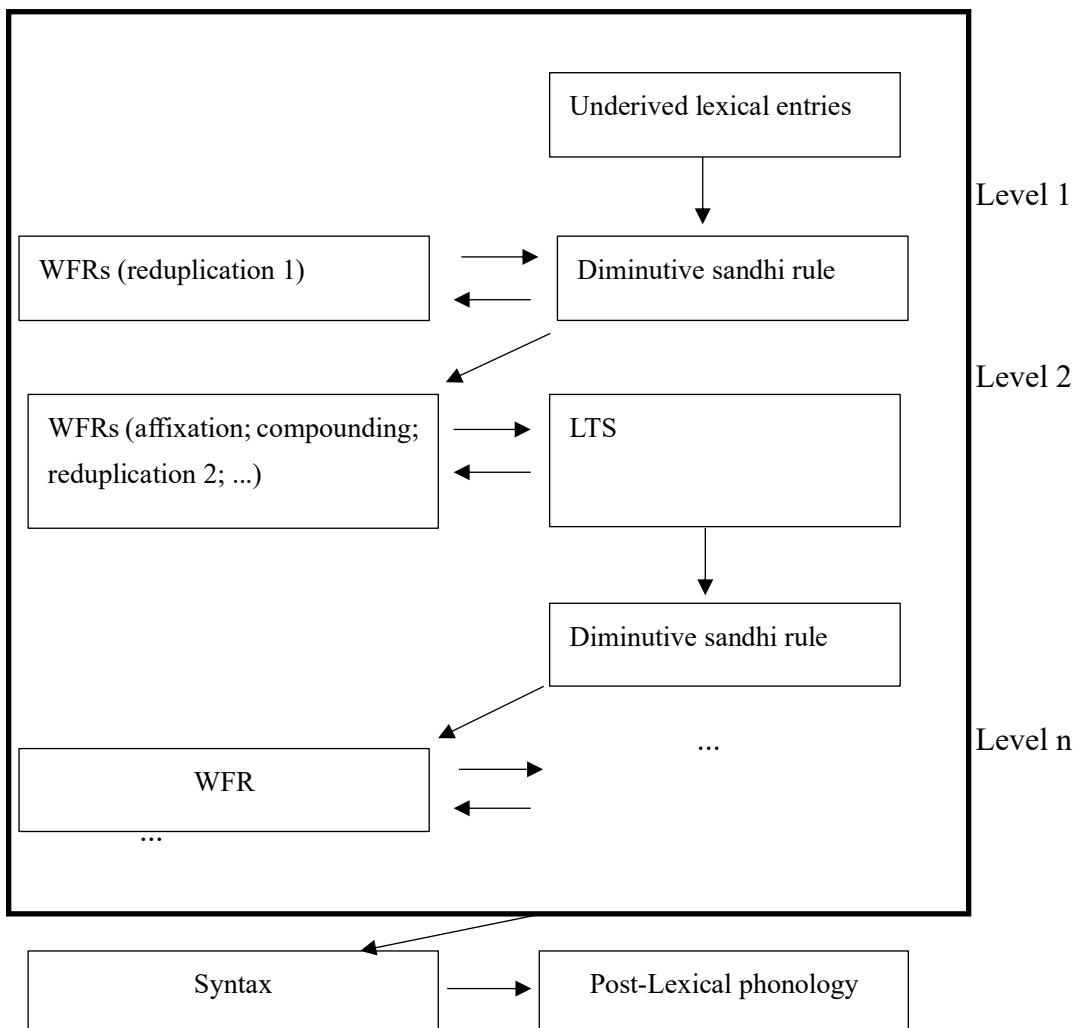
	<p>(a) directional clitic(s), or</p> <p>(b) non-directional clitic(s) that there is no possible host with which it or they share(s) more category memberships.</p> <p><u>Phonological Phenomena:</u></p> <p>a. Application of LTS (between the host and the enclitic)</p> <p>b. Application of Default Low Tone (between proclitic and the host)</p> <p>c. Application of assimilation of tones (between the verb host and the post-verb-particle)</p>
<p>Phonological Phrase (PPh/φ)</p> <p>(Discussed in Chapter VI)</p>	<p><u>Formation rules:</u> the domain of φ</p> <p>(a) consists of a clitic group which contains a lexical head (X) and all clitic groups on the non-recursive side up to the clitic group that contain another head outside of the maximal projection of X.</p> <p>(b) φ reconstructing</p> <p>A nonbranching φ which is the first complement of X on its recursive side is joined into the φ that contains X.</p> <p><u>Phonological Phenomena:</u></p>

	<p>a. Application of LTS (within the same phonological phrase)</p> <p>b. Application of PTS (at the juncture between two phonological phrases within the same IPh)</p>
<p>Intonational Phrase (IPh/t) (Discussed in Chapter VII)</p>	<p><u>Formation rules:</u> the domain of an IPh domain may consist of</p> <p>(a) all the phonological phrases in a string that is not structurally attached to the sentence tree at the level of s-structure, or</p> <p>(b) any remaining sequence of adjacent phonological phrase in a root sentence.</p> <p><u>Phonological Phenomena:</u></p> <p>a. Application of PTS (at the juncture between two phonological phrases within the same IPh)</p> <p>b. Application Default low tone</p>

On the basis of the summary of each constituent and the phonological phenomena relevant to each domain, we can find that that (i) a certain phonological phenomenon in Ningbo dialect may apply within one domain while it is blocked in other domains, i.e., PTS, which only applies to the position of the juncture between phonological phrases within the same intonational phrase; (ii) one Ningbo phonological operation could apply within more than one domain, .i.e., LTS, which can apply within prosodic words, clitic groups formed by the host plus enclitic as well as phonological phrases.

Furthermore, utilizing the previous research that has been performed on Mandarin Chinese and Chinese dialects, particularly Hongming Zhang's pioneering work on the prosodic phonology in various Chinese dialects as a base, I have also made a few discoveries based on my own research on Ningbo dialect.

In chapter IV, based on the observation of the order of application of LTS and DTS, following Zhang & Yu (2009) and Yu & Yin (2014), I have proposed the Lexical phonology in Ningbo dialect, as presented below:



Moreover, following Chen (2000) and Zhang (2017), I have argued that there exist disyllabic minimal word requirements and quadrisyllabic maximal word requirements in the formation of the prosodic word in Ningbo dialect. Based on the data of other dialects provided by Zhang and Chen, I propose that such kinds of word requirements must also exist in other Wu languages/dialects.

In Chapter V, as opposed to previous studies on Wu dialects which claim that function words can form TS domain with their preceding lexical item, influenced by Zhang (2017) and You (2017), I also distinguish the proclitic and enclitic in Ningbo dialect, which exhibit distinct phonological properties while satisfactorily accounting for the longstanding obscure TS issues within the CG domain.

In Chapter VI, by employing the formation rule of PPh proposed by Nespor and Vogel (1986) as well as the insight of the verb-movement within adverbial MH pointed out by Zhang (2017), I have not only solved the odd classification of the TS patterns in Ningbo dialect, but also defined the condition where PTS applies.

To sum up, this dissertation not only provides a comprehensive description of the phonological system of Ningbo dialect, especially the phonological tone sandhi rules and their interactions with other components of the grammar (precisely speaking, how each phonological phenomenon makes reference to certain types and amount of morphosyntactic or semantic information in this language), but also, based on the previous insightful theories, it successfully accounts for many outstanding phonological phenomena in Ningbo dialect as well as correcting some false impressions about the

TS patterns in this language such as the TS phenomena within the clitic group domain. Moreover, because the object of this dissertation is the new Ningbo dialect which is spoken by the younger generation of Ningbo citizens, this dissertation also provides this first-hand data as valuable resources for future studies on this dialect.

As for the theoretical contribution of this dissertation, this study on Ningbo dialect provides further evidence to support the main claims in the theory of prosodic phonology, particularly the Relation-Based approach (RBA), as well as many insightful proposals and hypotheses in the field. First of all, it provides solid evidence for the RBA and the existence of the prosodic hierarchy as well as the constituents on different levels to which various phonological phenomena and phonetic processes make reference. Second, the domain of the formation of each domain in Ningbo dialect further proves that a certain prosodic constituent domain must make reference to a specific type and certain amount of syntactic information. However, following Nespor and Vogel (1986), the proposal made based on the data in the Ningbo dialect also shows that the prosodic constituents are not necessary to be isomorphic with any morpho-syntactic structures. Third, this dissertation provides evidence to support Zhang's (2017) insight that, although the prosodic hierarchy universally exists in human languages, it does not mean that every unit in the hierarchy has to exist in a particular language. Fourth, this dissertation offers further evidence for Zhang's (2017) stipulation of the prosodic hierarchy, in which he argues that, while Non-recursivity is inviolable between the units of different major hierarchy, it can optionally be violated in the same hierarchy.

For example, a clitic group may dominate a phonological phrase, and a phonological phrase may directly dominate a prosodic word, which also indicates that other principles of the Strict Layer Hypothesis may also be violable under certain circumstances. Therefore, a weakened version of the Strict Layer hypothesis (Zhang, 1992, 2017) is assumed in this dissertation.

Finally, there are also some problems which remain in question. For example, whether a lower constituent in the morpho-syntactic-based hierarchy, i.e., prosodic word and clitic group, must or optionally be upgraded to the higher unit, i.e., the phonological phrase is still unclear since both approaches can account for the phonological phenomena within the IPh in Ningbo dialect. Moreover, the motivation of the assimilation of tones that occurs in the post-verb-particles is still in question which will be one of the objects of my future research in this language.

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