MASTER'S THESIS

Reduplication Tone Sandhi in Chongqing Mandarin: An Optimality Theoretic Analysis

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REDUPLICATION TONE SANDHI IN CHONGQING MANDARIN: AN OPTIMALITY THEORETIC ANALYSIS

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We hereby recommend that the Dissertation by Shen Xinlei entitled "Reduplication Tone Sandhi in Chongqing Mandarin: An Optimality Theoretic Analysis" be accepted in partial fulfilment of the requirements for the degree of Master of Arts in Language Studies.

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ABSTRACT OF THE DISSERTATION

This dissertation investigates AA reduplication tone sandhi in Chongqing Mandarin. This dissertation offers f0 profiles to establish that the four monosyllabic tones are indeed [LH, HL, LHL, HLH]. I propose that monosyllabic tones in Chongqing Mandarin are derived from a simple underlying tone inventory /L, H, LL, HH/ if one appeals to a combination of several universal constraints: (i) the OCP and (ii) the preference for each tone-bearing unit to be associated with one tone feature. Each monosyllabic tone has an AA reduplication form [LH. HH], [HL. LL], [HH. HL], [HL. LH], which fully duplicate the segment material. AA reduplication tone sandhi is derivable from inputting any one of the underlying tones and mapping those features to two syllables (one base syllable and its duplication) through the ranking of constraints in monosyllabic tones, additional alignment constraints and comparative markedness constraints. This analysis extends itself readily to account for most ditonal sandhi patterns sandhi adopting the ranking hierarchy of universal constraint.

A novel part of the study lies in not requiring any initial mapping between the tones and the moras. Mapping tones to moras is derivable through a tone to tone-bearing mapping model in the dissertation, which provides a crisper principled account for Chongqing AA reduplication tone sandhi.

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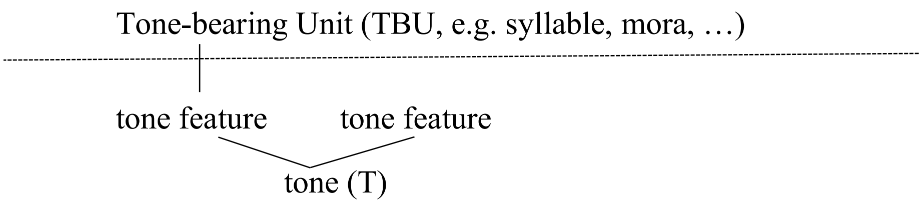
Chapter One

INTRODUCTION

Through a study of tonal alternations of Chongqing (Southwest Mandarin) reduplicative patterns, this thesis argues for an analysis where tone features map to syllables even though at a tonal tier these features themselves form a tonal constituency, schematically given in (1-1).

(1-1) Mapping tones to tone-bearing units



For those who imagine that the tone T in (1-1) is directly mapped to the TBU, the view advocated by this thesis is somewhat unconventional. This thesis will show that the view advocated here provides a crisper principled account for Chongqing AA reduplication patterns than other alternatives.

1.1 Patterns of reduplication in Chongqing

Reduplication as a morphological process is common in Chinese languages, often expressing meanings of diminution, and intensification, among other possibilities (Lu 2000). According to different parts of speech, reduplications can be categorized into noun reduplication, verb reduplication, adjective reduplication, etc. Noun reduplication is prominent in Chongqing Mandarin, exhibiting four patterns: AA, AAB, ABB, and AABB (Yu 1988), exemplified below.

(1-2) Four patterns of noun reduplication in Chongqing

Reduplication category	**Examples**
AA pattern	眼眼 *yanyan.* "pinholes"
AAB pattern	梭梭板 *suosuoban* "slide"
ABB pattern	纸飞飞 *zhifeifei* "paper scrap"
AABB pattern	咔咔角角 *kakagogo* "corner"

This essay focuses only on the AA pattern noun reduplication (AA reduplication for short later) and shall have no more to say of the others. As far as the AA pattern is concerned, even though reduplication produces different semantico-syntactic effects for different word classes, the tonological patterns are largely stable across the word classes. It is noteworthy that the AA pattern is the most productive (Wang 2011).

AA reduplication in Chongqing fully duplicates the segments of the source syllable. There is therefore nothing much in terms of the segmental phonology here that interests us. What is curious is the effects AA reduplication has on tone, as can be seen in (1-3).

(1-3) Tone sandhi in AA reduplication pattern

Tone category	**Monosyllabic tone**	**Reduplication tones**
T(one)1	σ rising	σ σRED rising high
T2	σ falling	σ σRED falling low
T3	σ peaking	σ σRED high falling
T4	σ dipping	σ σRED falling rising

For the moment, let us assume that the syllable marked RED is the reduplicant, although in Chapter 4.1, it would be demonstrated that this is a more viable option than otherwise. What is interesting about the patterns in (1-3) is how the reduplicated form appears to have partially corresponded to the tone of the monosyllabic form. For T1 and T2, the source tone is preserved in the first syllable of the AA form. In T3 and T4, it appears that two syllables together reconstruct the peaking or rising patterns. Evidently, reduplication is principled, and an account is necessary. At the same time, the patterns do not lend themselves to any obvious simple algorithm. Accounting for these patterns would be the main objective of this thesis.

1.2 Full and partial reduplication

When studying reduplications in a tonal language, one need to consider reduplication models in the phonologic segment and tone levels. Many languages copy entire segments, such as Warlpiri forms of plural nouns (Nash 1980:130-132), shown in (1-4a). Partial reduplication presents through reduction from full reduplication (Steriade 1988). For example, in Korean, reduplicative morpheme (RED for short later) only copies the prefix of the Base, shown in (1-4b).

(1-4) Full and partial reduplication examples (cf. Nash 1980)

a. Full reduplication in Warlpiri

Base	Reduplicated
kurdu ‘child’	kurdukurdu ‘children’

b. Partial reduplication in Korean (cf. Kim 2003)

Base	Reduplicated
kolu	kol-kolu

This classification can also be applied at the tone level. In full reduplication, the whole tone of the base morpheme (Base for short later) is copied to the reduplicant (McCarthy & Prince 1988). In the partial reduplication model, only partial tone of the Base transfers to RED (Marantz 1982). In other words, the whole tone of the Base will not appear on the RED. Thus, reduplications can also be classified as full and partial patterns on the tonal level.

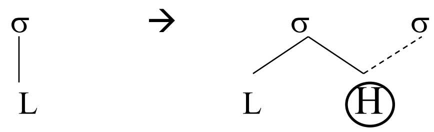
In Chongqing Mandarin, it is clear that AA reduplication fully duplicates the segmental material (cf. Table 1-3). However, it is hard to tell which reduplication patterns AA reduplication belongs to on the tonal level. According to (1-3), the tone of the Base keeps still in the Base and the RED duplicates the last half of the tone contour in T1 and T2 reduplication. Thus, it is reasonable to treat T1 and T2 reduplications as partial reduplications. However, in T3 and T4 reduplications, the tone of the Base is not fully saved in either segmental part of AA reduplication. T3 AA reduplication even deletes the low feature. I assume that AA reduplication in Chongqing belongs to a third possibility in addition to full and partial mentioned above. Later chapters will attempt to answer this question.

1.3 Surface and underlying tonal inventory

In Chongqing Mandarin, one observes that six different tones are found across syllables that appear in monosyllabic and reduplicative contexts. The six tones are rising, falling, peaking, dipping, high, and low. What might be original in this study is the postulation that the four underlying tones are /L, H, LL, HH/. The tones found in AA reduplicative forms may be principles (see Chapter 3 for details). A schematic summary of how the assumed underlying representations would yield the surface AA tonal forms given in (1-5), and the detailed analysis will be shown in Chapter 4. The inserted tonal features are circled, underlying tones are un-circled.

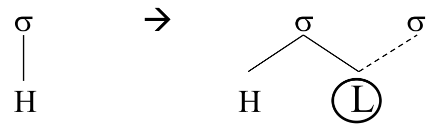
(1-5) Suppose underlying tones are /L, H, LL, HH/, tones in AA are derived.

a. How /L/ derives the T1 AA reduplicative tones



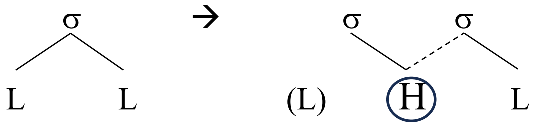
, Tone inserting and spreading

b. How /H/ derives the T2 AA reduplicative tones



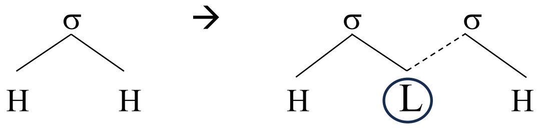
, Tone inserting and spreading

c. How /LL/ derives the T3 AA reduplicative tones



, Tone inserting, spreading, and deleting

d. How /HH/ derives the T4 AA reduplicative tones



, Tone inserting and spreading

1.4 Overview of the dissertation

This chapter provided a mapping model (tones to tone-bearing units), which would unravel the tone sandhi puzzle in the AA reduplication in Chongqing. Then, it provides basic information about reduplications in Chongqing, which includes the reduplication patterns, underlying and surface tone inventory, and AA reduplication tone sandhi in Chongqing. Chapter 2 will review previous studies in Chongqing tones and establish the Chongqing tones through analyzing F0 profiles of the participant, which provide a more accurate way to study Chongqing tones and facilitate the later analysis. Before figure the tone sandhi in AA reduplication in Chongqing, Chapter 3 will derive the Chongqing monosyllabic tone inventory based on Optimality Theory. Then, Chapter 4 will also use Optimality Theory to derive AA reduplication tone sandhi in Chongqing. Chapter 5 will test whether the analysis in Chapter 4 is compatible with normal disyllabic tone sandhi. Chapter 6 will conclude the dissertation and list disadvantages of the dissertation which can be improved in the future.

Chapter Two

ESTABLISHING CHONGQING TONES THROUGH FUNDAMENTAL FREQUENCIES

2.1 Variability in description of the Chongqing tone inventory

The earliest study on tones of Chongqing Mandarin carried out in the 1940s. Ding described and analyzed the tone of Baxian (the ancient name of Chongqing) in 1941, which was contained in *Sichuan Fangyan Diaocha Baogao* (Yang 1984). In the 1950s, Sichuan University Dialect Survey Group (hereafter SDSG) studied the dialects in Sichuan province (Chongqing was a city under Sichuan province jurisdiction before 1997). Zhai (1996) described the tones of Chongqing Mandarin in *Chongqing Fangyan Zhi* (Chongqing Mandarin Records). SDSG and Zhai's descriptions of four Chongqing tones are the same. Ding's description of T4 is different from other people.

More recently, Liang & Meng (2012) used T-values to make an experimental study of four tones in Chongqing Mandarin. Zhu (2012) made the experimental study of Chongqing tones through the Z-score (LZ method). These results are summarized in (2-1).

(2-1) Inventory tones in Chongqing Mandarin.

Researchers and year	**T1-Yinping**	**T2-Yangping**	**T3-Shangsheng**	**T4-Qusheng**
Ding (1941)	[55]	[31]	[42]	[25]
SDSG (1960)	[55]	[21]	[42]	[214]
Zhai (1996)	[55]	[21]	[42]	[214]
Liang & Meng (2010)	[45]	[31]	[341]	[213]
Zhu (2012)	[45/455]	[32]	[342/442]	[324]

Ding, SDDG, and Zhai describe T1 in Chongqing Mandarin as [55], a high flat tone, while Liang & Meng and Zhu believe that T1 is a high rising tone [45]. As for T2, although tone values are different, researchers seem agree that T2 is a low falling tone.

When it comes to T3, Ding, SDDG, and Zhai agree on the tone value [42], a higher falling tone than T2. However, Liang & Meng and Zhu describe T3 as a convex tone. The descriptions of T4 are quite consistent, almost all researchers agree that it is a concave tone. Ding represents a special case, describing T4 as a rising tone [25].

Studies on AA reduplication tone sandhi are very scarce and have not reached a consistency. Zhai (1996) believes that sandhi applies to the second syllable in all cases of AA. All tones of the second syllable are flat tones in AA reduplication form. Liu (1997) mentioned that when the morpheme of the reduplication is a noun, the tone of the second syllable in T1, T2, and T4 reduplication becomes half tone contour of the monosyllabic tone. Huang (2011) believes that in T1,T2, and T3 reduplication, the tone of the first syllable remains the same with the monosyllabic tone, while the tone of the second syllable becomes half T1, which is [5]. Liu and Huang both agree that the T3 reduplication in Chongqing Mandarin does not have tone sandhi. Table (2-2) summarizes three studies of the AA reduplication tone sandhi in Chongqing Mandarin.

(2-2) AA reduplication tone sandhi in Chongqing Mandarin.

Tone category	**Zhai (1996)**	**Liu (1997)**	**Huang (2011)**
T1	[55,55] → [55,44]	[55,55] → [55,5]	[45,45] → [45,5]
T2	[21,21] → [21,55]	[21,21] → [21,1]	[21,21] → [22,5]
T3	[42,42] → [42,22]	[42,42] → [42,42]	[42,42] → [44,42]
T4	[214,214] → [214,44]	[214,214] → [214,13/24]	[213,213] → [21,5]

The discrepancies in the descriptions in (2-1) and (2-2) call for an acoustic study of these tone properties to establish a reliable phonetic description of Chongqing Mandarin tones. This will be the subject of the present chapter.

2.2 Data elicitation and analytical framework

Despite the differences, variability in the descriptions given in (2-1) and (2-2) appears to be quite small. For the present purposes, I draw upon recordings made some years before I had decided to embark on the study of AA reduplication in Chongqing. The recordings came from a 23yo male (living in the Zhucheng district) whom other users of Chongqing Mandarin had judged to be typical.[1]

40 monosyllable words are selected for recording, 10 syllables for each tone. All words were taken from *Chongqing Fangyan Zhi* (Chongqing Mandarin Records, Zhai, 1996). Target words were randomly presented to the participant to read with noise fillers. The readings are recorded on a MacBook and saved as WAV files.

Pitch tracks were extracted and time-normalized using Praat script ProsodyPro (Xu, 2013). Average F0 values have been obtained at 10% intervals of the duration of each syllable excluding the onset. The pitch values at 10 measurement points of four tones in Chongqing are shown in (2-3).

(2-3) The pitch values at 10 measurement points of four tones.

	Measurement intervals					>>
	10%	20%	30%	40%	50%	
T1	141.4	126.9	130.0	136.6	144.3	
T2	116.6	123.3	124.2	123.1	121.1	
T3	112.5	117.1	119.7	112.2	124.6	
T4	112.7	105.5	101.5	98.9	98.1	

	Measurement intervals				
	60%	70%	80%	90%	100%
T1	152.9	162.0	170.8	177.3	177.3
T2	118.4	115.1	111.5	108.0	105.9
T3	125.7	124.8	121.6	116.0	110.6
T4	98.9	101.0	105.3	111.0	115.5

The AA reduplication words in this study were collected from 四川方言词汇释 *Sichuan Fangyan Cihui Shi* ‘The Paraphrase of Words in Sichuan Mandarin’. The total

[1] It was not possible at that time to obtain or apply for ethics clearance with HKBU back when this data was collected. This was a private study conducted on my own to understand certain properties of the Chongqing Mandarin before I embarked on the project of this dissertation. Further, the elicitation was non-invasive and aligned with standard procedures that typify such studies.

number of target reduplication words is 60, including 20 Tone1 reduplications, 18 Tone2 reduplications, 12 Tone3 reduplications, and 10 Tone4 reduplications. The recording procedure of AA reduplicative tones is the same with monosyllabic tones. Average F0 values have been obtained at 10% intervals of the duration of each syllable, there are 20 measurement points for one AA reduplication. The pitch values of 10 measurement points of the first syllable and second syllable are separately in (2-4) and (2-5).

(2-4) The pitch value of the first syllable in AA reduplications.

	Measurement intervals					
	10%	20%	30%	40%	50%	>>
T1	118.6	120.6	122.6	125.2	128.9	
T2	121.0	119.1	118.2	117.0	116.8	
T3	125.5	124.9	124.7	124.6	124.4	
T4	110.7	110.3	109.8	109.3	108.2	

	Measurement intervals				
	60%	70%	80%	90%	100%
T1	132.7	136.0	139.1	142.9	147.7
T2	116.8	116.8	116.7	116.7	117.7
T3	124.2	123.8	123.4	123.6	124.8
T4	107.3	106.6	106.5	107.5	110.1

(2-5) The pitch value of the second syllable in AA reduplications.

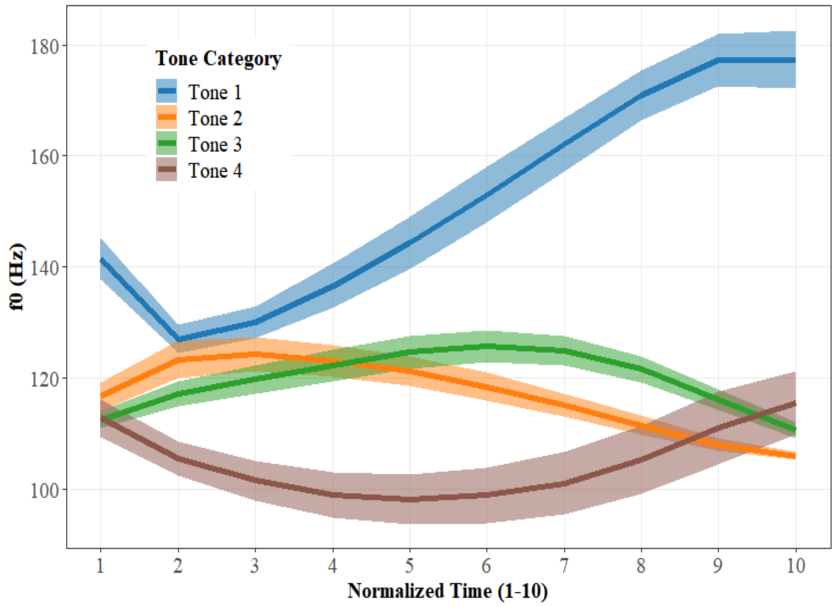
	Measurement intervals					
	10%	20%	30%	40%	50%	>>
T1	156.0	158.9	160.2	160.0	159.0	
T2	121.2	123.3	124.2	123.9	123.3	
T3	127.0	125.6	123.5	120.7	118.3	
T4	117.1	121.6	124.9	126.9	128.4	

	Measurement intervals				
	60%	70%	80%	90%	100%
T1	158.0	157.3	156.9	156.9	156.5
T2	122.7	122.5	122.7	122.7	123.0
T3	116.6	115.1	114.2	113.7	112.9
T4	130.0	131.3	132.4	132.7	133.1

2.3 F0 profiles of monosyllabic tones

To observe the citation tone in Chongqing straightforwardly, these data in (2-3) have been put in R Studio to draw time-normalized f0 profiles of four tones in Chongqing and presented in (2-6).

(2-6) F0 profile of four Chongqing tones.



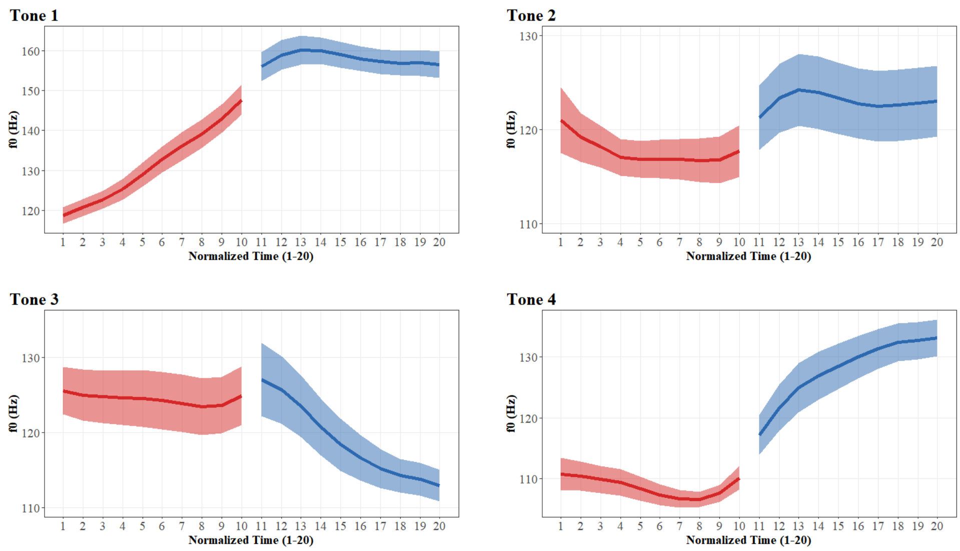
In (2-2), the solid line with a blue shadowing is the f0 of Tone1, the solid line with an orange shadowing is the f0 of Tone2, the solid line with a green shadowing is the f0 of Tone3, and the solid line with a brown shadowing is the f0 of Tone4. The solid lines indicate the mean value of f0 of four tones. The shadowing areas mean the standard deviation of the average f0.

From (2-6), it can be seen that four tones in Chongqing are four different tone contours. As for T1, it starts at 140 Hz and rises to 180Hz at the end. Thus, it is reasonable to treat T1 as a rising tone. T2 seems like a falling tone, though the falling is not significant, from 125Hz to 115Hz. As for T3, the maximum pitch value is in the middle of the tone, showing a convex tone contour. However, the minimum pitch value of the T4 is in the middle of the tone. The pitch value at the beginning and the end are almost even. Thus, T4 is a concave tone.

2.4 F0 profiles of AA reduplicative tones

To observe the tone sandhi in AA reduplicative form more straightforwardly, these data in (2-4) and (2-5) have been put in R Studio to draw time-normalized f0 profiles and presented in (2-7).

(2-7) The f0 profiles of AA reduplication in four tones.



In table (2-7), lines with a red shadowing mean the f0 of the first syllable of reduplications, and lines with a blue shadowing mean the f0 of the second syllable. Observe table (2-7), it seems that tone sandhi appears in all four tones A_1A_2 (A_1 stands for the first syllable, A_2 stands for the second syllable) pattern reduplications in

Chongqing. In T1 and T2 reduplication, the tone of A_1 remains the same as that of monosyllabic form, while the tone of the A_2 becomes a high flat tone and a low flat tone. The convex and concave tone contours of T3 and T4 in monosyllabic form do not remain in reduplicative form. The pitch profile of the A_1 in T3 reduplication becomes a high flat tone and that of A_2 becomes a falling tone. The tone of the A_1 and A_2 in T4 reduplication retains the first half and last half of its citation tone separately. Thus, the tone of A_1 and A_2 is a falling tone and a rising tone.

2.5 A tone feature description of Chongqing tones

To facilitate the analysis in the later Chapter, H(igh) and L(ow) features are used to describe tones in monosyllabic and reduplication forms. Since later analysis does not need accurate tone value of these tones, T-value of Chongqing tone inventory is not calculated in this study. According to the f0 profile in (2-6) and (2-7), four monosyllabic tones in Chongqing are presented in (2-8) and tones in reduplicative form are presented in (2-9).

(2-8) The tone inventory of monosyllabic in Chongqing.

Tone category	**Monosyllabic form**
T1	[LH]
T2	[HL]
T3	[LHL]
T4	[HLH]

(2-9) The tone inventory of AA reduplication form in Chongqing.

Tone category	**Reduplication form**	**Example**
T1	[LH, HH]	渣渣 ‘rubbish’
T2	[HL, LL]	盆盆 ‘basin’
T3	[HH, HL]	果果 ‘fruit’
T4	[HL, LH]	院院 ‘yard’

Chapter Three

DERIVING THE CHONGQING MANDARIN TONAL INVENTORY

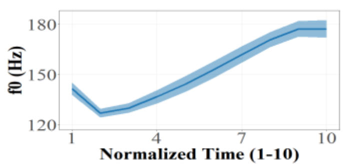
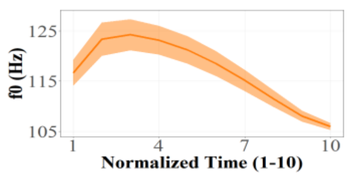
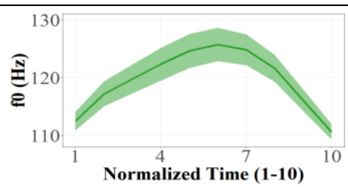
The four monosyllabic surface tones in Chongqing Mandarin raise the question of how and why these make up the tonal inventory rather than others. This chapter explains how these four surface tones would be generated by a set of ranked universal constraints even when considering a varied set of inputs required by *Richness of the Base.* From here, one might even reasonably argue that the underlying tonal inventory can then be reduced to just /H, L, HH, LL/, counterintuitive as the last two might appear.

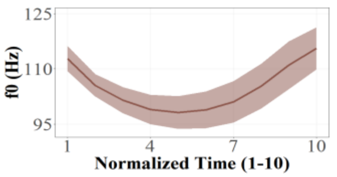
Although optimality theory is employed here, the conclusions reached do not commit one to this framework. It is more important to grasp from this discussion the acceptance of a model for where tone features map directly to tone-bearing units rather than mediated through nodes that organize these features.

3.1 The phonological representation of Chongqing Mandarin tones

Based on f0 profiles extracted for the four tones in Chongqing Mandarin (cf. Graph 2-6), it is reasonable to represent these tones phonologically as given in (3-1).

(3-1) Representation of the four Chongqing Mandarin tones

	Representation	**f0 profile (cf. Graph 2-6)**
a.	Tone 1 low high	
b.	Tone 2 high low	
c.	Tone 3 low high low	

d.	Tone 4 high low high	

The main idea behind (3-1) is that a tone contour is made up a sequence of tone features (Bao 1990: 36; Wee 2019:77). When these tone features are then mapped into syllables, then that syllable bears tones. Applying the moraic model in (1-1), syllables corresponding to each of the four tones would appear as (3-2).

(3-2) Mapping the tones to syllables in Chongqing Mandarin

Tone 1: σ μ μ low high T(one) 1	Tone 2: σ μ μ high low T2
Tone 3: σ μ μ low high low T3	Tone 4: σ μ μ high low high T4

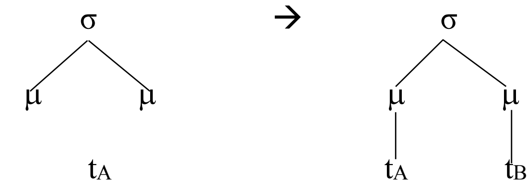
In using representations as seen in (3-2), I take a position where the tone features map to the moras that project to or from the syllable. This may not be the most commonly conceived model since one might have expected such nodes as T1, T2, T3, and T4 to be mapped to the tone-bearing units. As will become evident in section 3.2, this provides a coherent and convenient way of demonstrating how the Chongqing Mandarin tonal inventory can be derived from fundamental principles of organizing input tone features. Looking through the tonal inventory, one will notice that all tones are basically simple combinations of [high] and [low] features and appear to exhaust the logical possibilities of combination. If there were two features [low] and [high], then possible bi-featural combinations are only LH (i.e. [low][high], and similarly hereafter) and HL, if one could somehow discount level tones (i.e. just [high] or [low] being shared by both moras). With that same proviso, tri-featural combinations would only be LHL and HLH. Thus, the Chongqing Mandarin tonal inventory can be viewed as a simple matter of combinatorial possibilities subject to a constraint in the number of features.

3.2 *Richness of the base* and *Freedom of Analysis* in relation to Chongqing Mandarin

Stipulating that tones in Chongqing Mandarin are as given in (3-2) does not explain why those are precisely the tones. Within Optimality Theory, that inventory should be derivable from a ranked hierarchy of universal constraints under the stringent conditions set by the *Richness of the Base* (Prince & Smolensky 2004: 64). Specifically, one must be able to explain how any of the given inputs in (3-3) would yield only the corresponding outputs given therein.

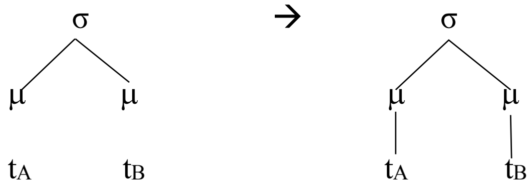
(3-3) Different Input-output Mappings

a. Where input contains one tone feature



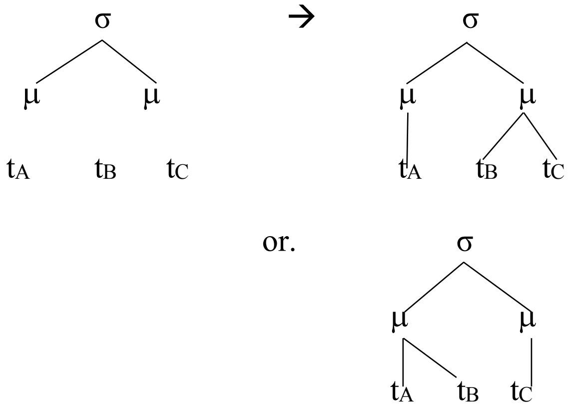
, epenthesis of tone feature

b. Where input contains two tone features



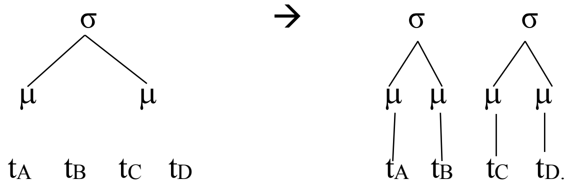
, simple mapping of both tone features to two moras

c. Where input contains three tone features



, simple mapping of all tone features to two moras

d. Where input contains more than three tone features



, epenthesis of another syllable and two moras

Note that in (3-3) there is no initial mapping between the tones and the moras. After all, if the associations can be derived, there is no need to have them stipulated in the input. This would also be the more challenging case.

From these rather varied input possibilities, a successful account must also rule out candidates that can be generated based on such inputs. Such is the demand of *Freedom of Analysis* in Optimality Theory. A suitable set of ranked universal constraints must logically derive all and only the possible monosyllabic tonal forms regardless of the theoretical possibilities in the varieties of input and candidates.

3.3 Relevant constraints

The analysis this chapter presents call for the constraints listed in (3-4). The reader will notice that these are all rather standard constraints. The ensuing paragraphs shall demonstrate the effects of each of these constraints and their interactions with one another.

(3-4) Constraints for Chongqing Mandarin[2]

*MULTILINK[t, μ][3]
Assign one violation mark for each additional mora linked to a tone feature.

*MULTILINK[μ, t]
Assign one violation mark for each additional tone feature linked to a mora.

OCP
Assign one violation for every adjacent identical tone feature.

BIN (Adapted from Green 1995)
Assign one violation mark for each syllable which does not have two moras.

MAX-t
Assign one violation mark for each tone feature in the input that does not have a correspondent in the output.

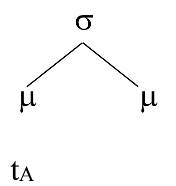
DEP-t
Assign one violation mark for each tone feature in the output that does not have a correspondent in the input.

DEP-σ/μ
Assign one violation mark for each syllable/mora in the output that does not have a correspondent in the input.

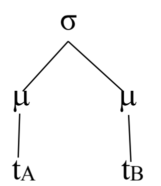
3.4 Ranking argument for MAX-t, *MULTILINK[t, μ], and DEP-t

As for inputs with only one tonal feature (cf. 3-3a), the relevant candidates that need to be considered are given in (3-5).

(3-5) P1: input



Candidate (i)



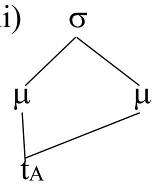
Violation: Count

DEP-t : 1

2 Unless otherwise indicated, all constraints in (3-4) are adapted from Wee (2019:156)

3 This constraint would have a reprise in section 4.3

Candidate (ii)



*MULTILINK[t, μ]: 1

The candidate (i) violates constraint *MULTILINK[t, μ] because two moras share one input tonal feature. The candidate (ii) violates DEP-**t**, but the candidate is still optimal because the ranking of DEP-**t** is lower than that of *MULTILINK[t, μ]. The ranking hierarchy of *MULTILINK[t, μ] and DEP-**t** needs to ensure that insertion is tolerable in Chongqing Mandarin and to rule out syllables that only have monotonal features (i.e., either just H or L). The candidates in (3-5) are evaluated in (3-6).

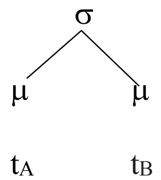
(3-6) The ranking for MAX-**t**, *MULTILINK[t, μ], and DEP-**t**

Input: σ μ μ t_A	*MULTILINK[t, μ]	DEP-**t**
☞Candidate(i)		*
Candidate(ii)	*!	

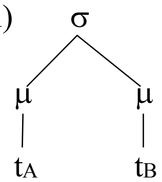
Legend: ☞ attested candidate * violation mark ! fatal violation

When the input has two tone features, the attested candidate is straightforwardly mapping the input two tonal features to syllable (cf. 3-3b). The relevant candidate set of two input tonal features is presented in (3-7). The candidates in (3-7) are evaluated in (3-8).

(3-7) P2: input

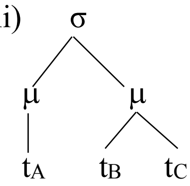


Candidate (i)



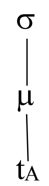
Violation: Count

Candidate (ii)



DEP-**t** : 1

Candidate (iii)



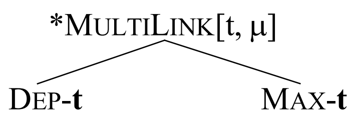
MAX-**t**: 1

(3-8) The ranking for MAX-**t** and DEP-**t**

Input: σ (μ tA, μ tB)	MAX-**t**	DEP-**t**
☞Candidate (i)		
Candidate (ii)		*!
Candidate (iii)	*!	

To ensure two tonal features are kept in output, the faithfulness constraint MAX-**t** is needed in Chongqing Mandarin. Candidate (ii) in (3-8) violates DEP-**t** by inserting another tone feature. Candidate (iii) deletes another tone feature from the input, which incurs violations of MAX-**t**. The attested candidate (i) is just mapping two input tonal features to moras. That does not violate any of these constraints. The ranking of these three constraints above is summarized as a Hesse diagram in (3-9).

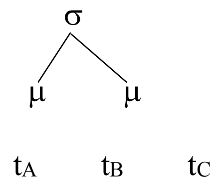
(3-9) Interim summary of constraint ranking hierarchy



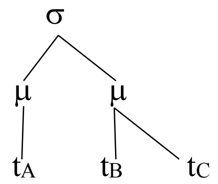
3.5 Ranking argument for *MULTILINK[t, μ],*MULTILINK[μ, t], BIN, and DEP-σ/μ

As for inputs with three tone features, the relevant candidates that need to be considered are presented in (3-10).

(3-10) P2: input



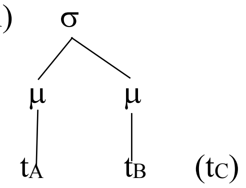
Candidate (i)



Violation: Count

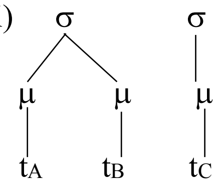
*MULTILINK[μ, t]: 1

Candidate (ii)



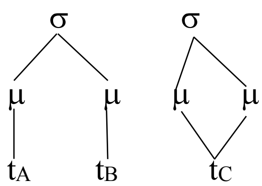
MAX-**t** : 1

Candidate (iii)



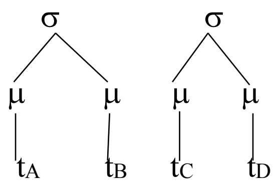
BIN: 1

Candidate (iv)



*MULTILINK[t, μ]: 1

Candidate (v)



DEP-**t**: 1

Observe candidates above, we will see three kinds of associations between the tones and TBUs. Association1 is one-to-one association between tones and moras. Association 2 is one-to-two association between tones and moras. Association 3 is two-to-one association between tones and moras. Among these association, Association3 is forbidden in Chongqing Mandarin. Thus, the ranking of *MULTILINK[t, μ] must higher than *MULTILINK[μ, t] to rule out candidates with Association3. Due to the mapping in (3-3), we will see that only bimoraic syllables are allowed in Chongqing. Thus, BIN is needed on the mora level to rule out monomoraic candidates.

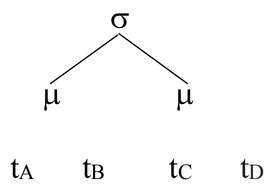
In (3-10), to ensure tritonal inputs are kept in output, MAX-**t** must dominate *MULTILINK[μ, t] to avoid deletion and then rule out candidate (ii). BIN also needs to outrank *MULTILINK[μ, t] to ensure the attested candidate is bimoraic and rule out monomoraic candidate (iii). To avoid the output candidate with four tonal features, DEP-**t** must dominate *MULTILINK[μ, t] to rule out candidate (v). *MULTILINK[t, μ] >> DEP-**t** is figured out in 3.4, thereby *MULTILINK[t, μ] must outrank *MULTILINK[μ, t] to rule out candidate (iv). The attested candidate violates *MULTILINK[μ, t], because the left mora is associated with two features. However, the violation of *MULTILINK[μ, t] is tolerated to satisfy the higher-ranking MAX-**t**. The candidates in (3-10) are evaluated in (3-11).

(3-11) The ranking for *MULTILINK[t, μ],*MULTILINK[μ, t], BIN, and DEP-σ/μ

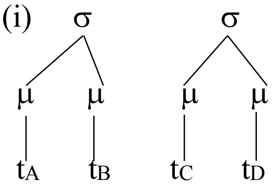
Input: σ (μ μ; t_A t_B t_C)	*MULTILINK [t, μ]	BIN	MAX-**t**	DEP-**t**	*MULTILINK [μ, t]
☞Candidate (i)					*
Candidate (ii)			*!		
Candidate (iii)		*!			
Candidate (iv)	*!				
Candidate (v)				*!	

As for the inputs with four tonal features, the attested candidate has added a syllable to the input (cf. 3-3d). The relevant candidate set of four input tonal features is presented in (3-12). The candidates in (3-12) are evaluated in (3-13).

(3-12) P3: input



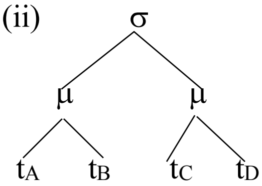
Candidate (i)



Violation: Count

DEP-σ/μ: 3

Candidate (ii)



*MULTILINK[μ, t]: 2

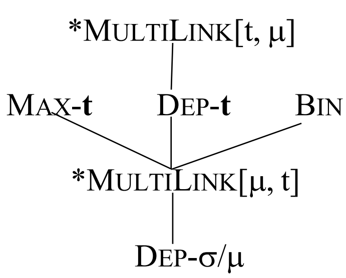
(3-13) The ranking for *MULTILINK[μ, t] and DEP-σ/μ

input: σ / μ μ / t_A t_B t_C t_D	*MULTILINK[μ, t]	DEP-σ/μ
☞Candidate (i)		***
Candidate (ii)	*!*	

In Chongqing Mandarin, epenthesis of another syllable and mora is tolerated. Thus, *MULTILINK[μ, t] must dominate DEP-σ/μ to rule out candidate (ii) which violates *MULTILINK[μ, t] twice. Although the attested candidate(i) violates the constraint DEP-σ/μ by inserting a syllable and two moras, the ranking of those two constraints can still predict candidate (i) to be optimal.

The rankings of these constraints, as illustrated above, are summarized as a Hess diagram shown in (3-14).

(3-14) Summary of constraint ranking hierarchy



3.6 Ranking argument for OCP, MAX-t, and DEP-t

Section 3.1 demonstrated that Chongqing Mandarin tonal inventory can be viewed as a simple matter of combinatorial possibilities subject to (i) a constraint in the number of features, and (ii) a constraint on distinctness in adjacent features. However, the demands of *Richness of the Base* also require the consideration of input string with identical adjacent tonal features, unnatural as they may appear.

Tableaus (3-15) evaluate relevant candidates of inputs with two identical L features and two identical H features. Three candidates are considered in both tableaux.

(3-15) The ranking for OCP, MAX-**t**, and DEP-**t**

a. input: LL	OCP	MAX-**t**	DEP-**t**
☞ i. LHL			*
ii. LLH	*!		*
iii. LH		*!	*
b. input: HH			
☞ i. HLH			*
ii. HHL	*!		*
iii. HL		*!	*

OCP predicts distinctness in adjacent features. Candidate (i) for both (3-15a) and (3-15b) inserts a tonal feature to satisfy OCP at the expense of DEP-**t**. Candidate (ii) for both (3-15a) and (3-15b) is harmonically bound by their candidate (i), as is candidate (iii) which violates MAX-**t** and DEP-**t**. Thus, OCP and MAX-**t** must outrank DEP-**t**. Any input of two identical tone features would yield a tri-feature output which would correspond to Tone 3 and Tone 4 of the Chongqing inventory.

3.7 Underlying tone in Chongqing Mandarin

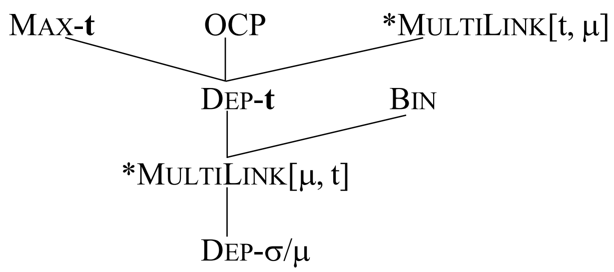
The above sections have shown how the four surface tones of Chongqing Mandarin may be derived by a consistently ranked set of universal constraints even in the face of different kinds of inputs allowed by *Richness of the Base*. This nonetheless does not address what the underlying forms of the four Chongqing tones are. If we adopt the assumption that the underlying tones specified in the lexicon do not contain any information derivable by established principles, one does not in fact need to assume that the underlying tones for Chongqing are /LH, HL, LHL, HLH/. The surface [LH] could have been derived from a simple stipulation of /L/, likewise [HL] from /H/. We may thus assume these to be the underlying forms for Tone 1 [LH] and Tone 2 [HL].

By the same reasoning, the simplest underlying forms that need to be posited for Tone 3 is /LL/ and for Tone 4 is /HH/ to derive respectively [LHL] and [HLH] (cf. Section 3.6). Although these forms may look unnatural at first sight, there is no empirical reason to reject such an assumption since it is the job of markedness constraints to find the most harmonic output. On the other hand, such a postulation gives the Chongqing tonal inventory a simple and elegant symmetry that makes for a strongly falsifiable claim that can be checked with the AA reduplication cases. These will be dealt with in Chapter 4.

3.8 Chapter conclusion

This chapter derives the phonological representation of the four Chongqing Mandarin tones under the stringent conditions of *Richness of the Base* to demonstrate how the Chongqing Mandarin tonal inventory can be derived from a coherent ranking of a rather standard set of universal constraints, given in the Hess diagram in (3-16). Based on this analysis, it is reasonable to argue that four surface tones in Chongqing could be generated from simple inventory of just /L, H, LL, HH/.

(3-16) The Final Hess Diagram



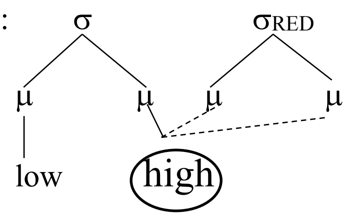
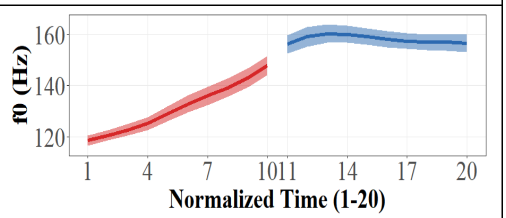
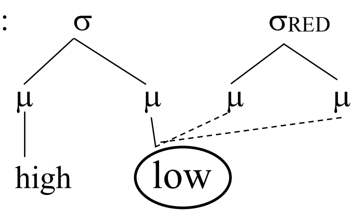
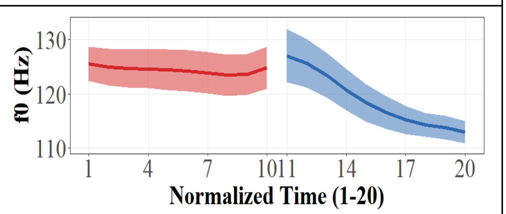
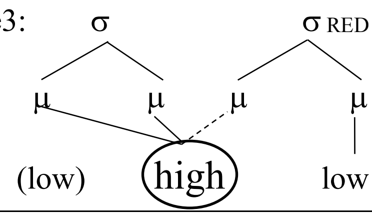
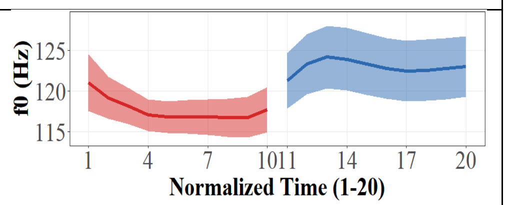
Chapter Four
DERIVING THE AA PATTERN REDUPLICATION TONE SANDHI IN CHONGQING MANDARIN

This chapter demonstrates that tone sandhi AA reduplication is derivable from inputting any one of the underlying tones argued for in Chapter 3 and mapping those features to two syllables (one base syllable and its duplication), each being bimoraic. Intricate as the Chongqing Mandarin reduplication tone sandhi may be, the phenomenon finds explanations in the same linguistic principles presented in Chapter 3 in conjunction with a set of alignment constraints.

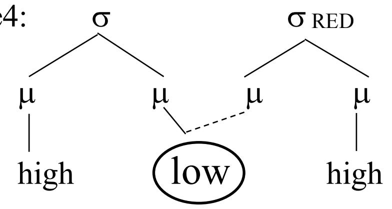
4.1 The phonological representation for reduplication tones in Chongqing

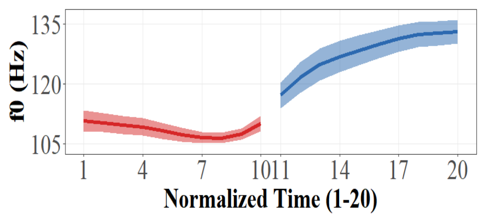
To begin, consider (4-1) which presents the f0 profiles extracted for four tones AA reduplications in Chongqing Mandarin (cf. Graph 2-7). Here, I offer what I believe is reasonable phonological representations of these AA reduplication tonal patterns.

(4-1) Phonological representation of tones in AA reduplicative form

	Phonological representation	**f0 profile (cf. 2-7)**
a.	Tone1: 	
b.	Tone2: 	
c.	Tone3: 	

d. Tone4:





The main idea behind (4-1) is that in Chongqing AA reduplication, only the syllable has been duplicated. The tonal features in circles are the additional tonal features that may not have been available when considering only the underlying tone features (given in un-circled) as inputs. These underlying tone features, recalling Chapter 3, are the most basic ones from which one may derive the surface monosyllabic tonal inventory.

To those familiar with African tonological patterns, the cases for T1 and T2 are reminiscent of the kinds of tone assignment seen in Mende (Leben 1973:64-65) and Kukuya (Hyman 1987). T3 and T4 cases are more complex, and do not appear to work quite so nicely as T1 and T2. To this end, one will require constraints that seek to align the tones to the tone-bearing units (which will be tackled in section 4.3).

4.2 Comparative Markedness constraints

Recall from (4-1a,b), AA reduplication tone sandhi in T1 and T2 are derivable from assigning input underlying tone to the first mora, and the additional tonal feature to the remaining moras. To predict the assignment between inserted feature and remaining moras, Chongqing Mandarin enables inserted tonal features to be shared by moras and do not allow the input underlying tonal feature to be shared by moras. In other words, the sharing process only occurs in the derived environment. Such a case in Chongqing Mandarin is problematic in traditional OT, since the traditional markedness constraint *MULTILINK[t, μ] fails to distinguish the two types of sharing described above.

The idea of Comparative Markedness (McCarthy 2003) distinguishes the traditional markedness constraint into $_{O}$M and $_{N}$M, which considers the markedness consequence of input-output mapping. The $_{O}$M is the “old” markedness constraint which would be violated by the fully faithful candidate. However, $_{N}$M is the "new" markedness constraint which would not be violated by fully the faithful constraint. Based on Comparative Markedness theory, the original constraint *MULTILINK[t, μ] is replaced by $_{O}$*MULTILINK[t, μ] and $_{N}$*MULTILINK[t, μ]. Sharing one input tonal features with moras will violate $_{O}$*MULTILINK[t, μ]. Sharing one inserted tonal feature with moras will violate $_{N}$*MULTILINK[t, μ]. This differentiation allows for a more nuanced analysis of one sharing tonal feature with moras phenomenon in Chongqing Mandarin, resolving the derived environment effect encountered in traditional OT.

Two notions are important when defining Comparative Markedness, locus of violation and t-correspondence. Every markedness constraint M_i is defined in terms of its locus-of-violation function Loc_i. $_{O}$M and $_{N}$M use the same function Loc_i. If different candidates correspond to the same elements in the input, these candidates form t-correspondence. Each candidate has its own correspondence $\Re_i$. The comparative constraint $_{X}$M is a function from the three tuples (cand, FFC, $\Re_t$) to zero or more violation-marks. The definition of an old and new version of the constraint is presented in (4-2).

(4-2) Comparative Markedness Definition

$_{O}$*MULTILINK[t, μ]$_i$ (cand, FFC, $\Re_t$) ≡ Let Loc_i (cand)={c1, c2, c3, …}. For each c_m that lacks a t-correspondence among f_n, assign one violation mark.

$_{N}$*MULTILINK[t, μ]$_i$ (cand, FFC, $\Re_t$) ≡ Let Loc_i (cand)={c1, c2, c3, …}. For each c_m that has a t-correspondence among f_n, assign one violation mark.

It will be demonstrated in the subsequent sections, the interaction among these Comparative Markedness constraints facilitates the sharing of the inserted tonal feature while inhibiting the sharing of the input feature.

4.3 Alignment constraints

The Comparative Markedness constraints predict that the inserted tonal feature is allowed to share with moras but does not restrict the location of insertion in T1 and T2 cases (cf. Section 4.2). Thus, ALIGN-LEFT will select the candidate which assigns the input tonal feature to the left edge and inserts tonal feature to the right of the input tonal string. Combined Comparative Markedness constraints and ALIGN-LEFT, the attested candidate in T1 and T2 cases will be selected as optimal.

In T3 and T4 AA reduplication, H features are always assigned to edges of the output tonal string. In the T3 case, an input L feature is deleted to allow the inserted H feature to assign to the left edge of the output string. ALIGN-H-EDGE will rule out candidates which do not align the H feature to edges. Constraints in section 3.3 have accounted for the monosyllabic tonal inventory of Chongqing Mandarin. These constraints and their ranking remain relevant in accounting for the AA tone patterns. Additional constraints of alignment are listed in (4-3).

(4-3) Constraints for AA reduplicative form

ALIGN-LEFT (McCarthy & Prince 1993: 34)
Assign a violation mark for every intervening mora between an input tone feature and the left edge in the output string.

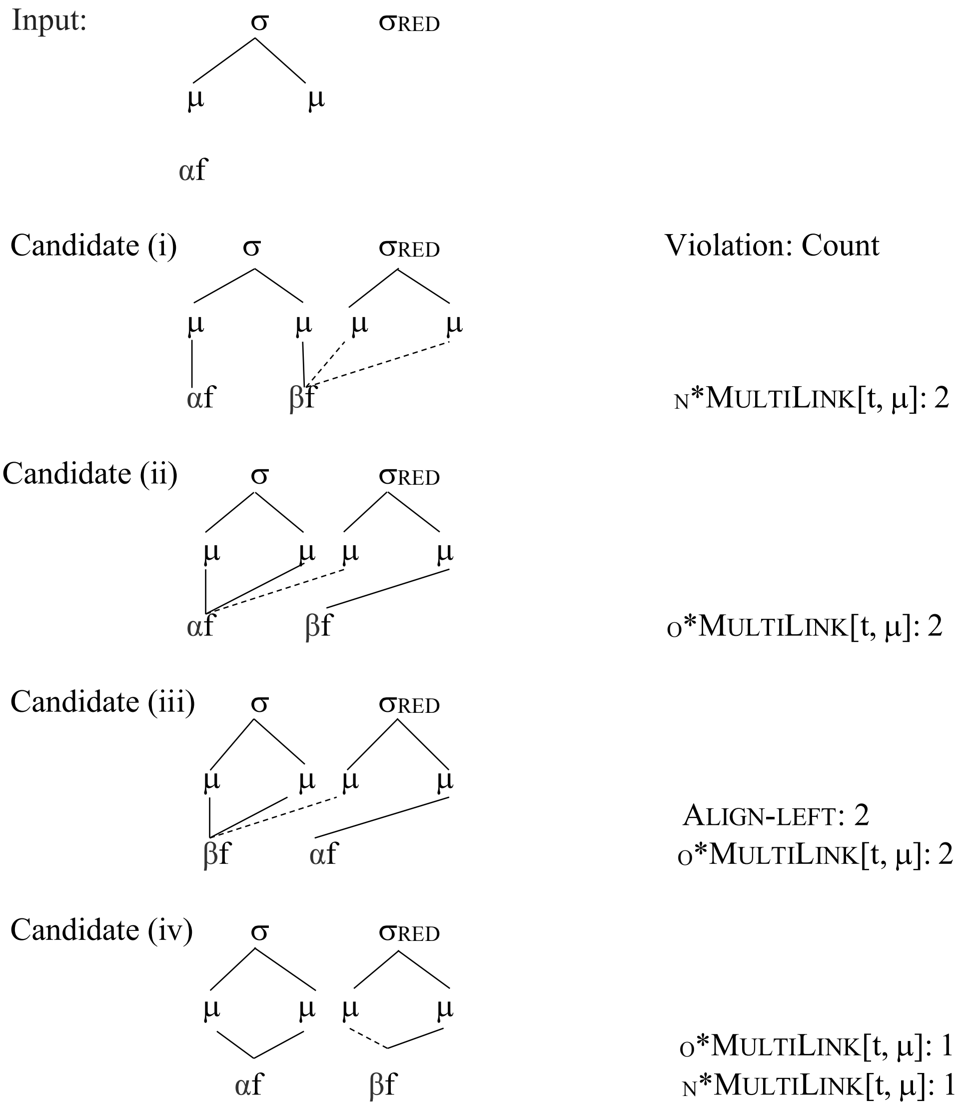
ALIGN-H-EDGE (Bickmore 1996)
Assign a violation mark for every High tone feature that is not aligned to an edge output string.

As will become evident in the ensuing sections, these constraints would seek to align [high] tone features to the edges of a given domain (in this case the reduplicated AA syllables) with a preference for the left edge.

4.4 Ranking argument for O*MULTILINK[t, μ], N*MULTILINK[t, μ], ALIGN-LEFT

The ranking among O*MULTILINK[t, μ], N*MULTILINK[t, μ], and ALIGN-LEFT can be most clearly seen by considering four competing candidates of T1 and T2 under AA reduplication. Both these cases have the same pattern where the input tone feature is assigned to the first mora, and the additional feature is assigned to the second mora. This is shown in (4-4) with αf and βf as the tone features. Violations of the constraints are tallied on the right.

(4-4)



In (4-4), candidate (i) violates N*MULTILINK[t, μ] twice, because the additional βf is assigned to two more moras. In candidate (ii), the input feature αf is assigned to two more moras, which violates $_{O}$*MULTILINK[t, μ] twice. Thus, $_{O}$*MULTILINK[t, μ] needs to rank higher than $_{N}$*MULTILINK[t, μ]. This means that only the sharing of inserted feature is tolerated. Candidate(ii) and candidate (iv) violate $_{O}$*MULTILINK[t, μ], so they should be ruled out. Candidate (iii) inserts βf on the left edge of the input tonal string, causing the violation of ALIGN-LEFT. The sharing of βf by two moras violates $_{N}$*MULTILINK[t, μ] twice. There is no ranking between $_{N}$*MULTILINK[t, μ] and ALIGN-LEFT because candidate (i) always violates fewer constraints. The candidates in (4-4) are evaluated in (4-5).

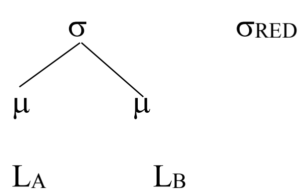
(4-5) The ranking for $_{O}$*MULTILINK[t, μ], $_{N}$*MULTILINK[t, μ], ALIGN-LEFT

input: σ $σ_{RED}$ μ μ αf	$_{O}$*MULTILINK [t, μ]	$_{N}$*MULTILINK [t, μ]	ALIGN-LEFT
☞Candidate (i)		**βf	
Candidate (ii)	*!*αf		
Candidate (iii)		**βf	*!*αf
Candidate (iv)	*αf!	*βf	

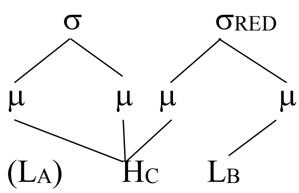
4.5 Ranking argument for ALIGN-H-EDGE, MAX-t, and $_{N}$*MULTILINK[t, μ]

In T3 reduplication pattern, the ranking of ALIGN-H-EDGE, MAX-**t**, and $_{N}$*MULTILINK [t, μ] can be revealed by considering relevant candidates of T3 AA reduplication. Unlike T1 and T2 reduplication, the first low feature in T3 reduplication pattern is deleted. An additional high tone is inserted in the middle of the input tonal string and assigned to the first three moras. Following this, the last low tone is assigned to the last mora. This is shown in (4-6) with L_A, H_C, and L_B. The evaluation of the relevant candidates is counted on the right.

(4-6) Input:



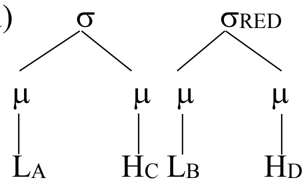
Candidate (i)



Violation: Count

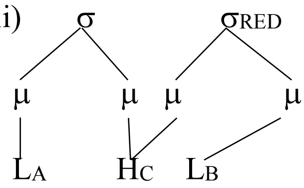
N*MULTILINK[t, μ]: 2
MAX-**t**:1

Candidate (ii)



ALIGN-H-EDGE: 1

Candidate (iii)



ALIGN-H-EDGE: 1
N*MULTILINK[t, μ]: 1

Candidate (i) deletes L_A to allow the H_C to align to the left edge, which violates the MAX-**t.** However, the violation is tolerated in Chongqing Mandarin to satisfy the higher-ranking constraint ALIGN-H-EDGE. The additional high feature assigns to two more moras, which violates the N*MULTILINK[t, μ] twice. The ranking of N*MULTILINK [t, μ] must be lower than ALIGN-H-EDGE to ensure that the candidate (i) is optimal. Candidate (ii) is ruled out because the additional H_C is not assigned to any edges of the output spring, violating the high-ranking constraint ALIGN-H-EDGE. Like candidate (i), candidate (iii) also inserts the high feature in the middle of the input tonal string. However, the additional high feature is not assigned to any edges of output, violating the ALIGN-H-EDGE. Although candidate (iii) has less violation of N*MULTILINK[t, μ] than candidate (i), the N*MULTILINK[t, μ] is undominated. The candidates in (4-6) are evaluated in (4-7).

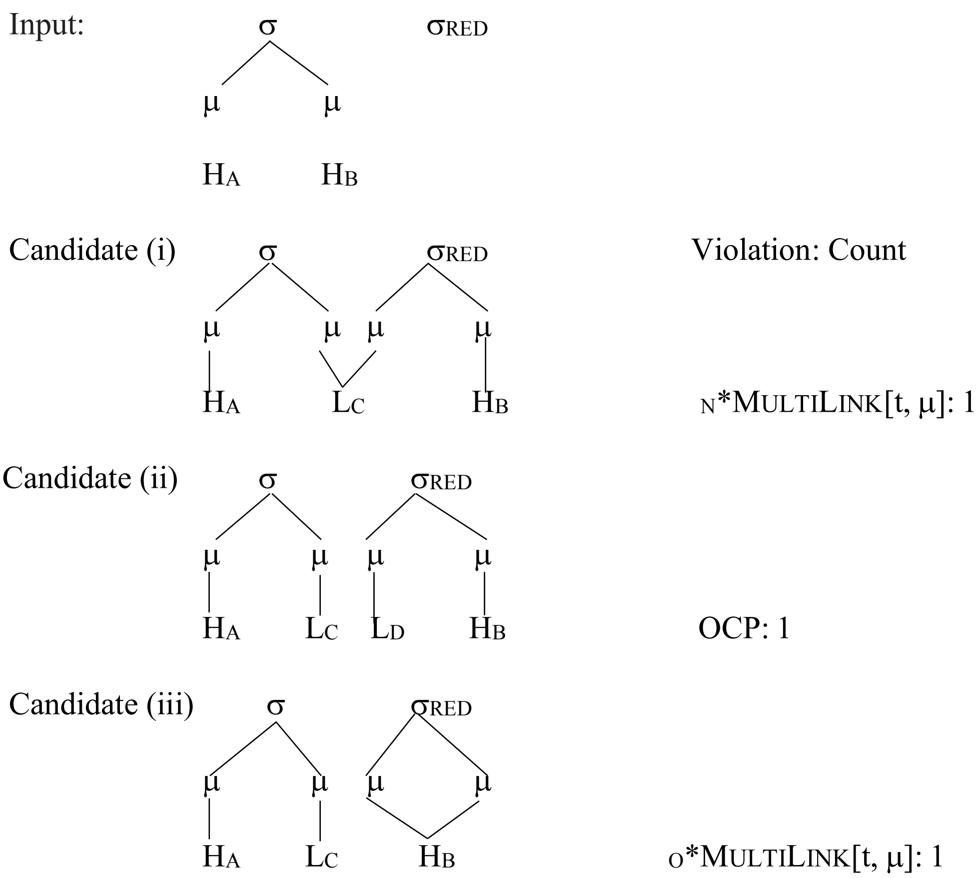
(4-7) The ranking for ALIGN-H-EDGE, MAX-**t** , and N*MULTILINK[t, μ]

input: σ σRED μ μ L_A L_B	ALIGN-H-EDGE	MAX-**t**	N*MULTILINK [t, μ]
☞Candidate (i)		*L_A	**H_C
Candidate (ii)	*H_C !		
Candidate (iii)	*H_C!		*H_C

4.6 Ranking argument for ${}_{O}$*MULTILINK[t, μ], ${}_{N}$*MULTILINK[t, μ], and OCP

The ranking of ${}_{O}$*MULTILINK[t, μ], ${}_{N}$*MULTILINK[t, μ], and OCP can be figured out by considering relevant candidates of T4 AA reduplication. In T4 reduplication pattern, the input two tonal features are assigned to two moras on the two edges in a one-to-one fashion, the additional tonal feature is assigned to two moras in the middle. This is presented in (4-8) with H_A, L_C, and H_B. Violations of relevant candidates are on the right.

(4-8)



In candidate (i), the additional L_C is assigned to two moras, which violates ${}_{N}$*MULTILINK[t, μ] once. However, this violation is less severe than the violation of ${}_{O}$*MULTILINK[t, μ] in candidate (iii), as the ${}_{N}$*MULTILINK[t, μ] is not dominating in the ranking. Thus, candidate (iii) is ruled out. Candidate (ii) inserts two low tones and then assigns to the middle of the two moras, which avoid violating ${}_{N}$*MULTILINK[t, μ] but causes the violation of OCP. The ranking of OCP is higher than N*MULTILINK[t, μ], and candidate (ii) is also ruled out. The candidates in (4-8) are evaluated in (4-9).

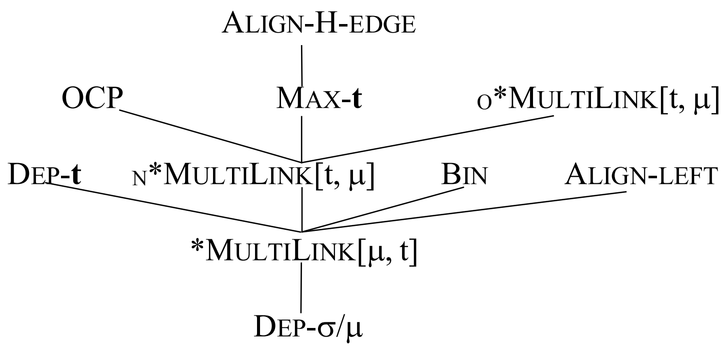
(4-9) The Ranking argument for O*MULTILINK[t, μ], N*MULTILINK[t, μ], and OCP

input: σ $σ_{RED}$ μ μ H_A H_B	OCP	O*MULTILINK [t, μ]	N*MULTILINK [t, μ]
☞Candidate (i)			*L_C
Candidate (ii)	*!		
Candidate (iii)		*H_B!	

4.7 Chapter conclusion

This chapter derives the AA reduplication tone sandhi in Chongqing Mandarin from underlying tone inventory through the ranking of constraints in Chapter 3, Comparative Markedness constraints, and additional alignment constraints summarized with the Hess diagram in (4-10).

(4-10) Summary of constraint ranking hierarchy



Chapter Five

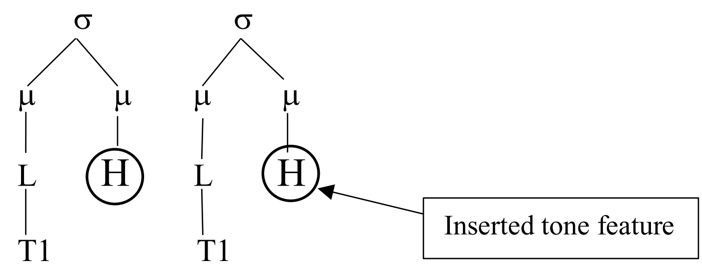
PREDICTIONS ON DITONAL SANDHI PATTERNS IN CHONGQING

This chapter attempts to test whether the analysis in Chapter 4 is compatible with normal disyllabic tone sandhi in Chongqing. Essentially, one would predict that combinations of input tones /L/, /H/, /LL/, and /HH/ would trigger various types of tone sandhi in response to high-ranking OCP. Together with high-ranking MAX-**t**, one predicts that the outputs would involve various degrees of tone feature insertions depending on how they respond to MULTILINK[t, μ]. This chapter shows that the predictions are largely borne out and may even offer clues to how some of the unranked constraints in Chapter 4 should be ordered (cf. Diagram 4-10). However, the chapter is unable to do justice to a full treatment of Chongqing ditonal sandhi and is forced to leave a number of open questions for future explorations.

5.1 The Effect of High-ranking OCP and MAX-t

Recall from (4-10) that OCP is dominant. Given that MAX-**t** also outranks DEP-**t**, any input where there are identical adjacent tone features would trigger epenthesis. As example, consider an input of adjacent T1s, as in (5-1).

(5-1) Illustration with T1 +T1
e.g. *sanL + guL* → *sanLH guLH* 'third aunt'
guoL + baL → *guoLH baLH* 'rice crisp'



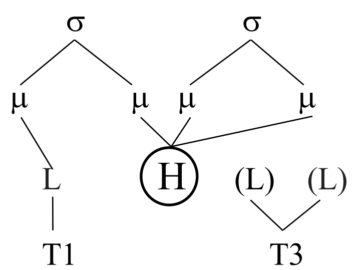
In (5-1), a disyllabic input of two T1s, which are /L/, would create an OCP-offending sequence. As can be seen above, the output is that both syllables become rising. Immediately, one can see that the result is consistent with the prediction of the analysis given in Chapter 4. One may observe that the inserted medial H would have sufficed to satisfy OCP, and thus the rising tone for the second syllable appears unnecessary. However, one would find a ready explanation in ALIGN-H-EDGE and/or MULTILINK[t, μ].

5.2 The Effect of ALIGN-H-EDGE, and N*MULTILINK[t, μ]

Based on (4-10), the ranking of N*MULTILINK[t, μ] is lower than OCP and ALIGN-H-EDGE. Inserted tonal features are thus predicted to be allowed to straddle moras. This prediction is borne out, and is instantiated, for instance, with a T1 + T3 ditonal sequence, shown in (5-2).

(5-2) Illustration with T1+T3

e.g. *guoL + diLL*	→	*guoLH diHH*	'bottom of pan'
xinL + shangLL	→	*xinLH shangHH*	'appreciate'



As can be seen in (5-2), there is an inserted H that is allowed to be multiply linked with three moras. The two final Ls are deleted for a number of possible reasons, including the fact that the sequence is OCP-violating, and that Align H demands a H at an edge.

5.3 Possibility of MAX-t >> O*MULTILINK[t, μ]

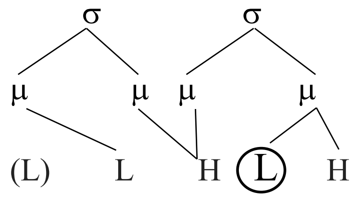
Recall from (4-10) that MAX-**t**, O*MULTILINK[t, μ], and ALIGN-H-EDGE have not been ranked. This was because there was no ranking argument to be made then. As it turns out, ditonal sandhi patterns may offer evidence to their ranking. In an indirect way, cases of such inputs as T3+T4 or T4+T3 sequences would offer support for the analysis advocated in Chapter 4. I illustrate this with a T3+T4 sequence in (5-3) below.

(5-3) Illustration with T3+T4

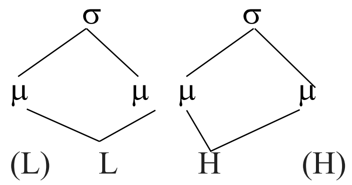
e.g. *duoLL + biHH* → *duoLH biHLH* ‘hide’

huoLL + banHH → *huoLH banHLH* ‘partner’

candidate (i)



*candidate (ii)



input: σ σ / μ μ μ μ / L L H H	MAX-**t**	O*MULTILINK [t, μ]
☞Candidate (i)	*	*
Candidate (ii)	**!	**

The input in (5-3) is the combination of /LL/ and /HH/. The attested form is given as candidate (i).

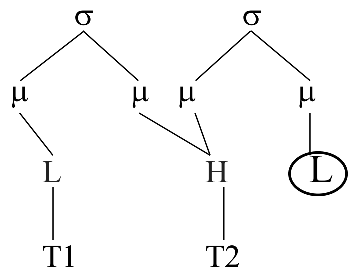
Evidently, such an input sequence would incur multiple violations of the OCP, which are resolved in the output clearly has no OCP violations. In the representation above, we see that this is done both by deletion of the initial L and by insertion of a different L between two Hs. While this may sound paradoxical, the OT tableau demonstrates that it is indeed a viable option when compared to a candidate that relies exclusively on deletion to resolve the OCP. The critical thing here is MAX-**t** >> O*MULTILINK[t, μ].

5.4 Ranking Paradox with N*MULTILINK[t, μ] and O*MULTILINK[t, μ]

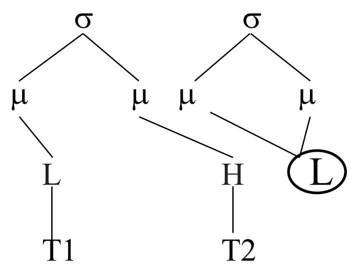
Recall again (4-10) in Chapter 4, O*MULTILINK[t, μ] outranks N*MULTILINK[t, μ]. This has consequences with cases when we consider ditonal inputs that have different tone features such as T1+T2 (i.e. /L+H/). This is illustrated in (5-4).

(5-4) Illustration with T1+T2
e.g. *guL + duH* → *guLH duHL* 'lonely'
fangL + yuanH → *fangLH yuanHL* 'circumference'

⚐ candidate (i)



☠ candidate (ii)



input: σ σ / μ μ μ μ / L H	O*MULTILINK [t, μ]	N*MULTILINK [t, μ]
⚐ Candidate (i)	*	
☠ Candidate (ii)		*

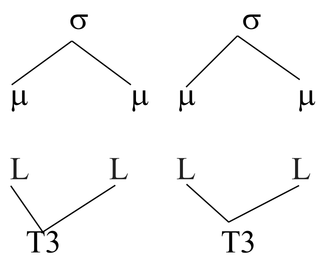
In (5-4), the attested optimal is candidate (i), but the ranking favors candidate (ii), indicated respectively by the flag ⚐ and the skull with cross bones ☠. A reversal in the ranking of these two constraints may get the right results, but that would be a ranking paradox. This may indicate that the adoption of Comparative Markedness was erroneous, or perhaps that there are higher constraints at work. This falls somewhat beyond the scope of the present thesis, and must regrettably be left as a limitation that awaits future work.

5.5 The Failure of N*MULTILINK[t, μ] and DEP-t

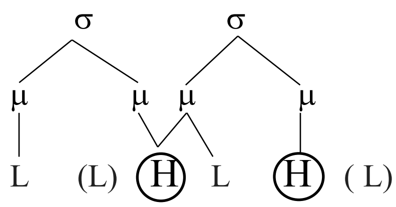
Recall from (4-10) that N*MULTILINK[t, μ] and DEP-**t** had not been ranked. It turns out that regardless of whether there was ranking argument between N*MULTILINK[t, μ] and DEP-**t**, ditonal sandhi patterns still may not be derived. As example, consider an input of adjacent T3s, as in (5-5).

(5-5) Illustration with T3+T3
e.g. *daguLL + guLL* → *guLH duHLH* ‘drum’
haiLL + shuiLL → *haiLH shuiHLH* ‘seawater’

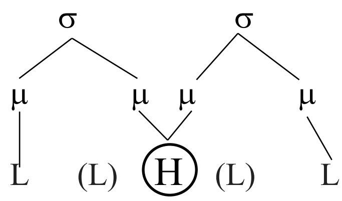
input: T3+T3



⚐ candidate (i)



☠ candidate (ii)



input: σ σ / μ μ μ μ / L L L L	N*MULTILINK [t, μ]	DEP-**t**
⚐ Candidate (i)	**	*
☠ Candidate (ii)	*	*

In (5-5), a dissyllabic input of two T3s, which are /LL/, would create three OCP-offending sequences. The attested candidate is (i), but the interaction of these two constraints favors candidate (ii). Even if N*MULTILINK[t, μ] and DEP-**t** are ranked, it is still unable to get the right results. Candidate (ii) inserted one H feature to satisfy OCP, while candidate (i) inserted two H features to satisfy OCP. No matter how the two constraints are ranked, candidate (ii) always violates DEP-**t** more times. I propose that higher constraints may be at work or output may be rendered in other structures. AB pattern tone sandhi is not the focus of this thesis, and it will be further explained in subsequent research.

5.6 Chapter conclusion

This chapter applies the ranking in Chapter 4 to predict 16 AB disyllabic tone sandhi in Chongqing Mandarin. The results indicate that 11 predictions are successful, while providing ranking evidence for unranked constraints. The failure of the left 5 predictions indicates (i) the application of Comparative Markedness might be incorrect (ii) higher-ranking constraints might be at work (iii) the output may have alternative structures.

Chapter Six

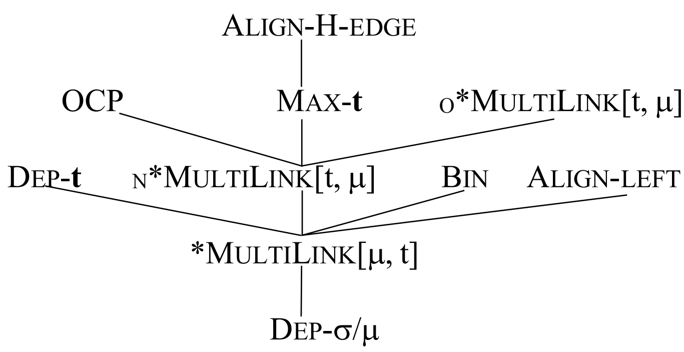
CONCLUSION

6.1 The key findings of the dissertation

This study investigates AA reduplication tone sandhi in Chongqing Mandarin. Chongqing Mandarin exhibits four distinct contour tones in monosyllabic form, and AA reduplication forms that offer *prima facie* evidence of derivability from monosyllabic tones. Descriptions of the Chongqing tones in precedent literature had been varied. This dissertation offered f0 profiles to establish that the four monosyllabic tones are indeed [LH, HL, LHL, HLH]. Each of these has an AA reduplicative tone pattern [LH.HH], [HL.LL], [HH.HL], and [HL.LH] respectively.

The fact that all monosyllabic tones in Chongqing Mandarin are contoured may be derived from a simple underlying tone inventory /L, H, LL, HH/, if one appeals to a combination of two universal constraints: (i) the OCP and (ii) the preference for each tone-bearing unit, i.e. the mora, to be associated with one tone feature. This analysis extends itself readily to account for AA tone patterns adopting a ranking hierarchy of universal constraints as listed in (6-1).

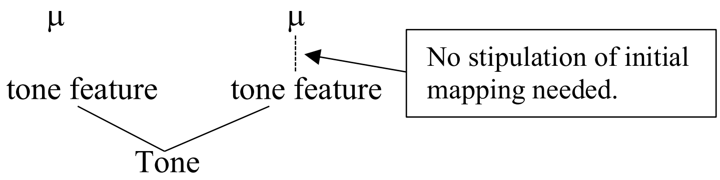
(6-1) Final summary of constraint ranking hierarchy (cf. Diagram 4-10)



The Hesse diagram in (6-1) is based on the analyses of three aspects of Chongqing tone sandhi: (i) monosyllabic tones, (ii) AA reduplication, and to some extent (iii) ditonal sandhi patterns. Most, if not all, of the constraints are evidently universal.

An attractive part of the analysis offered lies in not requiring any stipulative initial mapping between the tones and the moras, monosyllables or AA reduplication, regardless. Mapping tones to moras is entirely derivable through a model such as (6-2).

(6-2) Mapping tones to tone-bearing units (cf. Diagram 1-1)



6.2 The limitation of the dissertation

This study derives monosyllabic tones and AA reduplication tone sandhi in Chongqing through some ranked universal constraints in Optimality Theory. However, the adoption of some constraints needs further examination, (i) ALIGN-H-EDGE specifies the alignment of high features to edges, which needs further clarification, (ii) the definitions of *MULTILINK in this study need to be more accurate since this constraint has multiple interpretations, (iii) ranking paradox comes out when I adopt Comparative Markedness in Chongqing Mandarin, which is a new challenge and waits for further research in the future.

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