

TOPICS IN TONE 3 SANDHI

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ABSTRACT

Although Chen's [1] Minimal Rhythmic Units analysis and Duanmu's [2] Metrical Feet analysis can effectively account for a wide range of Tone 3 Sandhi (T3S) phenomena in Mandarin Chinese, the T3S patterns of sentences with a Topic phrase (TP sentences) were not discussed in their works. Therefore, this study intends to critically examine the power of prediction of those analyses by analyzing the T3S patterns produced by native speakers of Mandarin Chinese. The experimental results from a recitation task with TP sentences did not support Duanmu's analysis, which predicts that the critical words can be either a third tone or a second tone. On the other hand, Chen's analysis successfully predicts that the critical words in those sentences remain their citation tone (i.e. Tone 3). Based on the experimental results, the theoretical implications of these two analyses are discussed.

Keywords: Tone 3 Sandhi, Minimal Rhythmic Units (MRU), Metrical Feet, Mandarin Chinese

1. THIRD TONE SANDHI AND CURRENT ANALYSIS

Mandarin Chinese is a prototypical tone language and there are four lexically specified tones in Mandarin Chinese. A classic example of minimal pairs is shown in (1) with Chao's five-point scale [3, 4, 5].

(1) *Mandarin tones*

Tone 1	ma55	'mother'
Tone 2	ma35	'hemp'
Tone 3	ma213	'horse'
Tone 4	ma51	'to scold'

These citation tones, however, may undergo alternations in certain contexts. One of the most widely applied tone sandhi patterns is the Tone 3 Sandhi (T3S) (or Third-Tone Sandhi) in (2) and is exemplified in (3).

(2) *Tone 3 Sandhi Rule*

3 → 2 / __ 3

Tone 3 becomes Tone 2 when it is followed by another Tone 3.

(3)	<i>mai</i>	<i>ma</i>	'buy horse'
	3	3	citation tone
	2	3	sandhi tone

The citation tone of the word *mai* 'buy' is Tone 3, but it becomes Tone 2 when followed by another Tone 3.

Recently, two competing analyses, namely Chen's [1] Minimal Rhythmic Unit (MRU) analysis and Duanmu's [2] Metrical Feet analysis, could account for a wide range of T3S patterns in Mandarin Chinese. However, the T3S patterns in sentences with a Topic phrase are not explored in their works. Therefore, the purpose of this study is to critically examine the power of prediction of Chen [1] and Duanmu's [2] analysis on Tone 3 Sandhi by investigating how native speakers of Mandarin Chinese produce sentences with a Topic phrase.

1.1. Minimal Rhythmic Units Analysis

According to Chen [2] (p.366), connected speech can be broken up into 'Minimal Rhythmic Units' (MRUs), within which T3S applies obligatorily. When the two adjacent Tone 3s cross two MRUs, T3S applies optionally. Chen [2] (pp. 377-378) states that *the MRU stands apart from the conventional prosodic hierarchy; it is basically a device to group syllables of a wide variety of grammatical ranks and status into rhythmic units, as determined largely by constituency or tree configuration*. The issue at hand is to define the optimal rhythmic organization. Chen adopts an Optimality Theory analysis, a phonological framework proposed by Prince and Smolensky [6] and McCarthy and Prince [7]. The ranking of the relevant constraints for MRUs is listed in (4) and his definitions of the constraints are given in (5).

(4) *MRUs Constraints Ranking* ([2], p. 380)

{No Straddling, IP-Bound} >> Binariness >> Boundedness >> Congruence >> Left-to-Right Footing

(5) *Definition of Constraints*

a. **No Straddling (NoStr)**: Immediate constituents must be MRU-mates.

- b. **IP-Bound**: MRUs are bounded by intonation phrases (IPs).
- c. **Binarity**: The MRU is at least disyllabic.
- d. **Boundedness (Bound)**: The MRU is at most disyllabic.
- e. **Congruence (Congr)**: Group X forms an MRU with its closest morphosyntactic mate.
- f. **Left-to-Right Footing (LtoR)**: MRUs are constructed from left to right.

Chen proposes a two-pass MRU formation (and T3S) process, namely the Lexical MRU and Phrasal MRU.

1.2. Metrical Feet Analysis

In his monograph, Duanmu [2] proposes a Metrical Feet analysis, which groups a string of syllables based on the stress pattern. One of the essential stress assignment rules is Nonhead Stress, which is defined as (6) (Duanmu, [2, 8, 9]).

(6) *Nonhead Stress (Phrasal Stress)*

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

For instance, in a verb-object phrase such as *mai jiu* ‘buy wine’ where the verb *mai* ‘buy’ is the syntactic head of the entire VP and the NP (also an N) *jiu* ‘wine’ is the syntactic nonhead, *jiu* ‘wine’ receives a stress¹.

He proposes the condition for T3S in (7) and the definition of adjacency is given in (8) (from Duanmu, [2], p. 267 (36) and (37) respectively).

(7) a *Condition on T3S*

T3S is obligatory over two syllables that are adjacent.

T3S is optional over two syllables that are not adjacent.

b. *Definition*

Two syllables are adjacent if they belong to the same immediate syntactic constituent and they do not belong to separated full feet. (A full foot contains two (or more) syllables.)

(8) *Definition of Adjacency*

(. . . A)B]	AB adjacent
[A(B. . .)	AB adjacent
(. . . A)B](CD)	AB adjacent; BC not adjacent
(. . . A)B][C(D. . .)	AB and CD adjacent; BC not adjacent
(AB)(CD)	BC not adjacent

(AB)(CØ)

BC adjacent

The rules of his Metrical Footing are proposed as follows (9) (from [2], p. 268 (39)).

(9) *Rules of Metrical Footing*

- (a) Build disyllabic feet left-to-right for polysyllabic words.
- (b) Build feet cyclically based on phrasal stress.
- (c) Build disyllabic feet left-to-right for free words.
- (d) T3S starts from each foot and then cyclically.
- (e) In a T3S domain, T3 must change before T2, but can optionally change before T2 that came from T3.

2. NEW DATA, PREDICTIONS AND HYPOTHESIS

The relevant syntactic analyses of Topic phrases are reviewed and the predictions made by Chen’s MRU analysis and Duanmu’s Metrical Feet analysis are discussed subsequently.

2.1. Sentences with Topic Phrases

Mandarin Chinese is known as a topic-prominent language [10] and therefore manifests some distinct features from a subject-prominent language such as English. One notable feature of Mandarin Chinese Topics is that a Topic is the “center of attention” and announces the theme of the discourse ([10], p. 464). Please consider (10).

- (10) (Suiran) *chi* *Li Ming*
although *ruler* *Li Ming*
yong-wan *le, danshi*
use-finish *SFP but*
hai-mei *shou-hao*
not-yet *put away*
‘Although Li Ming finishes using the ruler, he doesn’t put it away yet.’

The *chi* ‘ruler’ in (10) is a topic and occupies the sentence-initial position. It is the discourse theme of a series of sentences. Specifically, *chi* ‘ruler’ is the logical object of both the verb *yong wan* ‘finish using’ in the first sentence and the verb *shou hao* ‘putting away’ in the second sentence. The pattern is commonly denoted as the Topic chain [11, 12, 13, 14, 15, 16, 17, 18].

2.1.1. *T3S Patterns Predicted by Chen’s MRU Approach*

The relevant words in (10) are *chi* ‘ruler’ and *Li* ‘li’. As Topics are the theme of a series of following

3.3. Procedure

Participants were invited to a quiet room individually. Each participant was allowed to read the list of sentences silently. They were free to check the pronunciations of the words if they were not sure. They were also encouraged to recite those sentences in the way that they felt natural.

3.4. Equipment, Software and Data Treatment

All the utterances were recorded by the build-in microphone of ASUS laptop X550L model. The software used to record the sounds was Praat [19].

The tones of the critical words (i.e. Tone 2 or Tone3) produced by the participants were judged by native speakers of Mandarin Chinese. One major coder listened to all the critical sentences and an additional coder coded 25% of the data. One thing to note here is that in nature speech and in contexts other than the environment specified in (2), the underlying Tone 3 (the falling-rising tone) is pronounced as Half Third Tone, where the falling part is maintained while the rising part is omitted [1]. Therefore, if the surface tone of the critical words was a falling tone, it was identified as Tone 3.

4. RESULTS

4.1. Inter-rater Reliability

The resulting kappa for sentences with a Topic phrase was 1.000. This robust agreement between two raters in two groups was not surprising because non-application of the sandhi processes could be easily detected by native speakers of Mandarin Chinese ([20], p. 169).

4.2. Tone Preference of Critical Words

The percentage of Tone 2 and Tone 3 produced by the participants are shown in Table 2.

Table 2: Percentage and number of tokens (in the parentheses) of Tone 2 and Tone 3

Sentence Type	Tone 2	Tone 3
Topics (N = 380)	3.9 % (15)	96.1% (365)

Native speakers of Mandarin Chinese consistently produced the critical words with Tone 3. The results lent support to Chen's MRU analysis.

5. DISCUSSION

The purpose of this study was to critically examine the power of prediction of Chen's Minimal Rhythmic Units analysis and Duanmu's Metrical Feet analysis on T3S patterns. While Duanmu's analysis predicted that the critical words in sentences with a Topic phrase could be optionally pronounced with Tone 2 or Tone 3, Chen's analysis predicted that those key words were consistently produced with Tone 3. The results from the recitation task indicated that the critical words were overwhelmingly produced with Tone 3 by native speakers of Mandarin Chinese, supporting Chen's MRU analysis of T3S patterns in Mandarin Chinese. One thing to note here is that the crucial difference between Chen's analysis and Duanmu's analysis was that Chen specified contexts where T3S must not apply while this 'must-not-apply' condition was absent in Duanmu's analysis.

One significant contribution of this study is that it is shown that the IP boundary formation is not simply an ad hoc rule for emphatic boundary, a criticism the MRU analysis previously incurred ([2], p. 265). Instead of stating separate ad hoc rules for sentences with emphasis and topic phrases, it is this IP boundary — segmenting a string of speech sounds into the minimal rhythmic units — that elegantly provides a unified account for the discrepant data.

6. REFERENCES

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¹ Readers who are interested in Duanmu's stress assignment rules can refer to his work ([2], pp. 129-157). The stress patterns of the examples in this work follow his original work.

² In Duanmu's ([2], p. 267) framework, an object can form a binary foot with an empty beat (∅) when it is in phrase-final position.