Layered OCP, Unparsed Preposition, and Local Constraint Conjunction in Mandarin Tone Sandhi*

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I. Introduction

Mandarin tone sandhi, the most well-known of the Chinese sandhi phenomena, involves the change of the L[1] tone to a sandhi LH tone before another L tone. This change has been studied both under the traditional approach (i.e. Cheng (1973), Shih (1986), Hung (1987) and Zhang Z. (1988)) and the Optimality Theoretic approach (Zhang N. (1997)). In this paper it is demonstrated that these previous studies do not adequately account for Mandarin tone sandhi. The most serious problem in the derivational tradition, as pointed out in Zhang N. (1997), is its inability to offer a unified account for both the PP and the non-PP utterances in Mandarin tone sandhi. For illustration in section III, I will review Shih's (1986) work, which is one of the most well-known derivational approaches. Although Zhang N. (1997) offers an analysis in the framework of Optimality Theory (Prince and Smolensky 1993) that seems able to solve the PP/non-PP discrepancy inherited from the derivational tradition, it is shown in Section III that Zhang's analysis still admits some problems which must be resolved.

The present paper attempts to reanalyze Mandarin tone sandhi using Optimality Theory (OT). A set of tonal constraints and a set of prosodic constraints are proposed in this study. The set of tonal constraints is mainly used to account for the tonal change (i.e. the change of a L tone to a LH tone before another L tone) in Mandarin tone sandhi. This paper argues that to account for such phenomena, the set of tonal constraints must distinguish between two levels of OCP, the tonal level and the tonemic level. The prosodic constraints are posited to determine the Mandarin tone sandhi domain. This paper shows that the unparsed preposition at the prosodic word level and the Local Constraint Conjunction proposed in Smolensky (1995) play an important role in determining the tone sandhi domain for PP and non-PP tone sandhi in Mandarin. Due to limited space, I will only discuss the adagio reading in Mandarin tone sandhi.[2]

The remainder of this paper is organized as follows: Section II offers a brief introduction to the phenomenon of Mandarin tone sandhi; Section III briefly reviews two of the previous studies (Shih (1986) and Zhang N. (1997)) of Mandarin tone sandhi, focusing on some of their problems; Section IV proposes a set of tonal constraint and Section V proposes a set of prosodic constraints for Mandarin tone sandhi; and Section VI summarizes the conclusions of this study.

II. Tone Sandhi in Mandarin

Mandarin has four tones: high level (H), rising (LH), low (L) and falling (HL). In Mandarin, when two L tones are adjacent in a string, the first tone changes to a LH tone.

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[1] In this paper, I follow the notation used in Shih (1986) and Hsiao (1991) to represent the Mandarin third tone as a L tone since the phonological function of Mandarin third tone is a L.

[2] Generally speaking, there are four types of readings conditioned by speech rate differences in Mandarin tone sandhi. The readings are the adagio reading, the moderate reading, the allegro reading, and the presto reading. For the discussions of these different readings in Mandarin tone sandhi, please refer to Cheng (1973) and Selkirk (1984a,b).

(1) 'umbrella'

	yu	san[3]
	rain	umbrella
base tone	L	L
sandhi tone	LH	L

In the derivational tradition, the tone sandhi rule in (2) is used to account for this tone sandhi phenomenon.

(2) Mandarin Tone Sandhi Rule: L→ LH/___L

However, not every L tone followed by another L tone changes to a sandhi LH tone. Consider the following trisyllabic examples:

(3)

	a. 'umbrella is good'			b. 'small umbrella'		
	yu	san	hao	xiao	yu	san
	rain	umbrella	good	small	rain	umbrella
base tone	L	L	L	L	L	L
sandhi tone	LH	LH	L	L	LH	L

To capture this phenomenon, an appropriate tone sandhi domain within which the tone sandhi rule will apply must be defined. Several kinds of tone sandhi domain are proposed in the derivational tradition. For example, Shih (1986) suggests that the domain for Mandarin tone sandhi is a prosodic foot within which the Mandarin tone sandhi rule should apply cyclically. The parameter for deriving the prosodic foot in Shih (1986) will be reviewed in the next section. By applying the tone sandhi rule in the prosodic foot, tone sandhi in the trisyllabic word strings in (3) can now be explained.

(4)

	a. 'umbrella is good'			b. 'small umbrella'		
	yu	san	hao	xiao	yu	san
	rain	umbrella	good	small	rain	umbrella
base tone	((L	L)	L)	(L	(L	L))
First cycle	LH				LH	
Second cycle		LH			n.a	
sandhi tone	LH	LH	L	L	LH	L

(...) = prosodic foot

III. Previous Analyses

3.1 Shih's (1986) Analysis

Shih (1986) proposes that the domain of Mandarin tone sandhi is prosodically defined and that it is the foot that constitutes the domain of Mandarin tone sandhi. The Foot Formation Rule proposed in Shih (1986) to derive prosodic feet is given below, where the formation of the IC foot should precede that of the DM foot and the super-foot.

[3] Mandarin words in this paper are represented by the Han-yu pinyin system.

(5) Foot Formation Rule (FFR) (Shih 1986: 110)

Foot (f) Construction

a. IC: Link immediate constituents into disyllabic feet.

b. DM: Scanning from left to right, string together unpaired syllables into binar feet, unless they branch to the opposite direction.

Super-foot (f') Construction

Join any leftover monosyllable to a neighboring binary foot according to th direction of syntactic branching.

The FFR successfully accounts for the domain formation of non-PP utterances like (6) However, it fails when the utterance is a quadrisyllabic string with a full NP object, as shown i (7).

(6) 'The cat walks with an umbrella.'

mao da san tzou
cat hit umbrella walk
└ └──┘IC ┘ f'
H LH LH L

(7) 'The cat is smaller than the dog.'

mao bi gou xiao
cat compare dog small
└ └──┘IC ┘ f'
?? H LH LH L

To predict the correct tonal domain, Shih suggests that FFR-IC should be skipped in these kind of word strings, and that such strings should be parsed into the DM feet directly, as shown in (8)

(8) 'The cat is smaller than the dog'

mao bi gou xiao
cat compare dog small
└──┘DM └──┘DM
H L LH L

However, the claim that FFR-IC should be skipped in all and only the quadrasyllabic [P NP structures is no more than a stipulation.

Just as Shih (1986), the present analysis assumes that the tone sandhi domain of Mandari tone sandhi is a prosodic foot. However, unlike Shih's approach, the analysis in this pape provides a unified solution for tone sandhi in both PP and non-PP utterances without stipulatio

3.2 Zhang's (1997) Analysis

In order to solve the PP/non-PP problem unresolved by the derivational tradition, Zhan (1997) proposes an analysis based on OT. Zhang's (1997) approach requires two things. Th first one is a set of ranked constraints that serves to account for Mandarin tone sandhi in genera They are PTAS, *33, CI >> PTRS, Align-Di-L, Max, as listed in (9).

(9) Constraints for Mandarin Tone Sandhi (Zhang 1997)

(a) Parse UT of an Absolutely Strong Node (PTAS): The underlying tone of a stron constituent, which is not dominated by any w(eak) node, must be parsed.

(b) Parse UT of a Relatively Strong Node (PTRS): The underlying tone of a stron

constituent, which is dominated by at least one w(eak) node, must be parsed.

(c) *33: No adjacent third tones are allowed.

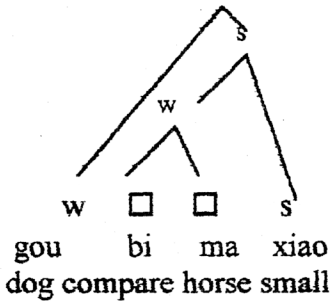
(d) Clitic Dependency (CI): A clitic cannot be separated from the tone sandhi domain of the preceding verb or preposition head.

(e) Maximal Domain (Max): The maximal tone sandhi domain is two syllables in normal speaking rate but larger in more casual or faster style.[4]

(f) Disyllabic Constituent Alignment (Align-Di-L): Align the left side of a tone sandhi domain with the left side of a disyllabic constituent when two or more tone sandhi domains occur. (disyllabic constituents are underlined in Zhang's (1997) tableaux)

The second one is the presence of the constituent strength, which serves as input to be evaluated by the constraint set. Zhang proposes that the different tonal behaviors in PP and non-PP are due to the differences of the constituent strength between the two categories. The constituent strength is a strength value assigned to every monosyllabic morpheme according to its function. To be more specific, a complement is always a phrase stress bearer. If no complement is present, then the head becomes the stress bearer. Specifiers and prehead modifiers are always weak. However, elements in PP are always unspecified, as shown in (10).

(10) 'The dog is small than the horse.'



The unspecified constituent strength of PP can surface as either s(trong) or w(eak). Zhang assumes that a node that is dominated by all and only s nodes is categorized as absolutely strong (represented by capitalized s) and a node that is dominated by w nodes is categorized as relatively strong (represented by small s); therefore, the constituent strength of (6) should be either wwsS or wswS. Zhang claims that it is the unspecification of PP that explains why PP behaves differently from non-PP in Mandarin tone sandhi. The following two examples illustrate Zhang's point.

[4] It is assumed in Zhang (1997) that if two outputs A and B tie each other with respect to all constraints except Max, A and B have the same acceptability. They differ only in style of speaking.