The *Journal of Chinese Linguistics* vol.49, no.1 (January 2021): 106–141

STATISTICAL MODELING OF APPLICATION COMPLETENESS OF TWO TONE SANDHI RULES

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ABSTRACT

This study examines the application of two Mandarin tone sandhi rules on real and wug words varying in degrees of phonological and semantic dependency. Using two statistical methods, we examined the surface f0 contours and underlying pitch targets. For the third tone sandhi, a lexical effect was discovered on the relationship between "word-likeness" of stimuli and completeness of rule application. The degree of application for the half-third sandhi tone, however, was less consistent. This study offers new insights in the debate between categorical and gradient views of sandhi rules. We propose three hypothesized situations and argue that the Mandarin tone sandhi rule application involves computation of sandhi forms, though it becomes more incomplete on wug words containing more illegitimate morphemes. Finally, between the two rules, the application of the third tone sandhi rule is less phonetically motivated and more biased in wug words, exhibiting differences between real words and wug words.

Acknowledgments This work is supported by grant [1-ZVHH] and [1-ZVHJ] from the Hong Kong Polytechnic University and partly supported by Early Career Scheme [No. 25602816] from the Research Grants Council of Hong Kong and the Language Fund [EDB(LE)/P&R/EL/175/12] from Standing Committee of Language Education and Research, Hong Kong.

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KEYWORDS
Mandarin tone sandhi **G**rowth curve analysis **U**nderlying pitch target **C**omputation mechanism **W**ug test

1. INTRODUCTION

1.1 Mandarin Tones and Tone Sandhi

Mandarin Chinese has four tones, which can be described by Chao tone numbers (Chao 1948). The tone numbers reflect the starting and ending point of tones on a one-to-five scale, where one indicates the lowest pitch of a speaker, and five the highest, as shown in (1).

(1) Tone 1 (T1) 妈 /ma/ high-level (55) "mother"
Tone 2 (T2) 麻 /ma/ high-rising (35) "hemp"
Tone 3 (T3) 马 /ma/ low-dipping (213) "horse"
Tone 4 (T4) 骂 /ma/ high-falling (51) "to scold"

Tone sandhi is the tonal alternation of a tone triggered by certain phonological environment (e.g., Chen 2000). There are two well-known tone sandhi rules in Mandarin as described in many studies (e.g., Chao 1948, 1965; Cheng 1968). They are shown in (2).

(2) a. T3(213) → T2 (35)/___ T3(213) (third-tone sandhi)
b. T3(213) → 21/___{T1(55), T2(35), T4(51)} (half-third sandhi)

In the tone sandhi rules in (2), (a) describes that the first T3 in a disyllabic combination T3 + T3 changes into T2. Rule (b) states that the second half of the first T3 is truncated in disyllabic combinations T3 + T1, T3 + T2 and T3 + T4. These rules are considered to be phonological for two reasons (Zhang and Lai 2010): first, they concern language-specific tone changes, and secondly, they are not due to tone co-articulation, which influences the beginning and ending of a tone (e.g., Chen, Wiltshire and Li 2018; Xu 1997).

1.2 Neutralization of the Third Sandhi Tone and T2 on Real Words

Myers and Tsay (2003) note two existing views of Mandarin third-tone

两组变调规则应用程度的统计建模

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摘要
本研究探讨了两组普通话变调规则在真词和假词上的应用。我们设计了语音和语义上不同种类的假词，并使用了两种统计方法，计算了表层基频曲线和底层声调目标。研究发现三声变调中假词越类似真词，规则应用程度越完整。然而，与三声变调相比，半三声变调规则的应用程度与假词是否类似真词并不一定相关。变调规则向来有范畴和渐进两种对立的观点，此项研究提供了新的思路。我们提出了三种假设情境，认为普通话变调规则涉及变调调型的计算，但应用于含多个非汉语语素的假词时，计算则变得不完整。最后，在两组变调规则中，我们进一步证实了与半三声变调相比,三声变调比较缺乏语音上的变调动机，因此真词与假词上的规则应用差异较大。

关键词
普通话三声变调 **增**长曲线分析 **底**层音调目标 **计**算机制 **假**词测试