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Matthew Chen's landmark study offers the most comprehensive analysis to date of the rich and complex patterns of tone used in Chinese languages. Chinese has a wide repertoire of tones which undergo often surprising changes when they are connected in speech flow. The term tone sandhi refers to this tonal alternation. Chen examines tone sandhi phenomena in detail across a variety of Chinese dialects. He explores a range of important theoretical issues such as the nature of tonal representation, the relation of tone to accent, the prosodic domain of sandhi rules, and the interface between syntax and phonology. His book is the culmination of a ten-year research project and offers a wealth of empirical data not previously accessible to linguists. Extensive references and a bibliography on tone sandhi complete this invaluable resource which will be welcomed as a standard reference on Chinese tone.

Having taught for many years at the University of California, San Diego, MATTHEW CHEN is Professor and chair of Linguistics and Dean of the Humanities and Social Sciences faculty at the City University of Hong Kong. He has written numerous articles on linguistics and is Associate Editor of the *Journal of Chinese Linguistics*, University of California, Berkeley.

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TONE SANDHI
Patterns across Chinese dialects

MATTHEW Y. CHEN
City University of Hong Kong



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Preface

Although applied to the description of languages as diverse as Ewe of Ghana (Clements 1978), Mixtec of Mexico (Hunter and Pike 1969), and Kairi of Papua New Guinea (Newman-Pettersen 1990), the term **tone sandhi** refers, first and foremost, to the kind of tonal alternations one typically finds in languages spoken in China and surrounding areas of the southeast Asian mainland. These languages share certain areal characteristics, notably highly developed tonal repertoires matched, in many cases, by even more complex tonal alternations in connected speech. The Sanskrit root of *sandhi* means junction, connection, combination, or liaison (cf. Allen 1962, Andersen 1986). Tone sandhi, therefore, *sensu stricto* describes phonetically conditioned morphotonic alternations at the juncture of words or morphemes. Over time, however, tone sandhi has been extended to cover a number of related phenomena, including allotonic variations, intonational effects, and morphologically or syntactically conditioned tone changes. Such a broad and loose usage of the term has one advantage over any strict definition, as Andersen (1986:2) argues in a different context, in that it gives us a convenient label without prejudging the issues involved.

Even though the tonal/registral systems and their historical developments have been investigated extensively in such language groups as Tibeto-Burman, Miao-Yao, Kam-Tai, and Mon-Khmer, tone sandhi has not received as much attention¹ – with the notable exception of the Sinitic group. As a consequence, our study of tone sandhi has a distinctly Chinese focus and flavor, although I will not shy away from drawing on other languages for facts and inspiration.

¹ For instance the nearly 900-page report on the Kam-Tai languages spoken in China (J. Wang et al. 1984) devotes exactly two short paragraphs to tone sandhi in only one out of the eight languages surveyed, all of which have highly developed tone systems. It is not clear whether the Kam-Tai languages are tone-rich but sandhi-poor, or display sandhi phenomena that have gone underreported as in the early days of Chinese dialectology.

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The investigation of tone sandhi has a long tradition in Chinese linguistics. The fourteenth-century pronouncing dictionary *Zhongyuan Yinyun* contains the earliest intimation of tone sandhi I am aware of. There the author, Zhou Deqing, noted that in versification “it would be best to avoid a pair of Rising tones or a pair of Departing tones.” The Standard Mandarin tone sandhi rule as we know it today already found a clear formulation by the sixteenth-century Korean scholar Cui Shizhen, which I quote in part:

If both syllables are in the Rising tone, then the circumstances make it difficult to retain the original tone. In this case, pronounce the first syllable like the voiced variety of the Level tone, and then the second syllable can retain its original tone when pronounced. (from Mei 1977:238f.)

A similar statement is found in the very first Western language grammar of Chinese written by Francisco de Varo, O.P. in 1682, whose statement is reproduced here:

mai, en tercera tonada es comprar . . . mas juntandola con otra tercera, como *mai ping*, pronunciandolas juntamente el *mai* ba quasi a ser primera [“*mai*, in the third tone, means ‘to buy’ . . . but next to another third tone, as in *mai ping*, it nearly becomes the first tone when pronounced together”; tr. MYC] (Francisco de Varo, 1682, *Arte de la Lengua Mandarina*, p. 9)

In modern times, systematic descriptive work on Chinese dialects dates back to the 1920s. The early surveys tended to focus on the static tonal systems, and were sparse in information on the dynamic interaction of tones in context. Two early works by Chiu (1931) and Luo (1930) – both on the south Min dialect of Xiamen – are exceptional in their extensive treatment of sandhi phenomena and close attention to phonetic details. These are among the true pioneers of the study of tone sandhi. Since then important works, especially doctoral dissertations, have been devoted to this specialized topic. But it was the launching of the journal *Fangyan* in 1979 that marked the beginning of a dramatic explosion of empirical knowledge about the range and diversity of sandhi phenomena, some of which occur in obscure and hard-to-reach dialects. We get a glimpse of the overall picture from A. Hashimoto (1987 [1980]), Chen (1991a [= 1985]), and Ballard (1988). Since then our knowledge about the subject matter has broadened and deepened considerably, and the time is ripe for a new synthesis.

Two leitmotifs underscore the study of tone sandhi with particular reference to Chinese. The first concerns the internal structure of tone. Different hypotheses regarding tonal features and their geometrical arrangements make different predictions about the typology of possible tonal processes. Tone sandhi, therefore, serves as an effective diagnostic probe into the anatomy of the complex entity we call tone. The second recurrent theme of tone sandhi studies concerns the scope or domain of sandhi rules. Unlike most segmental phenomena, which tend to be localized,² tonal processes are notorious long-distance runners, sometimes spanning entire phrases and sentences. The precise definition of tone sandhi domains, therefore, raises intriguing questions about the interface between phonology and grammatical structure. There is a third, far less well-developed issue, namely the interplay among sandhi processes. Given a tonal string A–B–C, the sandhi form of the whole is typically the composite result of the elementary processes operating on the substrings A–B and B–C. How exactly the elementary processes interact to produce the ultimate sandhi output is a topic that has not been heretofore explored in depth.

Thematically, this book is organized as follows: after the introductory and stage-setting chapter, the book is divided into two parts. The first part, comprising chapters 2 to 6, deals with various types of tone sandhi phenomena. Chapter 2 focuses in particular on tonal geometry and the typology of sandhi rules. Chapters 3 and 4 are devoted to issues regarding how a sandhi process is implemented (e.g. directional iteration) and how one process may interact with another. These issues are of particular significance from the perspectives of Optimality Theory (Prince and Smolensky 1993, *inter alia*). Chapters 5 and 6 together constitute an in-depth investigation of one particular dialect, New Chongming. One of the startling discoveries is that this northern Wu dialect is well on its evolutionary path toward a classic accentual system.

The question of sandhi domains is taken up in part two, consisting of chapters 7 to 11. The scope within which tone sandhi rules operate ranges from a sublexical stress-foot to a phonological word, phonological phrase, and intonational phrase. One surprising finding is that the “Minimal Rhythmic Unit,” which circumscribes the scope of tone sandhi in Beijing Mandarin (chapter 9), is not commensurate with any of the categories we know of conventional prosodic hierarchy. This and other findings are

² Vowel harmony and nasalization being two well-known exceptions.

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summarized in the Concluding Remarks, followed by References and a Subject Index.

I take for granted not only generative phonology with its subtheories including autosegmental phonology, feature geometry, metrical phonology, and prosodic phonology, but also Optimality Theory, which by the time this book sees the light of day, will no doubt have become every practicing linguist's stock in trade. Where alternative descriptions of the facts are equivalent, I generally couch my analysis in conventional, generative terms. I will not hesitate to exploit the insights and formalisms of Optimality Theory when it sheds light on the issue at hand.

Much of the empirical data underpinning the present study is in the public domain, published in journals or being circulated through informal channels (unpublished doctoral dissertations, manuscripts, etc.). However, given the nature of the theoretical issues under investigation, published sources are often silent on critical aspects of the problem; as a consequence we had to develop new *kinds* of data, involving a variety of larger and more complex constructions. This is true even of relatively well-known and well-documented dialects, such as Standard Mandarin or Xiamen. I use myself as the principal informant for Xiamen and Mandarin, consulting other native speakers where subtle judgments may differ. In data sampling, I have resisted the butterfly collector's temptation, and opt for in-depth analysis of a few dialects selected for certain structural properties they serve to illuminate. I have collected a fair amount of original data on the following dialects: New Chongming and Old Chongming (northern Wu), Wenzhou (southern Wu), Tianjin (northern Mandarin), and Pingyao (Jin).

Acknowledgments

From the earliest conception to the final stages of redrafting this book, I have benefited from the inspiration and insights of countless friends and colleagues. But most of all, I am indebted to my past and current students who have nurtured and shared with me an abiding interest in the wondrous ways tones behave in connected speech. Chilin Shih, Tony Hung, Yuchau Hsiao, Hongming Zhang, and Huichuan Hsu and Lily Chan have all completed their doctoral theses on tone sandhi. They have shaped my thinking as much as I have theirs.

My thanks go to the informants who patiently sat through interminable sessions. In particular, I wish to name two informants who are linguists

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in their own right: Pan Wuyun and Zhang Huiying. Pan Wuyun not only provided the raw data, but also offered some of the insights on which my analysis of Wenzhou (chapter 11) is based. Xu Baohua of Fudan University was my most gracious host in the fall of 1986 and the summer of 1990 during which most of the fieldwork on Wu dialects was carried out. Several of his colleagues, especially Pan Wuyun, Qian Nairong, Zhang Hongming, and Chen Zhongmin helped with various aspects of data elicitation and transcription. With patience and remarkable thoroughness, Lily Chan and Karanda Tang assisted me with the myriad minutiae of the final draft.

While the bulk of the present draft was written between 1994 and 1996 (during which the author was granted two quarters of sabbatical-in-residence), the underlying research took much longer. I have presented some of the preliminary results at various conferences and gatherings, including: a lecture series delivered at Centre de Recherches Linguistiques sur l'Asie Orientale (Paris, June 1990), talks delivered at the LSA Summer Institute (University of California, Santa Cruz, July 1991), Berkeley Linguistics Society Meeting (February 1992), Workshop on the Psychological Basis of Language (Taipei, December 1993), the Tilburg conference on "Derivational Residue" (Tilburg, October 1995), and on several occasions at East-Asian Linguistics Workshop (University of California Irvine, October 1993, October 1995), North-American Conference on Chinese Linguistics (Cornell University, May 1991; University of Delaware, May 1993; University of Southern California, May 1994; University of Wisconsin, June 1995; University of Illinois, May 1996), International Conference on Chinese Linguistics (Singapore, July 1992; Paris, June 1993), International Symposium on Chinese Languages and Linguistics (Taipei, July 1991, July 1992), Pan-Asiatic Linguistics Symposium (Chulalongkorn University, January 1992; Mahidol University, January 1996), and various colloquia (Berkeley, November 1990; November 1991; University of California, Los Angeles, April 1991; October 1995). I thank the organizers and the audiences of these meetings for their comments and criticisms.

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I wish to thank Richard Attiyeh, Vice-Chancellor of Research and Dean of Graduate Studies, University of California, San Diego, Joseph C-Y. Chen, Director of Wei-Kung Institute, and Yuchau Hsiao of National Chengchi University for their generous publication subsidy made to Cambridge University Press.

Notational conventions

Symbols	Meaning
T	Tone, tone root
T'	A modified or derived tone.
o	Zero tone, or unspecified for tone.
33, 24, 51 . . .	Tone letters devised by Y-R. Chao (1930), where digits indicate the pitch value on a five-point scale, 5 being highest. Thus 33, 24, 51 represent, a mid level, high rising, and a falling tone respectively.
H, M, L	High, mid, low. H, M, L and tone letters are used interchangeably throughout this book. Where appropriate, a dot separates tone digits and H, M, L, for instance to distinguish HM.L (= HM + L) from H.ML (= H + ML), or 3.52 (= 3 + 52) from 35.2 (= 35 + 2).
T1, T2 . . .	Tonal categories: tone 1, tone 2, etc. in a given system.
CVN	“Smooth” or “legato” syllable, i.e. ending in a vowel, offglide or a nasal.
CVq	“Checked” or “staccato” syllable, i.e. ending in an obstruent coda -p,t,k or a glottal stop -q.
MC	Middle Chinese
I, II, III, IV	MC tonal categories: <i>ping</i> , <i>shang</i> , <i>qu</i> , <i>ru</i> ; tone IV cooccurs only with checked or staccato syllables CVq.
Xa,b . . .	Middle Chinese tonal category X, register <i>a</i> (typically high) or <i>b</i> (low). Middle Chinese Ia, Ib, IIa, IIb . . . are sometimes referred to as T1, T2, T3, T4 . . . , with odd/even numbers indicating register <i>a</i> and <i>b</i> respectively.
Tq	Checked tone, i.e. a tone associated with a checked syllable (CVq); thus 5q and 23q stand for a high and a low rising tone linked to CVq. Smooth or legato tones, i.e. tones linked to CVN are unmarked.

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Symbols	Meaning
Hr, Lr	High register, low register, equivalent to [+upper] and [-upper]
h, l	Terminal tone segments, equivalent to [+raised] and [-raised] Lower case tone letters [h, m, l] are also used to indicate default pitch values H, M and L.
E, R, F	Even (= level), rising, falling
σ, μ	Syllable, mora
φ, p-word	Foot, prosodic word
p-phrase	Phonological phrase
IP	Intonational phrase
(x .), (. x)	Left-, right-prominent metrical unit
C ₁ ≧ C ₂	Constraint 1 ranks above constraint 2
X } Y	Candidate X is more “harmonic” than candidate Y
☞	Picks out the winning candidate

Phonetic transcription

Examples are usually cited in the form they are found in the sources. Occasionally, the same pronunciation is transcribed differently by different authors. For instance, the Shanghai pronunciation of the word *Australia* is given as *qo.ta.li.ya* (Duanmu 1993a) and *ɔ.ta.li.iA* (Xu et al. 1988). I have made no systematic effort to standardize the phonetic transcriptions or phonemicizations across the board. The inconsistencies from one source to another are seldom crucial for our purpose; where they are relevant, they will be duly noted. Here are some recurrent symbols used here and their interpretations:

q	glottal stop
<u>h</u>	voiced / murmured h
y, w	glides of i,u
ü	front-rounded u
C'	aspirated
ng	velar nasal
ɤ	mid, back, unrounded vowel
E, I	(in small cap), lax vowels

Where phonetic transcriptions are not provided in the sources, I use the standard Pinyin system, which is also the accepted convention for transcribing Standard (Beijing) Mandarin. Pinyin differs from the IPA system chiefly in the symbols used for consonants. Here are the Pinyin symbols and their phonetic interpretation:

		labial	dental	retroflex	palatal	velar
stops	plain voiceless	b	d			g
	voiceless aspirated	p	t			k
affricates	plain voiceless		z	zh	j	
	voiceless aspirated		c	ch	q	
fricatives		f	s	sh	x	h
sonorants		m	n, l	r		ng

Occasionally when clarity demands, I separate syllables as well as tones by a dot. Thus *tian.an.men* “The Gate of Heavenly Peace” is syllabified as indicated (rather than *tia.nan.men*). More pertinently, MH.L = MH + L, while M.HL = M + HL; correspondingly: 35.1 = 35 + 1, but 3.51 = 3 + 51.

In citing examples, I often adopt the following format:

red	ten	character		←	literal gloss
<i>hong</i>	[<i>shi</i>	<i>zi</i>]	“the Red Cross”	←	translation
(MH.LM)	(LM)			←	input, base form
(MH.	o)	(LM)	Deletion		
(M.	H)	(LM)	Spread		
(M.	H)	(MLM)	M-Insertion	←	output, sandhi form

Here the semantic relation between “the Red Cross” and its component parts (lit. “the character for the word ten”) is somewhat opaque.³ I omit the gloss in those cases where the mapping between the literal (morpheme-by-morpheme) gloss and the English translation is transparent. The square brackets indicate morphosyntactic constituency, while the parentheses mark prosodic units, in this case the metrical feet. The sandhi rules that generate the intermediate or final outputs are named on the right by their labels given in the main text.

³ The graphic representation of the root morpheme “ten” happens to be shaped like the cross: 十.

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Rule formalism

Occasionally I rotate the rewrite arrow clockwise by 90 degrees so that the target (which I underline for clarity) and the environment of a phonological rule would be right next to each other, rendering the rule more transparent. For instance:

$$\begin{array}{c} \underline{55}. 33 \\ \downarrow \\ 53 \end{array}$$

is equivalent to

$$55 \rightarrow 53 / \underline{\quad} 33$$