A morphosyntactic approach to domain construction of T3 tone sandhi in Mandarin Chinese

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Introduction: A pure morphosyntactic approach is feasible to deal with longer sequences with complex morphosyntactic structures in the domain construction of T3 Tone sandhi in Chinese Mandarin (marked TSMC as follows), which is considered to be challenging in the literature, e.g., Zhang (2014). The current approach instantiates the algorithm of TSMC directly operating on the syntactic surface structures as an external sandhi P1 rule in Kaisse (1985), and dispenses with the exceptional lexical domains (phonological words/cliticization, syntactic words and complex predicates) in the classical hybrid "lexical phonology-OT" model in Chen (2009).

Analysis: ***a. C-command***: C-command is the main parameter in the direct-syntax approach from Kaisse (1985) in domain construction of syntactic structures sensitive P1 postlexical rules including external sandhi rules, e.g., TSMC. Pak (2008) proposes two kinds of domain construction rules (i.e., phrase-left and head-left concatenation rule) to derive domains for postlexical (phrasal) rules, which is based on the pure c-command relations between adjacent morphological words. ***b. Compound words with transparent morphological structures***: The internal structures of compound words plays an important role in TSMC. In $[_{CP}$ gou $[_{VP}$ yao $[_{NP}$ wo]]] (*$[_{CP}$ dog $[_{VP}$ bite $[_{NP}$ me]]]*) and $[_{CP}$ gou $[_{VP}$ yao $[_{NP}$ nü-ren]]] (*$[_{CP}$ dog $[_{VP}$ bite $[_{NP}$ woman]]]*) (illustrated in example 7 in data table below), the only difference that leads to distinctive sandhi domains is the object noun with different morpheme quantity. Chen (2009) tackled this problem in a separate domain construction in lexical level prior to postlexical level, which brings some side effects of exceptional situations in lexical domains. Our approach shows that it is the c-command relations in the internal structures of compound words that plays a role, instead of the lexical boundary or the proximity of morphemes in the compound words. ***c. Cyclic effects with the competition between algorithms***: Kaisse (1985) reported the unusual cyclic application of TSMC as a postlexical rule, which she assumes to be a counterexample to the claim that postlexical rules are not cyclic in Kiparsky (1985), e.g., In $[[_{s}$ni zou$][_{s}$ hao]] ("*it is better you leave*") and $[_{s}$ni $[_{vp}$ zou hao]] ("*you walk well*"), cyclic application accounts for the fact that the first two T3 undergo sandhi change in the former and only the second T3 in the latter. Our current approach shows it may result in the competition between the two algorithms in Pak (2008). The example above can be differentiated in c-command algorithm—P M n M n # (or P M n # P n) in the former and (P (M n) P c) in the latter (see below).

Algorithms: The TSMC applies from "left to right" in the domain constructed by ***both*** phrase-left concatenation rule (maked as M…P c): identifies pairs of M-words X, Y where (i) X is left-adjacent to Y, and (ii) X does not c-command Y, ***and*** head-left concatenation rule (maked as P…M n): identifies pairs of M-words X, Y where (i) X is left-adjacent to Y, and (ii) X c-commands Y (Pak 2008). A sandhi domain boundary is inserted after the ultimate morphological word which can comply with the current Concatenation algorithms. Once one sandhi domain is determined, the subsequent new concatenation process is continued from the next Morphological word. The algorithms launch the internal competition, e.g., In (P (M n) P c), TSMC applies in M…P c firstly, which occupies the lower position in the syntactic tree, afterwards TSMC applies in P…M n. We add the internal c-command relations in the incorporated compounding structures (Harley 2009) of "N-N" and "A-N" structures (between 2 and 4 morphemes) into the algorithm (maked as m…p $_{c}$ and p…m $_{n}$ referring to the algorithm below classical phrasal level). **Data:** We use the original data from Chen (2009) covering basic syntactic structures—(S)V(O), (S)V+clause, involving different cases with PP, "baP", "V+resultant V" structure, "modifier-noun" structure, and cliticization of prepositions, object pronouns and classifiers. Please see the data section in the next page. **Implications:** It is shown that the unusual cyclicity of TSMC as a postlexical rule reported in Kaisse (1985) is not limited to lexical level in Chen (2009), but may result in universal competition in c-command based algorithms of domain construction in Pak (2008). Additionally, the c-command relations of the "N-N" compounding structures and "modifier-noun" structures ("N-N" or "A-N") seem to be the key factor to construct the unified algorithm.

Key words: T3 tone sandhi; Chinese Mandarin; external sandhi rule; phonology-syntax interface; compounding structures

Data section: Part of the data and algorithms are listed below: From **1** to **5** are cases of exceptional lexical domains in Chen (2009), which can be integrated in the current algorithm. **6** and **7** are data of comparison between monomorphemic structures and "N-N" compounding structures with two and four morphemes. **8** is an example of a longer sequence with the clitic of object pronoun, which is also illustrated in syntactic tree with the algorithm route in Figure 1. (# is used to mark a sandhi boundary.)

Data from Chen (2009)	**Type**	**Algorithm**
1. [$_{VP}$ kao # [$_{NP}$ **xiao[ruge]**] (*[$_{VP}$ roast # [$_{NP}$ small[squads]]]*)	"Modifier-Noun"	1. √**ruge**(√*squads*) p m$_n$ # 2. (M (p$_c$)m$_{n.}$)*
2. [$_{VP}$[$_{PP}$[$_{NP}$ zhong-tong-fu] **li**] you]# *([$_{VP}$[$_{PP}$[$_{NP}$ president palace]inside] have]#)*	Preposition	p m$_n$ m$_n$ M$_n$ M$_n$ #
3. [mao $_{VP}$[$_{PP}$[**bi** # gou] xiao] (*[cat $_{VP}$[$_{PP}$[than # dog] small]*)	Preposition	P M n. # P c. M n.
4. [$_{VP}$ mai [$_{ClP}$ **dian** [jiu]]] # (*[$_{VP}$ buy [$_{ClP}$ some [wine]]] #*)	Classifier	M M c P c #
5. [$_{CP}$ gou [$_{VP1}$ **chao xing** # [$_{VP2}$ [$_{NP}$ Xiaomei]]]]] (*[$_{CP}$ dog [$_{VP1}$ barks wakes up # [$_{VP2}$ [$_{NP}$ Xiaomei]]]]]*)	"V+Resultative V"	(P (m $_{n.}$) p $_{c.}$) # p $_{c.}$ m $_{n.}$
6. a.[$_{CP}$ gou [$_{VP}$ yao [$_{NP}$ wo]]] # (*[$_{CP}$ dog [$_{VP}$ bite [$_{NP}$ me]]] #*) **b.**[$_{CP}$ gou [$_{VP}$ yao # [$_{NP}$ nü-ren]]] (*[$_{CP}$ dog [$_{VP}$ bite #[$_{NP}$ woman]]]*)	Monomorphemic vs Two-morpheme compounding	**a.** (P (M n) P c) **b.** P M n. # p $_{c.}$ m $_{n.}$
7. [[[zhan-lan]$_{N1}$guan$_{N2}$]zhang$_{N3}$] # *([[[exhibition]$_{N1}$hall$_{N2}$]director$_{N3}$] #)*	Four-morpheme compounding	p m$_{n.}$ m$_{n.}$ m$_{n.}$ #

8. [$_{NP}$ fang-dong]#[$_{NegP}$ bu[$_{VP}$ yun-xu [$_{IP}$[$_{NP}$ wo]#[$_{VP}$ $_{PRO}$yang[xiao-mao]]]]

[$_{NP}$ landlord]#[$_{NegP}$ not[$_{VP}$ allow [$_{IP}$[$_{NP}$ me]#[$_{VP}$ $_{PRO}$ keep [kitten]]]]

p m $_n$ # (M $_n$ (p $_c$)m $_n$ M $_n$) # (M $_c$ (p $_c$)m $_n$)

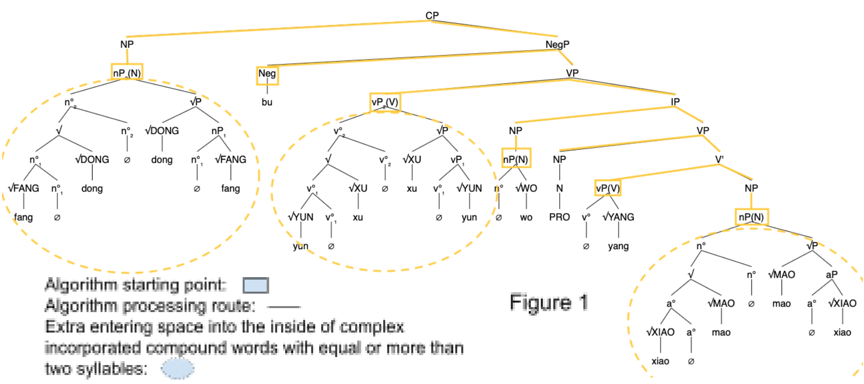

Figure 1

** In complex "Modifier-Noun" structure (e.g., [A[N-N]], [A[A[N-N]]] or [N[N-N]]), we use the remuneration of roots (Shwayder 2015) to construct multiple steps of incorporation movements. Alternative consecutive incorporated structures are all ruled out in a test based on stress assignment and clash resolution in Shanghai Chinese. We suspect that this exception is due to the innate feature of incorporation construction from simple to complex "M-N" structures (e.g., consecutive incorporation movements in [A[N-N]] will move A to the adjunct position)*

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