The role of Strong Strong Start in Mandarin Tone 3 Sandhi

Introduction. Selkirk's (2011) Match Theory (MT) assumes distinctness of prosodic and syntactic structures. The prosodic structure is isomorphic to the syntactic structure in the default case via a set of Match constraints. However, correspondence between the syntactic and prosodic structure can be altered on a language-particular basis via the intervention of prosodic markedness constraints. MT is a retreat from Selkirk's (1986) Align-XP model which claims that in the default case only one edge of a syntactic constituent will align with a prosodic boundary. The major empirical evidence in favor of MT has come from languages such as Connemara Irish in which both edges of a phonological phrase can be detected in the phonology (Elfner 2012, 2015). This paper (i) argues that Mandarin (Chinese) Tone 3 Sandhi (T3S), a phonological process by which a T3 (Low) is changed to a sandhi tone (*s*) (Low-High) when it is followed by another T3 (Low), provides support for MT, and (ii) proposes a formulation of Selkirk's (2011) Strong Start constraint in languages that allow for n-ary branching in their prosodic structures.

T3S: a domain-sensitive phenomenon. (i) <u>Grammatically unstructured strings</u> of numbers such as *wu3* 'five' in (1) are grouped into "Minimal Rhythm Units" that consist of two or three syllables (Chen 2000). (ii) <u>A left-branching structure</u> only has a non-alternating T3S pattern in which all but the rightmost T3 is changed to the sandhi T2, as shown in (2b) and (3c). This pattern can be derived via a bottom-up cyclic application of the T3S process to successive constituents in the hierarchical representation; in this mode of application a rightward extension of the sandhi domain coincides with the left-to-right flow of speech. (iii) The pattern of realization of <u>a right-branching structure</u> is more variable. The alternating T3S pattern in (4a) and (5a) can also be derived via a bottom-up cyclic T3S application; but in this mode of application the domain in which T3S applies extends leftward, in the direction opposite to the flow of speech. <u>Because left- and right-branching structures show distinct patterns of realization compared to grammatically unstructured strings, both the right edge of a left-branching structure and the left edge of a right-branching structure must be detectable in the phonology.</u>

(1)	a.	UR:	*wu3*	*wu3*	*wu3*	*wu3*		b.	UR:	*wu3*	*wu3*	*wu3*	*wu3*	*wu3*
		SR:	(*s*	3)	(*s*	3)			SR:	(*s*	3)	(*s*	*s*	3)

(2)	'leave a bit earlier'				(4)	'buy good wine'			
	UR:	[[*zao3*	*dian3*]	*zou3*]		UR:	[*mai3*	[*hao3*	*jiu3*]]
		early	a bit	leave			buy	good	wine
a.	SR:	*3	*s*	3	a.	SR:	3	*s*	3
b.	SR:	*s*	*s*	3	b.	SR:	*s*	*s*	3

(3)	'It is good to leave a bit earlier.'					(5)	'want to buy good wine'			
	UR:	[[[*zao3*	*dian3*]	*zou3*]	*hao3*]		UR:	[*xiang3*	[*mai3*	[*hao3*	*jiu3*]]]
		early	a bit	leave	good			want	buy	good	wine
a.	SR:	**s*	3	*s*	3	a.	SR:	*s*	3	*s*	3
b.	SR:	*3	*s*	*s*	3	b.	SR:	3	*s*	*s*	3
c.	SR:	*s*	*s*	*s*	3	c.	SR:	*s*	*s*	*s*	3

A Match-Theory analysis. I propose that T3S applies cyclically bottom-up on a prosodic structure that is "matched" from the syntactic structure. In the default case, the prosodic structure is isomorphic to the syntactic structure to satisfy the Match constraints in (6) (Selkirk 2011).

(6) a. **Match(XP, φ)**: The left and right edges of a lexical phrasal projection in the syntax must correspond to the left and right edges of a phonological phrase in the phonology.

b. **Match(φ, XP)**: The left and right edges of a phonological phrase in the phonology must correspond to the left and right edges of a lexical phrasal projection in the syntax.

I account for the various possibilities for a right-branching structure by the interchange between violations of the Match constraints in (6) and violations of **Strong Strong Start** (7a). Strong Strong Start is a more restrictive version of Selkirk's (2011) **Strong Start** (7b).

(7) a. **Strong Strong Start**: A prosodic constituent optimally begins with a leftmost daughter constituent not lower in the prosodic hierarchy than **any** sister constituent that follows.

b. **Strong Start**: A prosodic constituent optimally begins with a leftmost daughter constituent not lower in the prosodic hierarchy than the constituent that **immediately** follows.

The interchange is motivated by having STRONG STRONG START ranked variably with respect to the Match constraints. I suggest that three rankings are possible. The right-branching structure in (5) has three readings that correspond to five different prosodic structures (where the terminal nodes are ω). With **MATCH(XP, φ), MATCH(φ, XP) >> STRONG STRONG START**, the prosodic structure in (8a) is isomorphic to the syntactic structure. With **MATCH(XP, φ), MATCH(φ, XP), STRONG STRONG START** equally-ranked, the prosodic structures in (8b-c) both incur one violation of MATCH(XP, φ) and one STRONG STRONG START violation. Finally, with **STRONG STRONG START >> MATCH(XP, φ), MATCH(φ, XP)**, the prosodic structures in (8d-e) both satisfy STRONG STRONG START. With these rankings, all and only the possible readings can be derived.

Note that while the prosodic structures in (8b-c) both violate STRONG STRONG START, only that in (8b) violates STRONG START. Thus, if STRONG START were used in place of STRONG STRONG START, then the prosodic structure in (8b) (as well as those in (8d-e)) would be harmonically bounded by that in (8c), and the T3S pattern in (8b) (as well as the non-alternating T3S pattern in (8d)) cannot be derived.

(8) UR: $[_{VP1}$ *xiang3* $[_{VP2}$ *mai3* $[_{NP}$ *hao3* *jiu3*]]] 'want to buy good wine'
want buy good wine

a. SR: (ι (φ₁ *s* (φ₂ 3 (φ₃ *s* 3))))

MATCH(XP, φ)	MATCH(φ, XP)	STRONG STRONG START
		φ₁, φ₂

b. SR: (ι (φ₁ 3 (φ₂ *s* *s* 3)))

MATCH(XP, φ)	MATCH(φ, XP)	STRONG STRONG START
NP		φ₁

c. SR: (ι (φ₁ *s* 3 (φ₂ *s* 3)))

MATCH(XP, φ)	MATCH(φ, XP)	STRONG STRONG START
VP2		φ₁

d. SR: (ι (φ₁ *s* *s* *s* 3))

STRONG STRONG START	MATCH(XP, φ)	MATCH(φ, XP)
	VP2, NP	

e. SR: (ι (φ₁ (φ₂ *s* 3) (φ₃ *s* 3)))

STRONG STRONG START	MATCH(XP, φ)	MATCH(φ, XP)
	VP2	φ₂

The effect of STRONG STRONG START. I suggest that STRONG STRONG START is the appropriate formulation of Selkirk's (2011) STRONG START constraint in languages that allow for n-ary branching in their prosodic structures. To satisfy STRONG STRONG START, correspondence between syntactic and prosodic constituency can be altered such that <u>a right-branching syntactic constituent is "matched" by an equal-sisters prosodic constituent in the sense of Myrberg (2013), by (i) "flattening" the recursive structure, as in (8b-d), or (ii) grouping syntactic non-sisters at the left edge, as in (8e).</u> In Mandarin, these alterations optimize the way T3S applies on the prosodic structure by avoiding a leftward extension of the domain in which T3S applies in the direction opposite to the flow of speech, and result in the various possibilities for a right-branching structure. The lack of variation for a left-branching structure follows from the fact that the prosodic structure "matched" from a left-branching structure in the default case satisfies both the Match constraints and STRONG STRONG START, and thus any alteration is less optimal.

Size constraints. Elfner (2012, 2015) argues that STRONG START violations cannot be obviated by promoting ω to φ and necessarily result in syntax-prosody mismatches in Connemara Irish due to a top-ranked constraint **BIN(φ)**, which requires φ to consist of **exactly** two sister constituents. Similarly, I argue that STRONG START violations cannot be obviated by promoting ω to φ in Mandarin due to a top-ranked constraint **BINMIN(φ)**, which requires φ to consist of **at least** two sister constituents. I suggest that **BINMAX**, which requires a prosodic constituent to consist of **at most** two sister constituents, is absent at the φ-domain, but is present at the foot-domain, which accounts for the rhythmic grouping in grammatically unstructured strings (1).

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