

## Directionality of Tone Sandhi and Harmonic Serialism

### I Introduction

The patterns of Tone sandhi in polysyllabic forms are the aggregate of the basic tone sandhi patterns of two-tone sequence. The combination and interaction of these basic patterns are complex. The typical cases of directionality are paradox of Tianjin dialect (Chen 1986, 2000, Wee2004, Wang 2002 ).

Tianjin is a northern Mandarin dialect in China. It has four citation tones:

T1:LL(*yinping*). T2:HH(*yangping*): T3:LH(*shangsheng*). T4:HL(*qusheng*)

Two identical tones, except of HHs, cause tone sandhi, which can be viewed as tonal dissimilation: LL→LH/\_LL; LH→HH/\_LH; HL→LL/\_HL. In addition, Tianjin dialect disallows identical L tone features, which is dubbed as Tonal Absorption: HL→HH/\_LL. In the constraint-based theory, two OCP constraints: \*xy.xy and \*L.LL are taken into account for these four sandhi patterns. In trisyllabic sequences, there are 7 patterns of tone sandhi of Tianjin, 5 of them are involved in the problem of directionality:

input	intermediate level	output
1. <u>HL.HL</u> .LL	→ LL.HL.LL →	LL.HH.LL
2 <u>LH.LH</u> .LH	→ HH.LH.LH →	HH.HH.LH
3 HL. <u>HL.HL</u>	→ HL.LL.HL →	HH.LL.HL
4 LL. <u>LL.LL</u>	→	LL.LH.LL
5 HL. <u>LL.LL</u>	→	HL.LH.LL

For pattern 1 and 2, Tone Sandhi is triggered from left to right, for pattern 3,4 and 5, tone sandhi is triggered from right to left. The directions of tone sandhi are different within one language and there is no principle which governs the directions of sandhi operations in the frame work of rule-based theory. This paper argues that Harmonic Serialism(HS)(McCarthy2008,2009), a derivational version of OT, can explain the paradox of directionality.

The comparison of HS and standard OT:

HS            input → GEN → EVAL → GEN ... loop → output

standard OT input → GEN → EVAL → output

### II. Paradox of directionality as TMR problems

The so called paradox of directionality is a special version of Too Many Repairs problem. The differences on direction of sandhi operation are actually the differences on the choices of certain modes repairing the violation of markedness constraints. For instance, the input LH.LH.LH violates OCP twice, the mode chosen in this case is to repair this ill-formed trisyllabic sequence one by one, while for the input LL.LL.LL, the mode to repair all of the marked form by one step is chosen:

	LH.LH.LH	LL.LL.LL	
	∨ ∨	∨ ∨	
	OCP OCP	OCP OCP	
Step1	<u>HH</u> .LH.LH	LL. <u>HH</u> .LL	
	∨		
	OCP		
Step2	HH.HH.LH		

According to McCarthy(2010), HS can explain the TMR problem by limiting Gen. The Gen in HS is limited to make one change at a time. The unwanted repairs can be predicted by HS and eliminated by such mechanism. Three positional faithfulness constraints involved in the analysis of Tianjin tone sandhi:

**R-IDENT-IO(T)**: the tone of right boundary in output should have the same value with the tone in right boundary of input.

**M-IDENT-IO(contour, L)**: the L tone feature in the middle position in output should have the correspondent in the contour tone in the middle position of input.

**L-IDENT-IO(T)**: the tone of left boundary in output should have the same value with the tone in left boundary of input.

LH.LH.LH→HH.LH.LH→HH.HH.LH Pass 1:

input	LH.LH.LH	R-IDENT -IO(T)	M-IDENT-IO( contour, L)	*xy.xy	*xL.LL	L-IDENT- IO(T)
	a.LH.LH.LH			**!		
→	b.HH.LH.LH			*		*
	c.LH.HH.LH		*!			

Unwanted form LH.HH.LH is eliminated, and then the output HH.LH.LH is taken into the second pass as the input.

LL.LL.LL→LL.LH.LL Pass 1:

input	LL.LL.LL	R-IDENT -IO(T)	M-IDENT-IO( contour, L)	*xy.xy	*xL.LL	L-IDENT- IO(T)
	a.LL.LL.LL				**!	
	b.LH.LL.LL				*!	*
→	c.LL.LH.LL					

Because the tone in the middle position is a low level tone, the constraint M-IDENT-IO(contour, L) can not influence the evaluation. So candidate C is chosen.

In HS, Tonal stability in the 3 positions is different: Right >> Mid >> Left

So when two identical tones are adjacent in Mandarin, the left one changes its tone value. In three tone forms, if the tonal stability in that position is required; tone sandhi operation is directed from left to right. If the tonal stability in that position is ignored, the mid tone will change in order to repair all violations in one time.

The order and number of phonological strata in HS is intrinsic and determined by markedness constraints. In the case of Tianjin dialect, the fact that two markedness constraints are involved limits the existence of two strata maximally. Any repair which requires more strata is forbidden. e.g. LL.LL.LL→LH.LL.LL→LH.LH.LL→HH.LH.LL. The presentation in the third stratum has no harmonic improvement. Moreover, if such repair is chosen, the underlying form is difficult to detect after multi-level derivation.

III. HS analysis on Boshan, Changting and Yantai Dialect

IV. Conclusion

The problem of directionality is a subset of TMR problem. In HS, the principles governing the direction of sandhi operations are the positional stability of tones and limitation on Gen. HS offers a new account for the directionality of tone sandhi processes.

## Reference

- Chen, Matthew Y. 1986. The paradox of Tianjin tone sandhi. *CLS* 22:98-154.
- Chen, Matthew Y. 2000. *Tone Sandhi: Patterns across Chinese dialects*. Cambridge Univ.Press.
- McCarthy, John 2008 The gradual path to cluster simplification, *Phonology* 25
- McCarthy, John 2009 Harmony in harmonic serialism, manuscript.
- McCarthy, John.2010 Studying Gen, *Journal of the Phonetic Society of Japan*
- Wang, Jialing. 2002. Youxuanlun he tianjinhua de liandu biandiao ji qingsheng. [OT and the tone sandhi and tone neutralization in Tianjin dialect. *ZhongGuoYuWen* 4 (289):363-371. (In Chinese).
- Wee, Lianhee. 2004. Inter-Tier Correspondence Theory, PhD Dissertation Rutgers, the State University of New Jersey