An analysis of the Xiamen Tone Circle

Keywords: Xiamen, Tone Circle, Computer Assisted Phonology.

The tone system of Xiamen presents systematic tone sandhi, organized in a circular fashion. ((1) and (2), page 2). This process is notorious for appearing to rely on a noncomputable function that is not analyzable in classical OT (Moreton (1999)). The analysis of circular shifts of this type faces two challenges: one is the identification of the constraints that motivate the circular move. The other challenge is completeness: the analysis of the Xiamen circle must evaluate 3,125 candidates, the number of permutations with repetitions of the five citation tones (assuming that the set of possible sandhi tones is identical to the set of citation tones). This paper addresses both challenges.

I show, building on recent work by Barrie (2006) and Hsieh (2004), that the simplest complete account of the Xiamen tone circle must include the following analytical ingredients: anti-correspondence constraints (cf. Alderete (2001), Hsieh (2004)) to prevent citation and sandhi tones from being identical; anti-merger constraints (cf. Flemming (2002); Padgett (2003); Łubowicz (2003)) to prevent distinct citation tones from mapping to the same sandhi tone; and a new class of faithfulness constraints, below.

Barrie (2006) has recently proposed an OT analysis of the tone circle in terms of Contrast Preservation (Łubowicz (2003)), in a grammar where each candidate is a scenario that represents a mapping between each of the five citation tones of Xiamen, and its corresponding sandhi tone. Figure (3),page 2, illustrates the scenario that represents the actual tone circle. However, Barrie considers a set of only six candidates, whereas he recognizes that a complete set of candidates would include 3,125. In order to evaluate Barrie's analysis, I wrote a Perl script that generates all 3,125 candidates and evaluates them automatically, using constraints defined in the script. The output is a table where each candidate is associated with its violations for each constraint. The set of constraints is ranked using OTSoft (Hayes et al. (2003)). The results invalidate Barrie's analysis. In his system, where EVAL is split in two stages, the desired winning candidate, (3), is harmonically bound by 44 other candidates in the 1st stage of EVAL.

An analysis of the candidates that are not ruled out by Barrie's analysis indicates what kind of constraints are needed to generate the correct output. In addition to the constraint types identified above (anti-faithfulness, anti-merger, plus standard markedness and faithfulness) it is necessary to include a constraint against raising targets, DRAT (Don't Raise Any Target): a mapping between a citation tone and a sandhi tone incurs one violation for DRAT if and only if at least one of the targets of the sandhi tone has a higher F0 value than the corresponding target of the citation tone. This constraint is analyzed as a member of a more general family of Linear Faithfulness Constraints. I am currently exploring other possible uses of this family of constraints. It is a natural constraint, since non prosodic heads prefer lower tones cross-linguistically, as shown in De Lacy (2002).

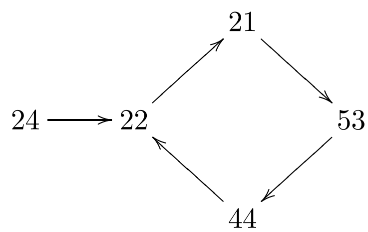
The grammar was successfully tested against the set of 3,125 candidates for the system of tone sandhi of Xiamen. An extension to the full set of Southern-Min sandhi systems is in progress.

An analysis of the Xiamen Tone Circle

Keywords: Xiamen, Tone Circle, Computer Assisted Phonology.

Examples and data:

(1)



(2) From Chen (1987)

Citation Form	Translation	Sandhi Form	Translation
we-24	'shoe'	we-22 tua-21	'shoe laces'
wi-22	'stomach'	wi-21 pih-22	'stomach ailment'
tsu-21	'house'	tsu-53 ting-53	'roof top'
hai-53	'ocean'	hai-44 kih-24	'ocean-front'
pang-44	'fragrant'	pang-22 tsui-53	'fragrant water'

(3) $\{/24, 22, 21, 53, 44/ \rightarrow [22, 21, 53, 44, 22]\}$

References

John Alderete. *Morphologically Governed Accent in Optimality Theory*. Outstanding Dissertations in Linguistics. Routledge, 2001.

Michael Barrie. Tone Circle and Contrast Preservation. *Linguistic Inquiry*, 37(1), 2006.

Matthew Y. Chen. The Syntax of Xiamen Tone Sandhi. *Phonology*, 4:109–149, 1987.

Edward Flemming. *Auditory Representations in Phonology*. Outstanding Dissertations in Linguistics. Routledge, 2002.

Bruce Hayes, Bruce Tesar, and Kie Zuraw. Otsoft 2.1 software package, 2003. http://www.linguistics.ucla.edu/people/hayes/otsoft/.

Feng Fan Hsieh. On the proper treatment of tonal chain shifts. MIT, 2004. Generals Paper.

Paul De Lacy. The interaction of tone and stress in optimality theory. *Phonology*, 19:1–32, 2002.

Anna Łubowicz. *Contrast Preservation in Phonological Mappings*. PhD thesis, UMass Amherst, 2003.

Elliot Moreton. Non-Computable Functions in Optimality Theory. *ROA 36*, 1999.

Jaye Padgett. Systemic contrast and catalan rhotics. Ms., 2003. ROA 574-0203.