Terminal Spread in Gao'an

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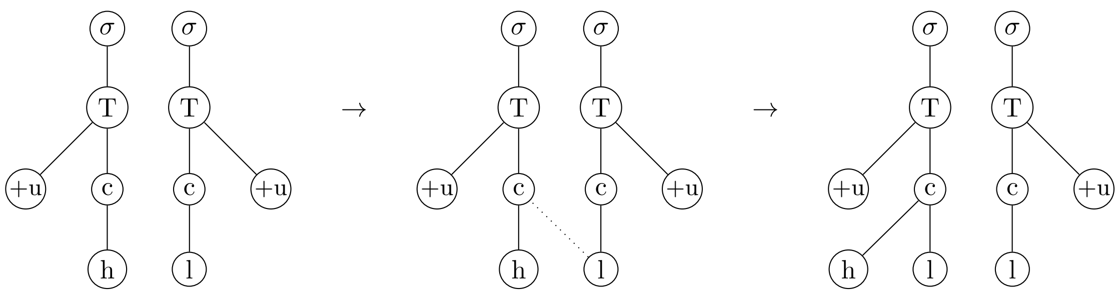
Consider the following data from Gao'an (Bao, 1990; Yan, 1981):

ɕiɛu	han	'make charcoal'	kuŋ	ɕia	'commune'
55	33	base form	55	11	base form
53	33	sandhi form	53	11	sandhi form
soŋ	tɕi	'bi-seasonal'	ka	pʰɛi	'double'
55	33	base form	55	11	base form
53	33	sandhi form	53	11	sandhi form

Bao interprets these data as evidence of local spreading of *terminal tonal nodes*; [l] tone (either [L] as -u;l or [M] as +u;l) spreads regressively to a heterosyllabic high-registered [H] tone. This is represented graphically for /H.M/↦[HM.M], again assuming tier conflation.



Crucially, this sandhi pattern only applies to level low/mid tones spreading regressively to high level tones. Contour tones do not participate in the alternation, nor does the data exhibit any evidence of high-tone spread.

We may formalize this spread as a logical transduction in a similar fashion as spreading on higher tiers, that is, by generating a copy of the spreading tone in a separate copy set, and defining domination such that the tone *spreads* regressively to an adjacent syllable. Syllable, 'T' root, and contour 'c' nodes do not change from input to output, so their unary relation definitions are omitted. Register features do not change as a result of sandhi, but their definition is relevant as only specific combinations trigger the alternation. Unary relations defined over the second copy set other than the [l] terminal are set to `False`.

$$\begin{aligned} P^1_{+u}(x) &\stackrel{\text{def}}{=} P_r(x) & P^1_{-u}(x) &\stackrel{\text{def}}{=} P_r(x) \wedge \neg pnlt(x) \\ P^1_{l}(x) &\stackrel{\text{def}}{=} P_l(x) \wedge final(x) & P^1_{h}(x) &\stackrel{\text{def}}{=} P_h(x) \wedge pnlt(\delta(x)) \wedge \neg(pnlt(\delta(succ(x)))) \\ P^1_{l}(x) &\stackrel{\text{def}}{=} P_l(x) \wedge final(x) \end{aligned} \tag{1}$$

These unary relation definitions ensure that regressive terminal-l spreading are predicted only in observed contexts. Sequences of two [+u]-registered syllables or a [+u.-u] sequence will trigger spreading, but no others (via the definitions of $P^1_{+u}(x)$ and $P^1_{-u}(x)$). Definitions of tonal elements achieve the same result;

only a high level tone followed by either a mid (+u;l) or low (-u;l) level tone will trigger sandhi. As before, the spreading element is generated in the second copy set, in this case a single terminal node.

Association does not change, so it is omitted here. Note that association between copy sets and within the second copy set are set to `False` The dominance functions are as below:

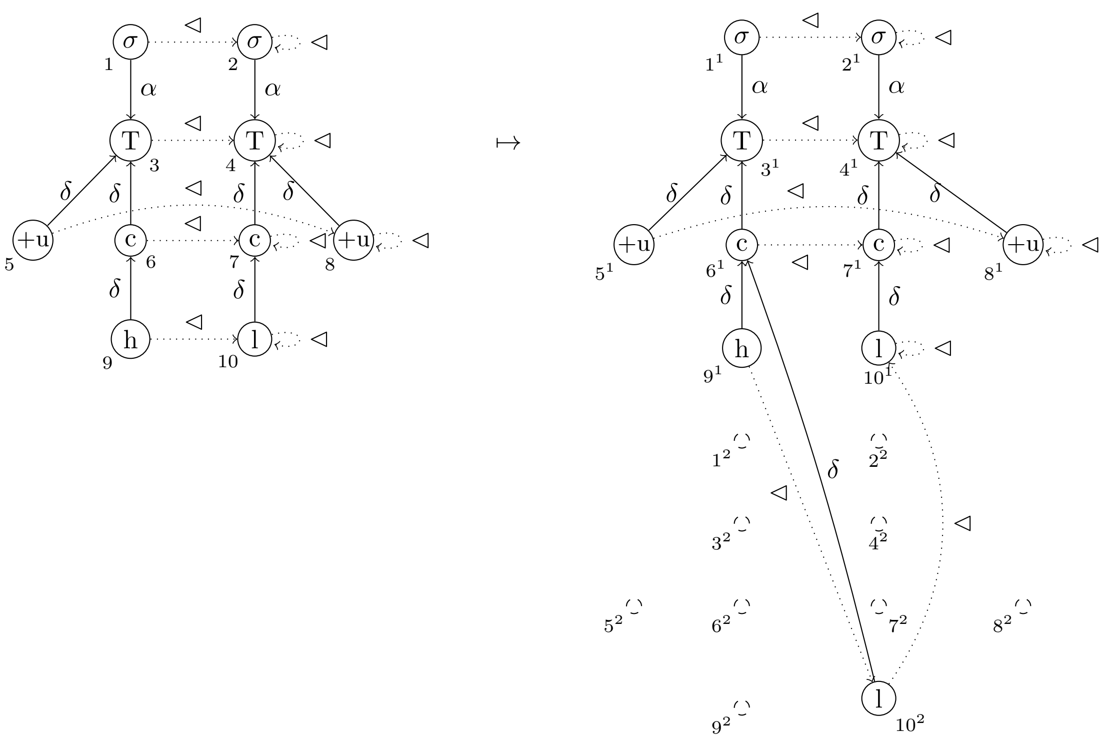
$$\begin{aligned} &\delta^{1,1}(x) \approx y \stackrel{\text{def}}{=} \delta(x) \approx y && \delta^{1,2}(x) \approx y \stackrel{\text{def}}{=} \texttt{False} \\ &\delta^{2,1}(x) \approx y \stackrel{\text{def}}{=} P_l(x) \wedge P_c(y) \wedge final(x) \wedge pnlt(y) && \delta^{2,2}(x) \approx y \stackrel{\text{def}}{=} \texttt{False} \end{aligned} \tag{2}$$

Between the input and the first copy set of the output, no changes are observed in domination relations, so it is defined identical to the input. Domination from the second copy set to the first achieves regressive spread.

Linear order of structural nodes does not change between input and output with the exception of the terminal node tier, and in this case the change is rather complex. The successor of the initial [h] node in the first copy set is the [l] node in the second copy set, and its successor is its equivalent in the first copy set (which itself is the final element). To achieve this ordering, we define linear order over these nodes via $succ(x) \approx y$ thus:

$$\begin{aligned} &succ^{1,1}(x) \approx y \stackrel{\text{def}}{=} P_l(x) \wedge P_l(y) \wedge x \approx y \\ &succ^{1,2}(x) \approx y \stackrel{\text{def}}{=} P_h(x) \wedge P_l(y) \wedge pnlt(\delta(x)) \wedge \neg(pnlt(\delta(succ(x)))) \wedge final(y) \\ &succ^{2,1}(x) \approx y \stackrel{\text{def}}{=} P_l(x) \wedge P_l(y) \wedge x \approx y \\ &succ^{2,2}(x) \approx y \stackrel{\text{def}}{=} \texttt{False} \end{aligned} \tag{3}$$

Applying this transduction to a model of a /H.M/ sequence (+u;h followed by +u;l) yields:



References

Bao, Z. (1990). *On the nature of tone.* PhD thesis, Massachusetts Institute of Technology.

Yan, S. (1981). Gaoan (Laowu Zhoujia) fangyan de yuyin xitong [The phonetic system of Gao'an (Laowu Zhoujia]. *Fangyan*, 1981(2):104–121.