Extending the Autosegmental Input Strictly Local Framework: Metrical Dominance and Floating Tones

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I. Overview

Subregular phonology and phonological locality

- Phonology is *subregular* – *Strictly Local* (Chandlee 2014, Chandlee & Heinz 2018, Chandlee & Jardine 2019)
- Basic observation: most, if not all, phonological processes operate on substrings of *bounded length*. Contexts and targets are *local*

Non-local phonology?

- Long-distance harmony, tonal processes (spreading, deletion, etc.)
- Solution: Autosegmental Phonology (Leben 1973, Goldsmith 1976)
  Non-local processes become local on relevant tiers (Odden 1994)

Autosegmental Representation and Strictly Local Phonology

- Many tonal processes are indeed only Strictly Local over Autosegmental Representation (Koser et al. 2018, Chandlee & Jardine 2019)
- More interestingly, adopting Autosegmental Representation does not always contribute to achieving phonological locality (Chandlee & Jardine 2019)

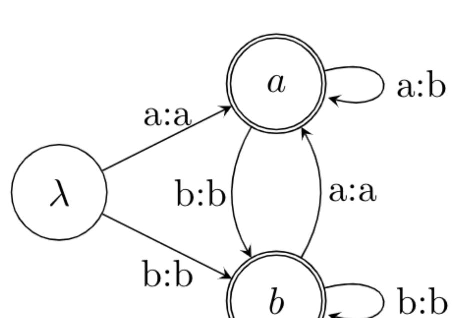
Scope of the current paper

- Extend the empirical coverage of the Autosegmental Input Strictly Local (A-ISL) framework (Chandlee & Jardine 2019): More data on tones
- Provide some discussion on phonological locality: How much 'help' can Autosegmental Phonology offer?

II. Input Strictly Local (ISL) Functions

Input Strictly Local (ISL) Functions

- Mapping relations defined on contiguous substrings of bounded length *in the input* (Chandlee 2014)
- Example: *aaaa* → *abbb*
  Rule: /a/ → [b] / a_
  Substring length: 2 (permits *#a, a#, #b, b#, ab, bb, ba*, changes *aa* to *ab*)
- FSA Equivalent: Subsequential Finite State Transducer (Chandlee 2014)



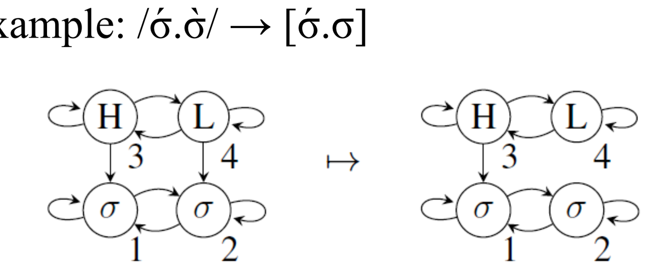
- Logical Equivalent: Quantifier-Free First-Order logic (Chandlee & Lindell in prep)

$$a'(x) \overset{\text{def}}{=} a(x) \wedge \neg a(p(x))$$
$$b'(x) \overset{\text{def}}{=} b(x) \vee (a(x) \wedge a(p(x)))$$

"Output is *a* if input is *a* and not preceded by another *a*"
"Output is *b* if input is *b* or input is *a* preceded by another *a*"

Autosegmental Input Strictly Local (A-ISL) Functions

- ISL mappings with Autosegmental Representations (Chandlee & Jardine 2019)
- Association lines as binary relations – *A (x,y)*
- Example: /σ́.σ̀/ → [σ́.σ]



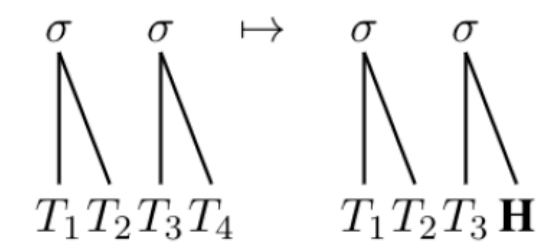
$$\sigma'(x) \overset{\text{def}}{=} \sigma(x) \qquad x\text{: TBU tier}$$
$$T'(y) \overset{\text{def}}{=} T(y) \qquad y\text{: Tonal tier}$$
$$A'(y,x) \overset{\text{def}}{=} A(y,x) \wedge \neg\texttt{last}(y)$$

III. Floating tone representation and metrical dominance

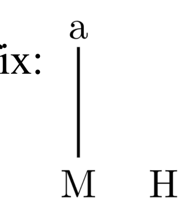
Floating tone suffixation in Cantonese (Chen 2000, Yip 2002)

- [a] (M) 'Old', a vocative prefix
  [tsæŋ] (HM) 'Zhang', a last name
  [tsʰan] (ML) 'Chen', a last name
  [a.tsæŋ] (M.HH) 'Old Zhang'
  [a.tsʰan] (M.MH) 'Old Chen'

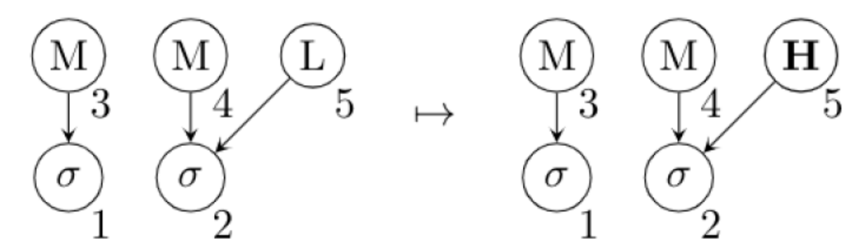
Cantonese H tone suffixation



- Vocative prefix = /a/ with an associated M tone and a floating H suffix:
  Suffixation = H tone substitution



- **QF transduction**
  a. $\sigma'(x) \overset{\text{def}}{=} \sigma(x)$
  b. $H'(y) \overset{\text{def}}{=} H(y) \vee \texttt{last}(y)$
  c. $M'(y) \overset{\text{def}}{=} M(y) \wedge \neg\texttt{last}(y)$
  d. $L'(y) \overset{\text{def}}{=} L(y) \wedge \neg\texttt{last}(y)$
  e. $A'(x,y) \overset{\text{def}}{=} A(x,y)$

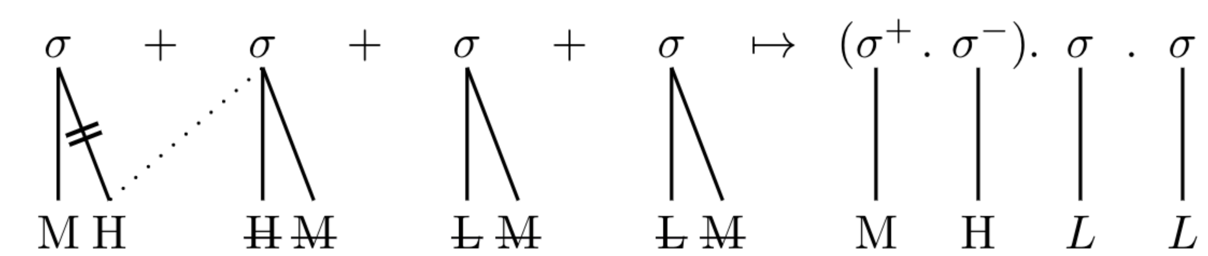


- Keep all TBUs (a) and all association lines (e)
- Map input tones faithfully to output *except for the last tone* (b-e); substitute the last tone with H (b)

- Here, floating tone = a tone without segmental information / tone-TBU association

Metrical left dominance in Shanghai tone sandhi (Duanmu 1995, 1999)

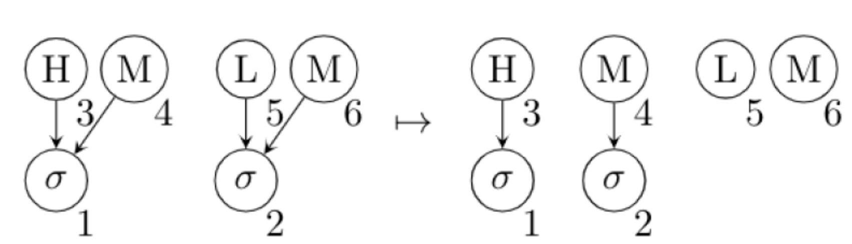
- [ɕʲo] (MH) 'small'
  [ɕi] (HM) 'fresh'
  [wã] (LM) 'yellow'
  [ŋ̩] (LM) 'fish'
  [ɕʲo.ɕi.wã.ŋ̩] (M.H.L.L) 'small fresh yellow fish'



- Left dominance: one left-aligned trochee (σ⁺.σ⁻) per prosodic word; redistribute *leftmost* syllable tones within the foot; delete all tones after (toneless syllables realized as phonetic *L*)

- **Not linearly ISL if leftmost syllable has indefinitely many tones**
  /T_1T_2…T_n.T…/ → [T_1.T_2]   "Hold the memory of T_1T_2 until encountering a syllable boundary"

- **QF Transduction**
  a. $\sigma'(x) \overset{\text{def}}{=} \sigma(x)$
  b. $H'(y) \overset{\text{def}}{=} H(y)$
  c. $M'(y) \overset{\text{def}}{=} M(y)$
  d. $L'(y) \overset{\text{def}}{=} L(y)$
  e. $A'(y,x) \overset{\text{def}}{=} (A(y,x) \wedge \texttt{first}(x) \wedge \texttt{first}(y)) \vee (A(y,p(x)) \wedge \texttt{second}(x) \wedge \texttt{second}(y))$



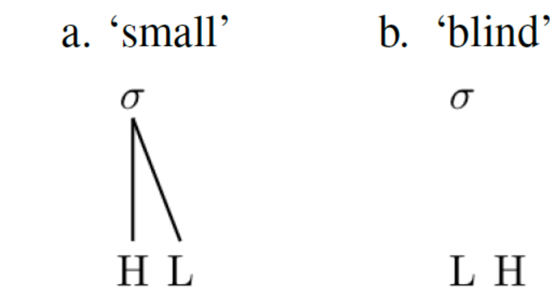
- Keep all TBUs (a) and all tones (b-d)
- Create only two association lines: first tone to first syllable (e, left disjunct), second tone to second syllable (e, right disjunct)
- Note: redistribution of tones is only possible when second tone belongs to first syllable *in the input*

- Lexical tones are *all associated* to the TBUs: association lines = morphological affiliation (e.g. MH tones are affiliated with the morpheme 'small' by association lines)
- Same sequence on the tonal tier + different associations → different sandhi outcome
  Compare: /**MH**.**L**/ → [**M**.**H**] vs. /**M**.**HL**/ → [**M**.*L*]

IV. Floating tones + metrical dominance

Suzhou tone sandhi (Shi & Jiang 2013, Zhu in prep)

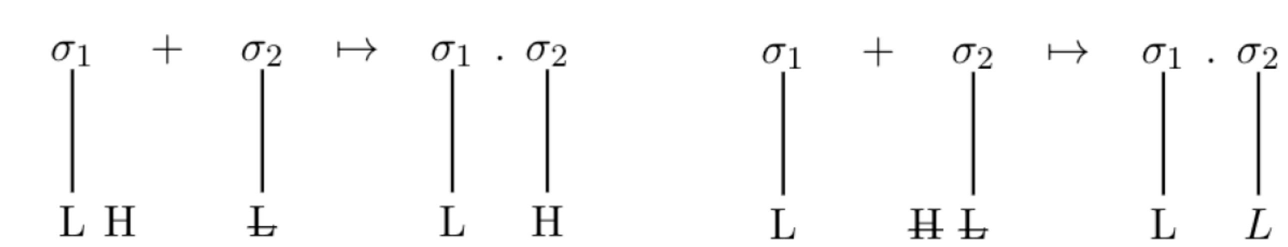
- [sʲæ] (HL) 'small'
  [mã] (LH) 'blind'
  [nɪn] (LH) 'person'
  [sʲæ.nɪn] (HL.*L*) 'child'
  [mã.nɪn] (L.H) 'blind person'



- The /HL/ lexical tone always "stays in place", while /LH/ always redistributes
- Hypothesis: lexical tones could be either associated or floating. Associated tones cannot be deleted in Suzhou, while floating tones can redistribute

A representational problem

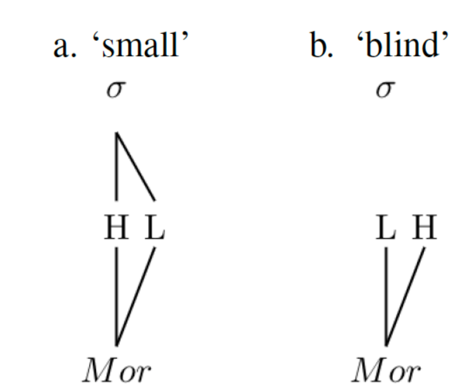
- How do we know if a certain tone "belongs" to the first/second syllable?
  A hypothetical minimal pair:



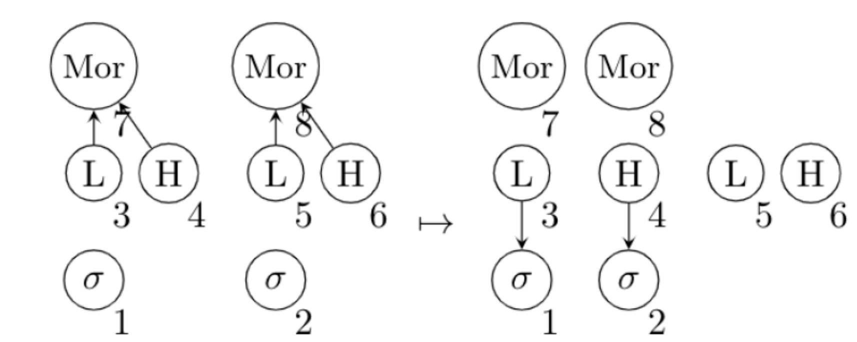
- Same sequence on the tonal tier (L H L) + same associations (first L–first syllable, second L–second syllable) → **different sandhi outcome**
- By using associated/floating status to represent tonal stability/displacement, **we have lost the information on morphological affiliation**

A morphophonological solution

- An additional autosegmental tier: Morpheme
- Morphological affiliation = Tone–Morpheme association



- **QF Transduction**
  a. $\sigma'(x) \overset{\text{def}}{=} \sigma(x)$
  b. $H'(y) \overset{\text{def}}{=} H(y)$
  c. $M'(y) \overset{\text{def}}{=} M(y)$
  d. $L'(y) \overset{\text{def}}{=} L(y)$
  e. $Mor'(z) \overset{\text{def}}{=} Mor(z)$
  f. $A'(x,y) \overset{\text{def}}{=} (A(x,y) \wedge \texttt{first}(x)) \vee (\texttt{first}(x) \wedge \texttt{first}(y))$
  $\vee (\neg A(p(x),y) \wedge R_{Mor}(y,z) \wedge \texttt{first}(z) \wedge \texttt{second}(x) \wedge \texttt{second}(y))$



Tone-TBU associations conditioned by Tone-Morpheme associations
- Keep all associations to first syllable in the input (f, first disjunct)
- Associate first tone to first syllable if floating in the input (f, second disjunct)
- Associate second tone to second syllable, *only when* the second tone is associated with the first *Morpheme* in the input (f, third disjunct)

- ***Not* a model-internal issue of A-ISL functions, but an underlying property of Autosegmental Representations**
- Regardless of types formalism, one has to capture:
  1. Some lexical tones always redistribute, some do not
  2. Redistribution only operates on the leftmost lexical tone