Remarks on Autosegmental Representations

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Questions about Autosegmental Representations (ASRs)

1. Phonologists often represent words with graph structures, but what kinds of graphs are they?
2. What aspects of these representations are language-specific and what are universal?

Today's Focus

1. How are tonal melodies associated to the timing tier?

Different answers

1. Left-to-right and right-to-left association conventions (Leben 1973, Goldsmith 1976, inter alia)
2. Optimal satisfaction of universal, violable constraints whose prioritization is language-specific (Zoll 2003)

The proposal:

- Constraints govern how tonal melodies associate to the timing tier. These constraints are:
  1. language-specific,
  2. inviolable,
  3. and *local*.
- We will illustrate with reference to Mende, Hausa, Kukuya, and Northern Karanga (a Shona dialect).

What 'local' means

The well-formedness of a structure can be determined solely on the basis of all of its local sub-structures.

What 'local sub-structure' means

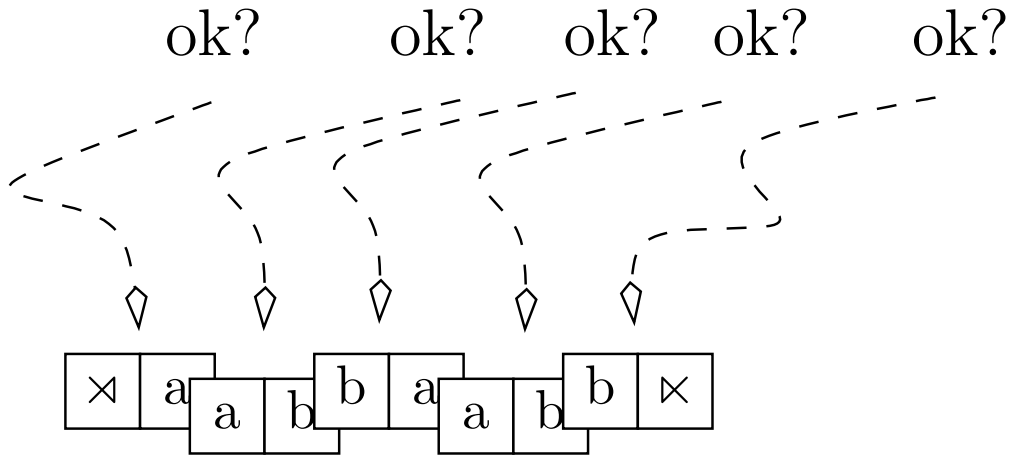
A sub-structure is local if it fits inside a sphere whose diameter we fix in advance.

(DRAW PICTURE HERE)

Strictly Local constraints for strings

When words are represented as strings, **local sub-structures are sub-strings** of a certain size.

Here is the string *abab*. If we fix a diameter of 2, we have to check these substrings.



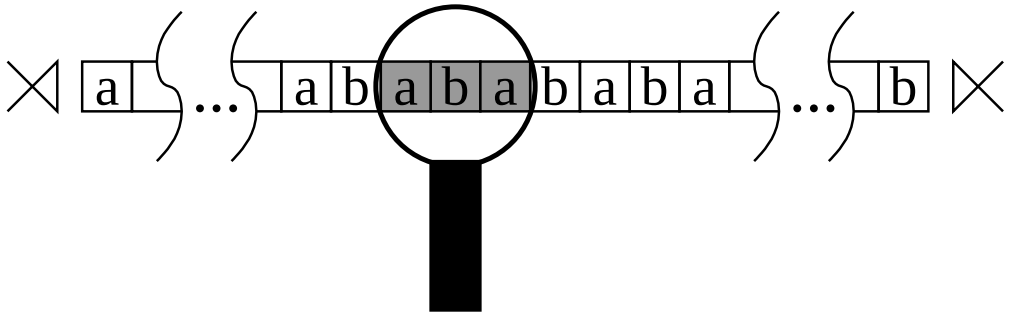
An ill-formed sub-structure is **forbidden**.

(Rogers and Pullum 2011, Rogers et al. 2013)

Strictly Local constraints for strings

When words are represented as strings, **local sub-structures are sub-strings** of a certain size.

- We can imagine examining each of the local-substructures, checking to see if it is forbidden or not. The whole structure is well-formed only if each local sub-structure is.



(Rogers and Pullum 2011, Rogers et al. 2013)

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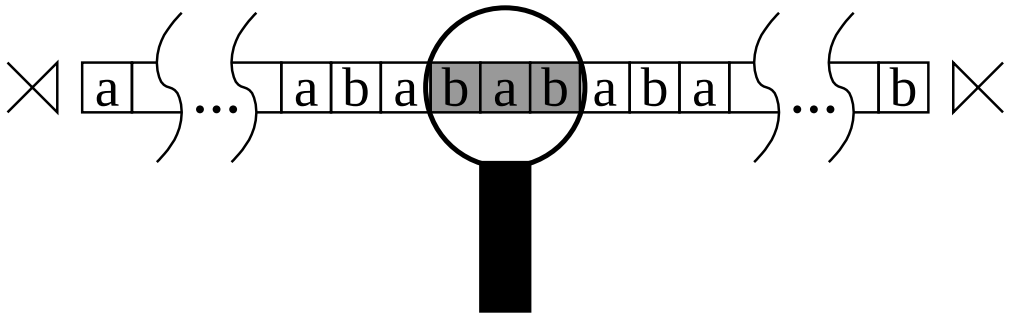

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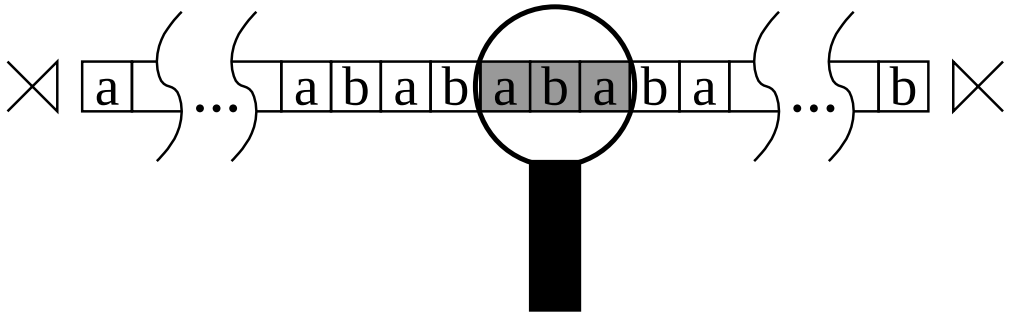


(Rogers and Pullum 2011, Rogers et al. 2013)

Examples of Strictly Local constraints for strings

- *aa
- *ab
- *N$\underset{\circ}{\text{C}}$
- NoCoda

Examples of Non-Strictly Local constraints

- *s...ʃ (Hansson 2001, Rose and Walker 2004, Hansson 2010, inter alia)
- *#s...ʃ# (Lai 2012, to appear, LI)
- Obligatoriness: Words must contain one primary stress (Hayes 1995, Hyman 2011, inter alia).

Simple Mende

(1) Mende word tone (Leben, 1973, 1978)

a. kɔ́	‘war’	b. pɛ́lɛ́	‘house’	c. háwámá	‘waist’
d. kpà	‘debt’	e. bɛ̀lɛ̀	‘pants’	f. kpàkàlì	‘three-legged chair’
g. mbû	‘owl’	h. ngílà	‘dog’	i. félàmà	‘junction’
j. mbă	‘rice’	k. nìká	‘cow’	l. ndàvúlá	‘sling’
m. mbā́	‘companion’	n. nyàhâ	‘woman’	o. nìkílì	‘groundnut’

Simple Mende surface tone patterns

(2)

H	HH	HHH
L	LL	LLL
F	HL	HLL
R	LH	LHH
R-F	LF	LHL

Left to right association (Leben 1973)

(ILLUSTRATE WITH HL MELODY AND $\sigma\sigma\sigma$)

The analysis, among other things, accounts for the absence of surface HHL (in Simple Mende).

It is 1973. A Hyperbolic Theory of Tone (Version 1)

- In ALL languages, tonal melodies associate in left-to-right fashion as in Simple Mende.

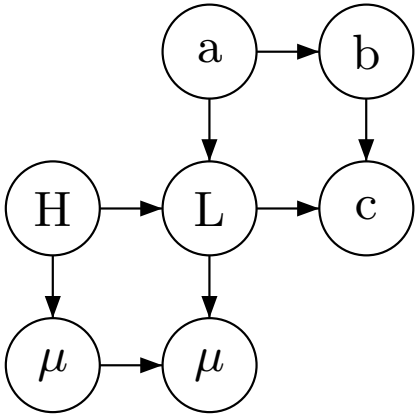
Overview of Issues

1. Right-to-left association in Hausa
2. Quality-dependent spreading in Kukuya
3. Accent-like effects (actual Mende)
4. Edge-in association in Northeren Karanga

(Zoll 2003)

Graphs

Graphs are labeled nodes connected by labeled edges.

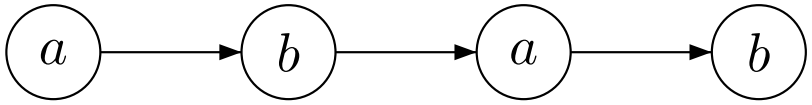


Earlier work

- Previous research took a 'top-down', *axiomatic* approach to understanding ASRs (Goldsmith, 1976; Bird and Klein, 1990; Coleman and Local, 1991; Kornai, 1995).
- Jardine and Heinz (to appear, MOL) provide a 'bottom-up' approach to ASRs by concatenating graph primitives (cf. Engelfriet and Vereijken 1997).

String graphs

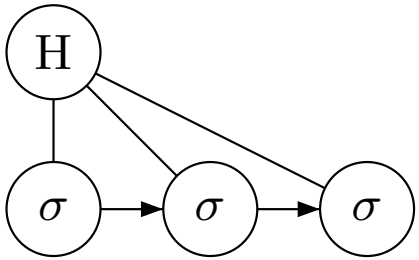
String graphs are "chains" of labeled nodes, where the edge represents the successor relation.

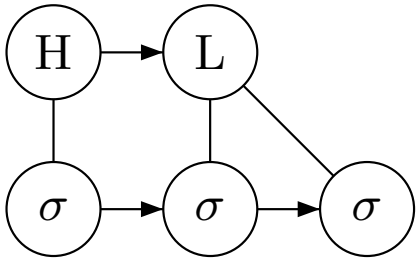


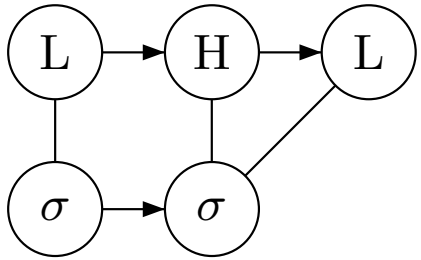
Axioms for ASRs

1. ASRs contain two string graphs (for melodic and timing tiers), with association edges connecting nodes of one string graph to another.
2. NCC: If x precedes y on the timing tier than the elements associated to x on the melodic tier must precede elements associated to y on the melodic tier.
3. OCP: Elements in the successor relation on the melodic tier cannot be identical.

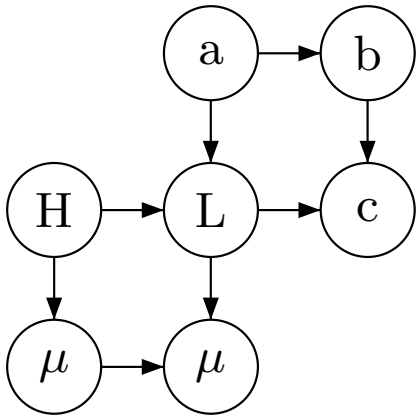
Example ASRs

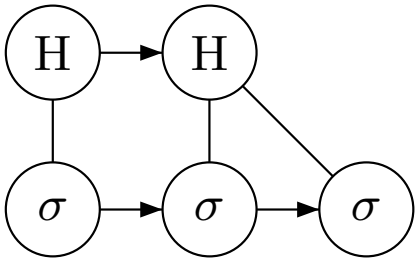


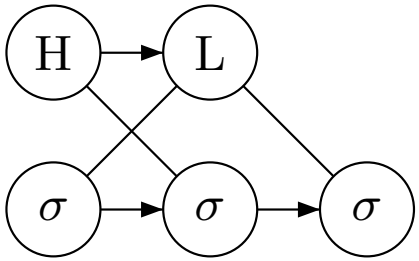




Example graphs that are not ASRs

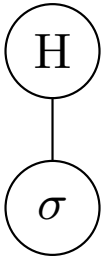


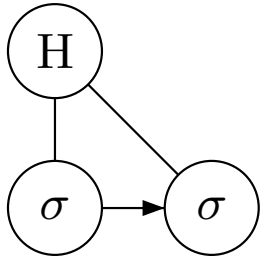


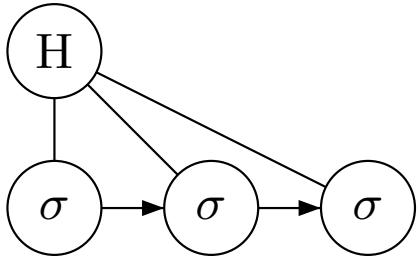


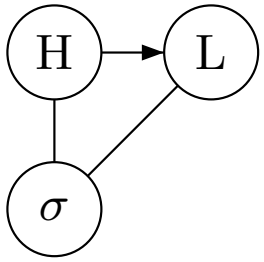
ASRs for Simple Mende

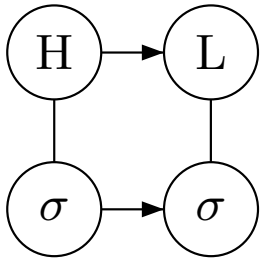
(3)

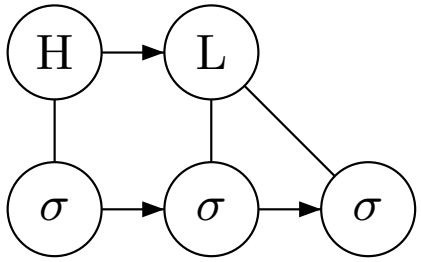
$g(\text{H}) =$ 

$g(\text{HH}) =$ 

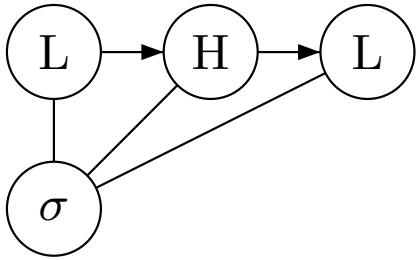
$g(\text{HHH}) =$ 

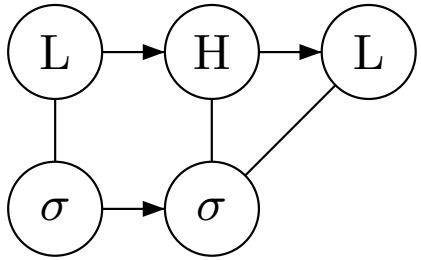
$g(\text{F}) =$ 

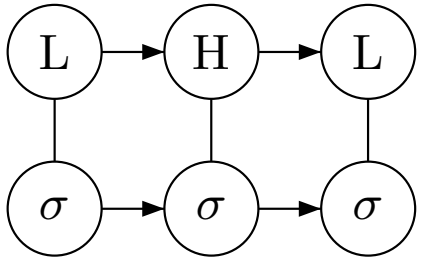
$g(\text{HL}) =$ 

$g(\text{HLL}) =$ 

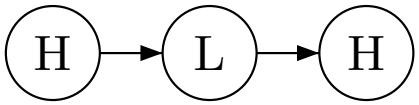
More ASRs in Simple Mende

(4) $g(\mathrm{C}) =$ 

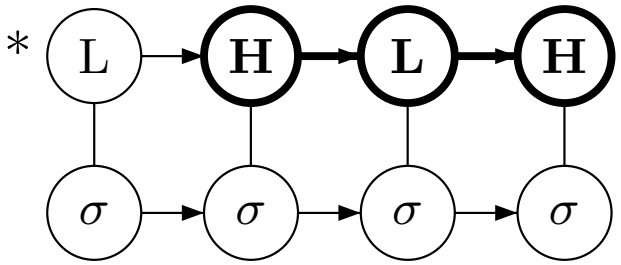
$g(\mathrm{LF}) =$ 

$g(\mathrm{LHL}) =$ 

Forbidding HLH

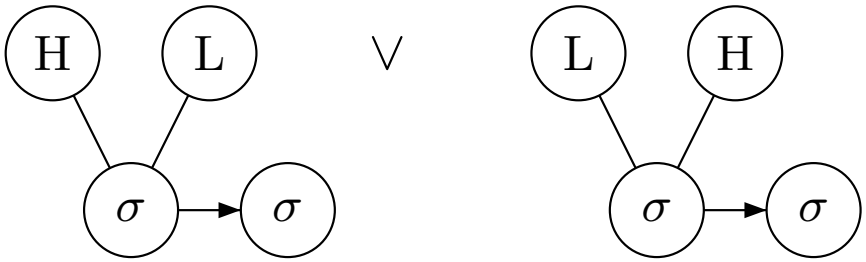
(5) $\phi_{HLH} =$ 

Example

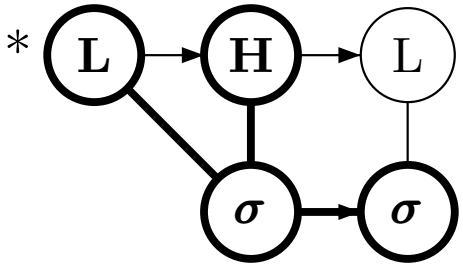


$^*g(\mathrm{LHLH})$

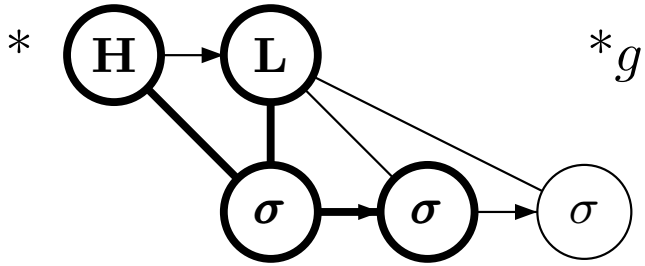
Forbidding nonfinal contours

(6) $\phi_{NF\text{-}Cont} =$ 

Example

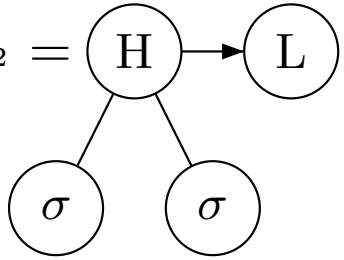


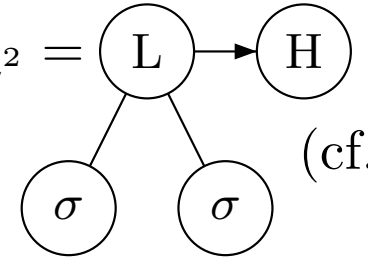
$^*g(\mathrm{RL})$



$^*g(\mathrm{FLL})$

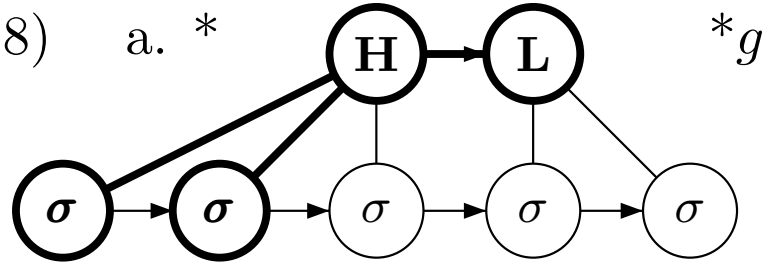
The last piece: directionality in Simple Mende

(7) a.$\phi_{NF\text{-}H^2}$ = 

b.$\phi_{NF\text{-}L^2}$ = 

(cf. Zhang 2000)

Example

(8) a. * 

*g(HHHLL)

(Later on we shall see with Kukuya that languages may pick one or the other—this corresponds to Zoll (2003)'s notion of spreading that is 'dependent on tone quality'.)

Summary of Simple Mende Analysis

$$\neg\phi_{HLH} \wedge \neg\phi_{NF\text{-}Cont} \wedge \neg\phi_{NF\text{-}H^2} \wedge \neg\phi_{NF\text{-}L^2}$$

Interpret $\neg\phi$ as "The structure ϕ is forbidden."

Right-to-left association in Hausa

(9) Hausa word tone

a. jáa	'pull'	b. jíráa	'wait for'	c. béebíyáa	'deaf mute (FE
c. wàa	'who?'	d. màcè	'woman'	e. zàmfàrà	'Zamfara'
f. jàakíi	'donkey'	g. jìmìnúu	'ostriches'	h. bàbbàbbàkú	'be well roaste
i. fáadì	'fall'	j. hántúnàa	'noses'	k. búhúnhúnàa	'sacks'
l. mântá	'forget'	m. káràntá	'read'	n. kákkáràntá	'reread'

Hausa surface tone patterns

(10)

H	HH	HHH
L	LL	LLL
LH	LLH	LLLH
HL	HHL	HHHL
FH	HLH	HHLH

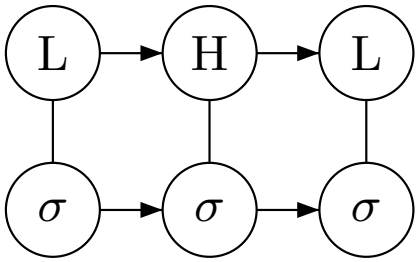
Right-to-left association

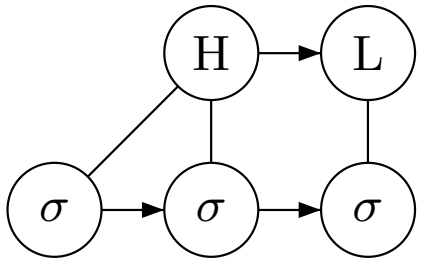
(ILLUSTRATE WITH HL MELODY AND $\sigma\sigma\sigma$)

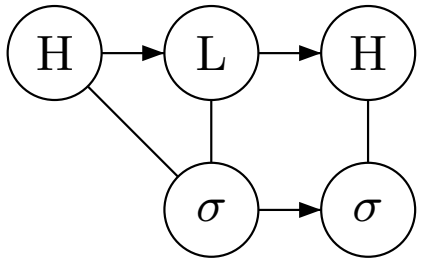
The Hyperbolic Theory of Tone (Version 2)

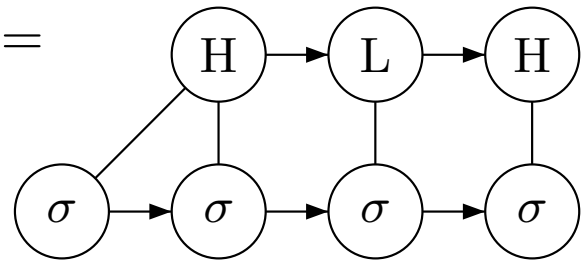
- In ALL languages, tonal melodies associate either left-to-right OR right-to-left.

Well-formed Hausa words

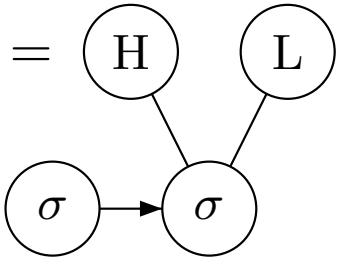
(11) $g(\text{HLH}) =$ 

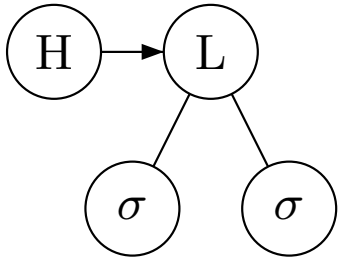
$g(\text{HHL}) =$ 

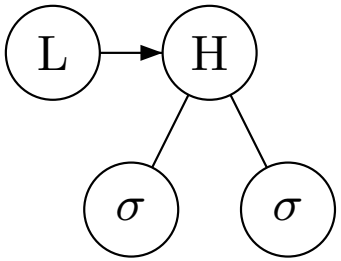
$g(\text{FL}) =$ 

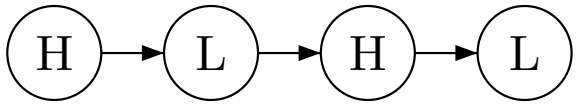
$g(\text{HHLH}) =$ 

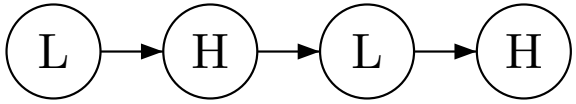
Forbidding sub-structures in Hausa

(12) a.$\phi_{NI\text{-}Cont}$ = 

b.$\phi_{NI\text{-}L^2}$ = 

c.$\phi_{NI\text{-}H^2}$ = 

(13) a. ϕ_{HLHL} = 

b.ϕ_{LHLH} = 

Summary of Hausa Analysis

$$\neg\phi_{NI\text{-}Cont} \wedge \neg\phi_{NI\text{-}L^2} \wedge \neg\phi_{NI\text{-}H^2} \wedge \neg\phi_{HLHL} \wedge \neg\phi_{LHLH}$$

Again, interpret $\neg\phi$ as "The structure ϕ is forbidden."

Kukuya

- Zoll (2003) points out that direction-based analyses of spreading predict that H and L tones will have identical behavior.
- Zoll (2003) shows with Kukuya that H and L behave independently.
- This is captured straightforwardly by forbidding sub-structures since these grammars may ban *any combination* of $\phi_{NF\text{-}H^2}$, $\phi_{NF\text{-}L^2}$, $\phi_{NI\text{-}H^2}$, and $\phi_{NI\text{-}L^2}$.

Kukuya data

Kukuya is like Mende but LHH patterns are not possible.

(14)

F		HL		HLL	
a. kâ	'to pick'	b. sámà	'conversation'	c. káràgà	'to be entangled'
R		LH		LLH	(*LHH)
d. să	' knot'	e. kàrá	'paralytic'	f. m^{w}àrəgí	'younger brother'
R-F		LF		LHL	
g. bv̋ĩ	'falls'	h. pàlî	'goes out'	i. kàlógì	'turns around'

Deriving LHH

(ILLUSTRATE WITH HL,LH MELODIES AND $\sigma\sigma\sigma$)

Some approaches to Kukuya

Hyman (1987) and Archangeli and Pulleyblank (1994) achieve this effect through the imposition of additional association rules.

- Hyman (1987) posits a L-Spreading rule that undoes the leftmost association of a doubly associated H.
- Archangeli and Pulleyblank (1994) instead stipulate there is a right-to-left Final H Association rule that takes priority over general left-to-right association.

Zoll (2003)

- Zoll (2003) argues that both of these analyses miss the generalization that a prosodically prominent H tone is not allowed to spread in Kukuya.
- As previously mentioned, forbidding particular aforementioned local sub-structures captures this generalization:

$$\neg\phi_{HLH} \wedge \neg\phi_{NF\text{-}Cont} \wedge \neg\phi_{NF\text{-}H^2} \wedge \neg\phi_{NI\text{-}H^2}$$

Actual Mende

Dwyer (1978) and Leben (1978).

(15)

Melody		2σ			3σ	
HL		HF			HHL	
	a.	kɔ́nyô	‘friend’	b.	séwúlò	‘rodent’
LH		LR			LLH	
	c.	(not attested)		d.	lèlèmá	‘mantis’

Analysis of Mende

- Actual Mende can also be described by forbidding particular sub-structures.

Northeren Karanga

- Hewitt and Prince (1989) argue that this language shows edge-in association (Yip 1988)
- This complicated pattern is sensitive to morphological tense.
- Nonetheless, it is also describable by forbidding sub-structures.

A missing generalization

- Former accounts miss the generalization that association—including directionality—is fundamentally local.
- All any grammar needs to do to evaluate the grammaticality of an association is to check it for banned *local* sub-structures.

Conclusion

Constraints govern how tonal melodies associate to the timing tier. These constraints are:

1. language-specific,
2. inviolable,
3. and *local*.

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