

Autosegmental Phonology: Tone

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Concatenative Approaches to
Nonconcatenative Morphology
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Early History of Autosegmental Morphology

Goldsmith (1976) Autosegmental approach to tone

McCarthy (1979) Autosegmental approach to Roots & Patterns

Marantz (1982) Autosegmental approach to reduplication

Definition of Tone

Pitch contrast, which is distinctive
for words/word forms

Tone in Chinese

Segments Tone

ma	high	‘mother’
ma	mid-high	‘hemp’
ma	mid-low-high	‘horse’
ma	high-low	‘scold’

Phonetic Implementation of Pitch

Pitch \approx Vibration speed of vocal chords

high \approx high speed

low \approx low speed

Level Tones vs. Contour Tones

Level Tones (constant pitch)	Contour Tones (change of pitch)
high	rising
low	falling
mid	rising/falling

Typology: Contour tones imply level tones

Notation of Tones

	IPA	IPA (Africa)	East Asia
high	ᵿ	á	555
low	ᵻ	à	11
mid	ᵿ	ā	33
rising	ᵿ	ǎ	35
falling	ᵿ	â	53

Tone as a Morpheme: Hausa Verbal Nouns

Segments	Ton		Segments	Ton	
ʃa:	high	'to drink'	ʃa:	falling	'drinking'
tʃsi	high	'to eat'	tʃi:	falling	'eating'

Tone as a Morpheme: Somali Case

	Nominative	Vocative	Genitive	Absolutive
'males'	rag	–	rág	rág
'billy-goat'	orgi	órgi	orgí	órgi
'mothers'	hooyooyin	hóoyooyin	hooyooyín	hooyoóyin
'family'	xaas	–	xaás	xáas
	No H	Initial V	Final V	Penultimate V

(Hyman, 1981; Banti, 1988; Yip, 2002)

Tone as a Morpheme: Mende Noun Classes

1 σ

2 σ

3 σ

H	kó	‘war’	pélé	‘house’	háwámá	‘waistline’
L	kpà	‘debt’	bèlè	‘trousers’	kpàkàlì	‘tripod chair’
HL	mbû	‘owl’	ngílà	‘dog’	félàmà	‘junction’
LH	mbă	‘rice’	nàvó	‘money’	ndàvúlá	‘sling’
LHL	mbã	‘companion’	njàhâ	‘woman’	nìkíli	‘groundnut’

What makes Tonal Morphology Problematic?

- ▶ Tone is pronounced simultaneously with segments/syllables
- ▶ Tone might be considered a phonological feature of segments or syllables
- ▶ Hence expressing morphology by a change of the tone/pitch contour of a word doesn't seem to add material, but to change it
- ▶ Hence tonal morphology seems to be inherently non-concatenative

The Absolute Slicing Hypothesis (Goldsmith, 1976)

In traditional phonology, a phonological representation is a complete transitive order of segments.

This means that for all sounds in the representation:

- ▶ Either Sound₁ precedes Sound₂,
or Sound₂ precedes Sound₁

(Two sounds cannot be simultaneous,
be unordered or follow each other)

- ▶ If Sound₁ precedes Sound₂,
and Sound₂ precedes Sound₃,
then Sound₁ precedes Sound₃

Weakening the Absolute Slicing Hypothesis in Autosegmental Phonology (Goldsmith, 1976)

- ▶ A phonological representation consists of a fixed number of subrepresentations
- ▶ The Absolute Slicing Hypothesis holds for each sub-representation, but not for the overall representation
- ▶ Relative linearization of subrepresentations is achieved by association between the units of single subrepresentations


The Autosegmental Representation of Tone

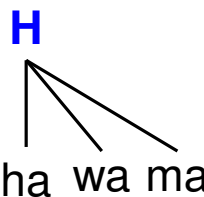
H
|
sha

H L
 \ /
 \ /
 \ /
 \ /
 sha

- ▶ Tone and segments/syllables are represented on different ‘tiers’, separate planes in a three-dimensional space
- ▶ Linked (associated) elements of different tiers are pronounced as a unit
- ▶ A single tone may be linked to more than one syllable
A single syllable may be linked to more than one tone (resulting in a contour tone)

1 Tone – Many Syllables: Mende

kó = 

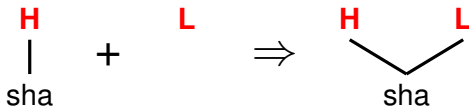
háwámá = 

1 Syllable – Many Tones: Mende

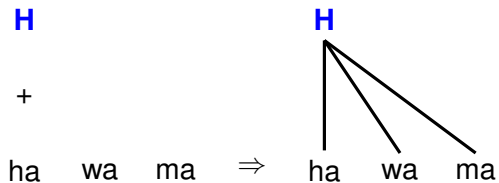
nàvó = $\begin{array}{cc} \text{L} & \text{H} \\ | & | \\ \text{na} & \text{vo} \end{array}$

mbǎ = $\begin{array}{cc} \text{L} & \text{H} \\ \diagdown & / \\ & \text{mba} \end{array}$

Autosegments Make Tone Concatenative: Hausa



Autosegments Make Tone Concatenative: Mende



Phonological Evidence: Tone Mobility in Chizigula

Tone-less Verbs

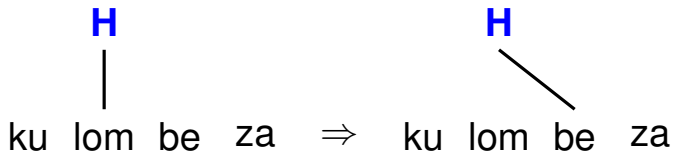
ku-damanj	‘do’
ku-damanj-iz-a	‘do for’
ku-damanj-iz-an-a	‘do for each other’

H-Tone Verbs

ku-lomb é z-a	‘ask’
ku-lombe z-é z-a	‘ask for’
ku-lombe z-ez-á n-a	‘ask for’ each other’

Phonological Evidence: Tone Mobility in Chizigula

ku-lombéz-a \Rightarrow ku-lombéza



Phonological Evidence: Stability in Thai Secret Language

kl-uáì h-òóm ⇒ kl-óòm h-uàí 'banana'

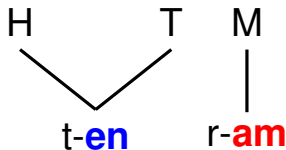
t-éñ r-āṁ ⇒ t-ám r-ēñ 'dance'

→ Rhimes are exchanged, tones stay where they are

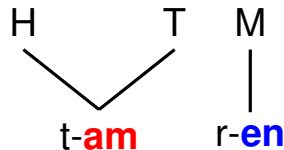
Phonological Evidence: Stability in Thai Secret Language

t-é^hèⁿr-ā^mm̄

⇒

t-á^mà^mr-ēⁿñ

⇒



Phonological Evidence: Tone Polarity in Margi

[á	dlà	gú]	‘you fall’
[á	wì	gú]	‘you runn’
[á	g ^h à	gú]	‘you reach’
[à	sá	gù]	‘you go astray ’
[à	tsú	gù]	‘you beat’
[à	hú	gù]	‘you take’
[á	vǎl	gù]	‘you fly’

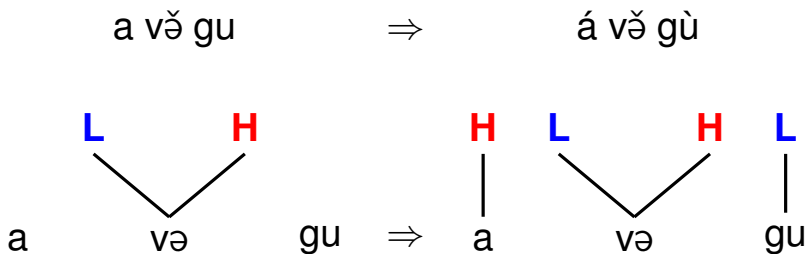
(Kenstowicz & Kisseberth, 1979:43)

Phonological Evidence: Tone Polarity in Margi

a dlà gu \Rightarrow á dlà gù

a sá gu \Rightarrow à sá gù

Phonological Evidence: Tone Polarity in Margi



Derivations in Autosegmental Morphology

- ▶ **Wellformedness Constraints:** general requirements and preferences for the linking between tones and syllables
- ▶ **Repair Mechanisms:** derivational rules which ensure that the Wellformedness Constraints are (more or less) obeyed

Constraints on Possible Representations

▶ **Hard Constraints:**

- ▶ must be obeyed at all levels of representation
- ▶ cannot be violated by input or output
- ▶ cannot be produced by any phonological process

▶ **Soft Constraints:**

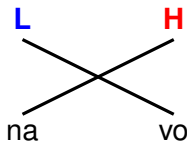
- ▶ can in principle be violated
- ▶ But as soon as a violation occurs, repair mechanisms ensure that the violation is removed as far as this does not result in violating hard constraints

▶ **Preferences:**

- ▶ can in principle be violated & do not trigger repair,
- ▶ but are observed by repair mechanisms as far as this does not result in violating hard or soft constraints

The central **Hard** Constraint: No Crossing

Association Lines are not allowed to cross:



If T_1 precedes T_2 on Tier_a and
If S_1 precedes S_2 on Tier_b
then linking T_1 to S_2
excludes linking T_2 to S_1

The Central **Soft** Constraints

There should be no unassociated structure

i.e.

- ▶ Every tone should be associated to at least one syllable
- ▶ Every syllable should be associated to at least one tone

The Central Preference

Association should be as unique as possible

i.e.

- ▶ Every tone should be associated to **at most** one syllable
- ▶ Every syllable should be associated to **at most** one tone

The Repair Algorithm (Goldsmith, 1976)

1. If there are unassociated syllables and tones:

- ▶ Associate tones und syllables 1:1 from left to right (if possible without violating hard constraints)

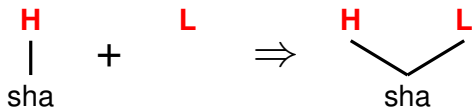
2. Else: If there are unassociated tones:

- ▶ Associate every unassociated tone T to the syllable to which the tone immediately preceding T is associated (if possible without violating hard constraints)

3. Else: If there are unassociated syllables:

- ▶ Associate every unassociated syllable S to the tone to which the syllable immediately preceding S is associated (if possible without violating hard constraints)

Deriving Hausa



Deriving Mende Noun Classes

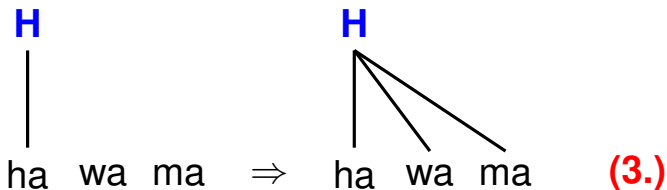
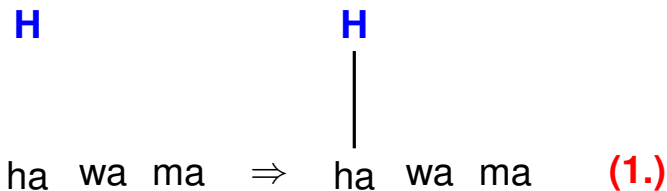
1 σ

2 σ

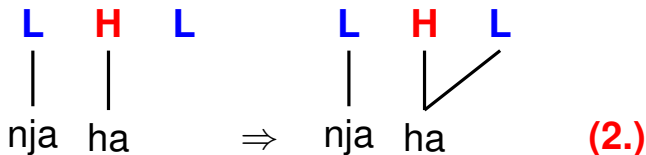
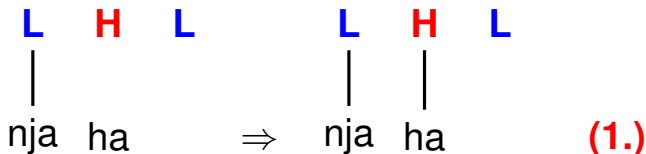
3 σ

H	kó	‘war’	pélé	‘house’	háwámá	‘waistline’
L	kpà	‘debt’	bèlè	‘trousers’	kpàkàlì	‘tripod chair’
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Association Algorithm: Mende



Association Algorithm: Mende



Deriving Tone in Chinese

Segments Tone

ma	high	‘mother’
ma	mid-high	‘hemp’
ma	mid-low-high	‘horse’
ma	high-low	‘scold’

One More Soft Constraint: The Obligatory Contour Principle (OCP)

Adjacent identical tones are disallowed:

***H H**

***L L**

Repair Strategy for the OCP

If there are two adjacent identical tones:

- ▶ Merge them into a single tone


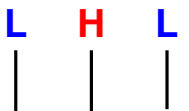
The Motivation of the OCP in Mende

- ▶ Mende doesn't have tone plateaus in non-final syllables. Assume that this is an important property of the system we want to derive
- ▶ This follows if we assume the tonal patterns we stated up to this point, but a tonal pattern violating the OCP (e.g. H H L) could lead to a violation of the generalization (e.g. for a three-syllabic noun)
- ▶ However, if OCP-violations are automatically repaired any time the OCP is violated, H H L would be transformed into H L before any damage could be done

Evidence for the OCP: Tone Polarity in Margi

a dlà gu \Rightarrow á dlà gù

a sá gu \Rightarrow à sá gù

a sa gu \Rightarrow a sa gu

Predictions of the Association Algorithm

- ▶ Contour tones are avoided if possible
- ▶ Tone plateaus are avoided if possible
- ▶ Contour Tones prefer to appear at the right word edge
- ▶ Tone plateaus prefer to appear at the right word edge

Contours and Tone Plateaus in Mende

1 σ **2** σ **3** σ

H	kó	‘war’	pélé	‘house’	háwámá	‘waistline’
L	kpà	‘debt’	bèlè	‘trousers’	kpàkàlì	‘tripod chair’
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Further Questions

- ▶ is there also Right-to-Left Association
- ▶ Can unassociated tones remain in the output
- ▶ Can unassociated tones be deleted

What changed: Concatenation

- ▶ Concatenation remains the same:
Affixes, roots and stems are combined in a specific linear order: Only the phonological consequences change
- ▶ If two morphemes M_1 and M_2 are combined and share material on the same tier, the order of concatenation determines the phonological order
- ▶ However, if M_1 do not share phonological material on any tier concatenation doesn't impose by itself a phonological ordering
This is achieved by the phonological repair mechanisms

What changed: Phonological Alternation

- ▶ The model of phonological alternation has changed from a completely segmental one to one where specific features share more autonomy
- ▶ However, there is independent evidence for this independence in the phonology of tone, vowel harmony, and other areas

Phonological Tone Spreading: Chilungu (Yip:68)

zugrundeliegend Infinitiv

vul k^ú-v^ú-à “to be enough”

vi:mb k^ú-v^í:mb-à “to thatch ”

fulumj k^ú-f^úl^úmj-à “to boil over”

so:bolol k^ú-s^ó:b^ól^ól-à “to sort out”

Turkish [BACK] vowel harmony (Mailhot & Reiss 2007: 33)

	Nom pl.	Gen. sg.	Gen.pl.	gloss
a.	ip-ler	ip-in	ip-ler-in	'rope'
b.	kız-lar	kız-in	kız-lar-in	'girl'
c.	sap-lar	sap-in	sap-lar-in	'stalk'
d.	yüz-ler	yüz-ün	yüz-ler-in	'face'
e.	son-lar	son-un	son-lar-in	'end'

Advantages of Doing Vowel Harmony Autosegmentally

- ▶ Spreading (= harmony) becomes the most natural process for vowel-vowel alternation which corresponds closely to the typological facts
- ▶ Accounts for the directionality of vowel harmony
- ▶ Vowel harmony can be modeled as a completely local process
- ▶ Exceptions to harmony can be captured by prespecification (e.g. **b**eg**A**n-ly**o**r-**I**m \Rightarrow **b**eg**e**n**i**y**o**r**u**m; Kabak & Vogel, 2001:344)