

Tone and (Non-)concatenative Morphology

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Ton
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An Ideal World

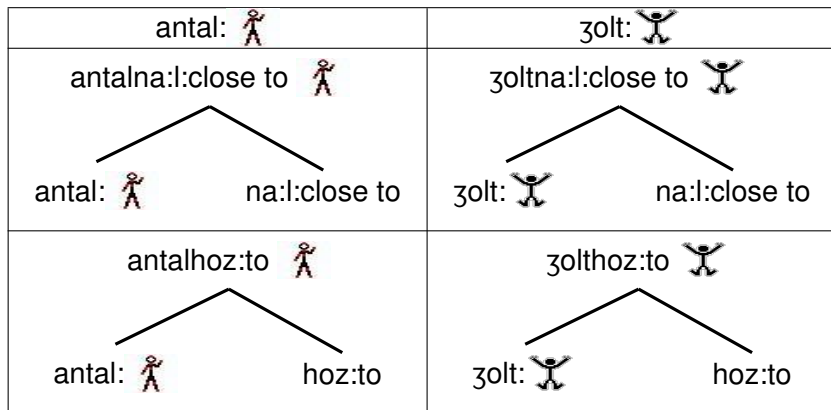
Morphology consists of

Concatenation

+

Alternation

Concatenation

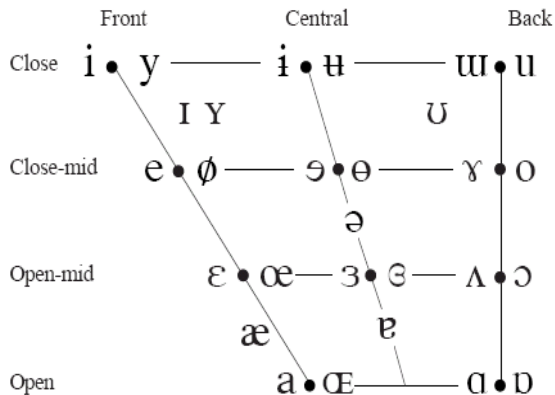


Alternation

antal- na:l	'to Antal'	pe:ter- ne:l	'to Péter'
zolt- na:l	'to Zsolt'	imi- ne:l	'to Imi'
borba:la- na:l	'to Borbála'	erzi- ne:l	'to Erzsí'
antal- hoz	'to Antal'	pe:ter- hez	'to Péter'
zolt- hoz	'to Zsolt'	imi- hez	'to Imi'
borba:la- hoz	'to Borbála'	erzi- hez	'to Erzsí'

Articulation of Vowels

VOWELS



Alternation

antal- na:l	'to Antal'	pe:ter- ne:l	'to Péter'
zsolt- na:l	'to Zsolt'	imi- ne:l	'to Imi'
borba:la- na:l	'to Borbála'	erzi- ne:l	'to Erzsí'
antal- hoz	'to Antal'	pe:ter- hez	'to Péter'
zsolt- hoz	'to Zsolt'	imi- hez	'to Imi'
borba:la- hoz	'to Borbála'	erzi- hez	'to Erzsí'

Back vowels get front vowels after front vowels

Concatenation + Alternation

	antal na:l	imi na:l
Concatenation	antalna:l	imina:l
Alternation	antalna:l	imine:l

German Noun Inflection

Rat	[Ra:t]	'advice'	Rat+es	[Ra:t+əs]	'advice (gen.)'
Stück	[ʃtyk]	'piece'	Stück+es	[ʃtyk+əs]	'piece' (gen.)

Rad	[Ra:t]	'wheel'	Rades	[Ra:d+əs]	'wheel' (gen.)
Tag	[ta:k]	'day'	Tages	[ta:g+əs]	'day' (gen.)

Voiced stops get voiceless at the end of a word

German Noun Inflection: Concatenation + Alternation

Affixation

	Ra: d əS	Ra: t əS
Concatenation	Ra: d əS	Ra: t əS
Alternation	—	—

No Affixation

	Ra: d	Ra: t
Alternation	Ra: t	Ra: t

An Ideal World

Morphology consists of

Concatenation

+

Alternation

An Ideal World

Morphology consists of

Syntax

+

Phonology

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	˘	à	11
mid	˥	ā	33
rising	˩̎	ǎ	35
falling	˩̌	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

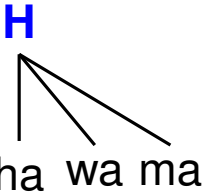
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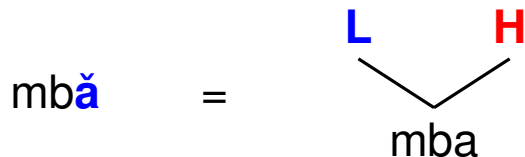
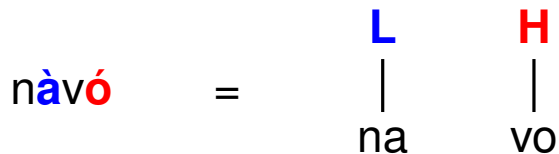
- ▶ Tone and segments/syllables are represented on different 'tiers', separate planes in a three-dimensional space
- ▶ Linked (associated) elements of different tiers are pronounced as a unit
- ▶ A single tone may be linked to more than one syllable
A single syllable may be linked to more than one tone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

1 Tone – Many Syllables: Mende

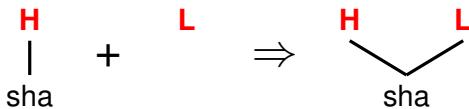
kó = 

háwámá = 

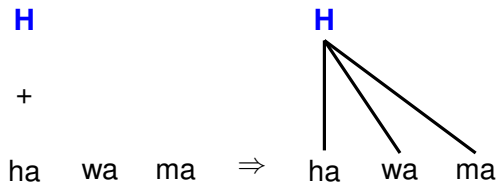
1 Syllable – Many Tones: Mende



Autosegments Make Tone Concatenative: Hausa



Autosegments Make Tone Concatenative: Mende



Phonological Evidence: Tone Mobility in Chizigula

Tone-less Verbs

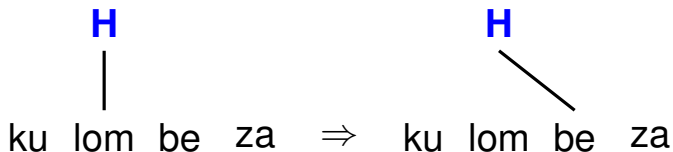
ku-damanj	‘do’
ku-damanj-iz-a	‘do for’
ku-damanj-iz-an-a	‘do for each other’

H-Tone Verbs

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

Phonological Evidence: Tone Mobility in Chizigula

ku-lombéz-a \Rightarrow ku-lombé-z-a



Phonological Evidence: Stability in Thai Secret Language

kl-uáì h-òóm ⇒ kl-óòm h-uàí 'banana'

t-é̀n r-ā̄m̄ ⇒ t-á̀m̄ r-ē̄n̄ 'dance'

→ Rhymes are exchanged, tones stay where they are

Phonological Evidence: Tone Polarity in Margi


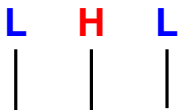
[á	dlà	gú]	‘you fall’
[á	wì	gú]	‘you runn’
[á	g ^h à	gú]	‘you reach’
[à	sá	gù]	‘you go astray ’
[à	tsú	gù]	‘you beat’
[à	hú	gù]	‘you take’
[á	vě̀l	gù]	‘you fly’

(Kenstowicz & Kisseberth, 1979:43)

Phonological Evidence: Tone Polarity in Margi

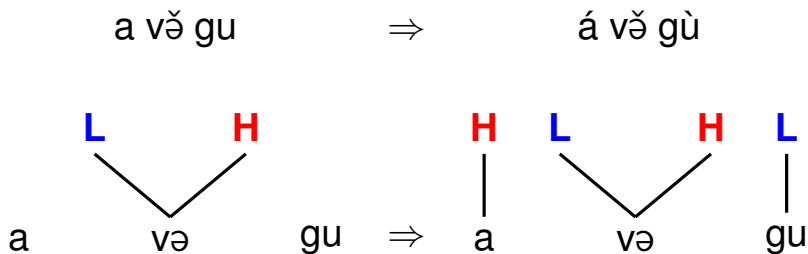
a dlà gu \Rightarrow á dlà gú

a sá gu \Rightarrow à sá gù

a sa gu \Rightarrow a sa gu

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:**

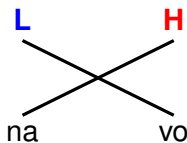
- ▶ can in principle be violated
- ▶ But as soon as a violation occurs, repair mechanisms ensure that the violation is removed as far as this does not result in violating hard constraints

▶ **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)

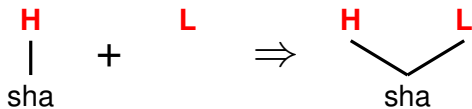
2. Else: If there are unassociated tones:

- ▶ 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

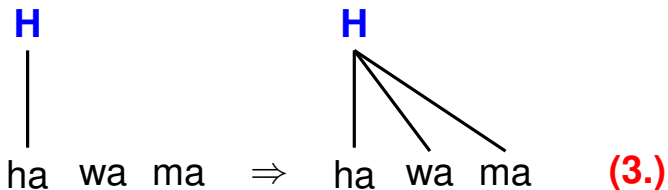
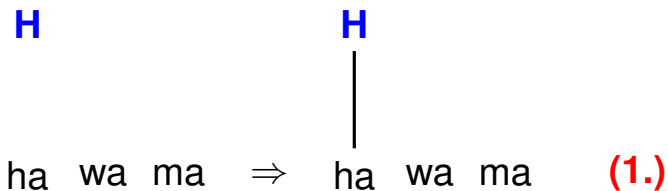
1 σ

2 σ

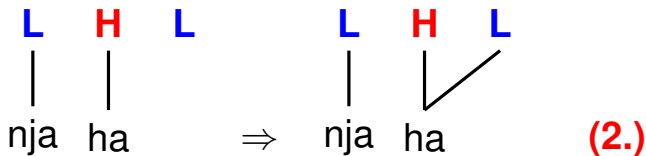
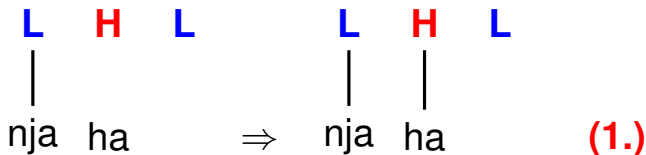
3 σ

H	kó	‘war’	pélé	‘house’	háwámá	‘waistline’
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LHL	mbã	‘companion’	njàhâ	‘woman’	nìkílì	‘groundnut’

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

\Rightarrow

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’
HL	mbû	‘owl’	ngílà	‘dog’	félàmà	‘junction’
LH	mbă	‘rice’	nàvó	‘money’	ndàvúlá	‘sling’
LHL	mbã	‘companion’	njàhâ	‘woman’	nìkíli	‘groundnut’

Further Issues

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

Two Big Questions

- ▶ How is Morphological Tone positioned?
- ▶ Why do (some) morphological tones overwrite other tones?

How is Morphological Tone positioned: 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)

Affixation: No Overwriting

- | | | | | | |
|----|----------------|---|----------|---|-----------------|
| a. | ba-goo-bir | + | -ii | → | bagoobirii |
| | L L H | | H | | L L H H |
| | 'from-Gobir' | | -ethonym | | 'a Gobir man' |
| b. | ba-zamfara | + | -ii | → | bazamfarii |
| | L L L L | | H | | L L L H |
| | 'from-Zamfara' | | -ethonym | | 'a Zamfara man' |

(Hausa recessive affixes, Inkelas 1998)

Tonal Template: Overwriting

a.	ba-katsina	+	-ee	→	bakastsinee
	L L H L		HL		H H H L
	'from-Katsina'		-ethonym		'a Katsina man'
b.	ba-zamfara	+	-ee	→	bazamfaree
	L L L L		HL		H H H L
	'from-Zamfara'		-ethonym		'a Zamfara man'

(Hausa dominant affixes, Inkelas 1998)