

## Class 14: Autosegmental/non-linear representations, part I

### To do

- Holoholo assignment due Friday, Nov. 20 (a week from tomorrow)
- Goldsmith reading due Tuesday
- Be working on project, of course!

### Overview of today and next time

We've mostly treated a phonological representation as a sequence of feature matrices. Goldsmith (1990, 1976, 1979, and others) argues that this is inadequate and we need to move tones and some other features onto their own "tiers". We'll see some more cases along those lines.

Next time we'll consider whether we should move other features onto their own tiers too, and some properties of the "skeletal" tier.

### 1. Tiers

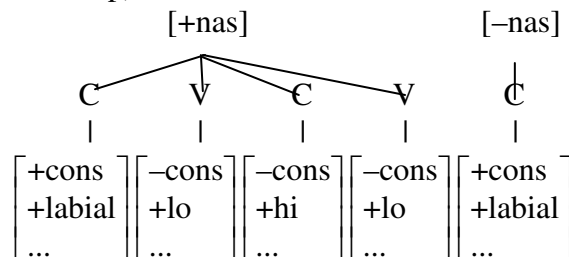
A "linear representation" (i.e., what we've been using till now) of [mãjãb] might look like:

$$\begin{bmatrix} +nas \\ +cons \\ +labial \\ \dots \end{bmatrix} \begin{bmatrix} +nas \\ -cons \\ +lo \\ \dots \end{bmatrix} \begin{bmatrix} +nas \\ -cons \\ +hi \\ \dots \end{bmatrix} \begin{bmatrix} +nas \\ -cons \\ +lo \\ \dots \end{bmatrix} \begin{bmatrix} -nas \\ +cons \\ +labial \\ \dots \end{bmatrix}$$

but we could imagine a reasonable notation system where we write instead:

$$\begin{bmatrix} +nas \\ +cons \\ +labial \\ \dots \end{bmatrix} \begin{bmatrix} -cons \\ +lo \\ \dots \end{bmatrix} \begin{bmatrix} -cons \\ +hi \\ \dots \end{bmatrix} \begin{bmatrix} -cons \\ +lo \\ \dots \end{bmatrix} \begin{bmatrix} -nas \\ +cons \\ +labial \\ \dots \end{bmatrix}$$

If we add a "C-V skeleton" tier, as Goldsmith does, this might look like (arbitrarily putting the nasal tier on top):



We could even put every feature on its own tier:

$$\begin{array}{ccccccc} [ & & +nas & & ] & [-nas & ] \\ [+cons & ] & -cons & & ] & [+cons & ] \\ [+labial] & & & & & [-labial] & \\ & [+lo & ] & [-lo & ] & [+lo & ] \\ & [-hi & ] & [+hi & ] & [-hi & ] \end{array}$$

## 2. How can we decide?

Changing the theory in this way is a good idea only if the new theory does a better job than the old at correctly<sup>1</sup> distinguishing highly valued from lowly valued grammars.

As before, the claim is that rules that can be expressed in a simple form (though we will not attempt to spell out how rule simplicity is to be calculated in this new notation) are highly valued.

So, we are interested in

- rules that look relatively complicated (relative to other rules, that is) in the old theory but relatively simple in the new one—new theory predicts they are highly valued
- rules that look relatively simple in the old theory but relatively complicated in the new one—new theory predicts they are lowly valued

## 3. Notation clarification

We often use acute (á) and grave (à) accent marks to mark primary and secondary stresses. In strict IPA usage, these marks are reserved for tone, and today we'll use them only for tone.

á = [a] with high tone

à = [a] with low tone

ā, or sometimes just "a" = [a] with mid tone

â = [a] with falling tone (high then low) } contour tones

ã = [a] with rising tone (low then high) }

When a language has no mid tone, often the highs (and contours) are marked, but not the lows.

## 4. Tonal association

Kikuyu (Niger-Congo language from Kenya with about 5.3 million speakers; discussion here based on Goldsmith 1990, whose data come from Clements & Ford 1979)

tò <b>ròr</b> ìré	'we looked at'	má <b>rór</b> ìré	'they looked at'
tò <u>mò</u> <b>ròr</b> ìré	'we looked at <u>him</u> '	má <u>mó</u> <b>ròr</b> ìré	'they looked at <u>him</u> '
tò <u>mà</u> <b>rór</b> ìré	'we looked at <u>them</u> '	má <u>má</u> <b>rór</b> ìré	'they looked at <u>them</u> '
tò <b>tòm</b> íré	'we sent'	má <b>tóm</b> íré	'they sent'
tò <u>mò</u> <b>tòm</b> íré	'we sent <u>him</u> '	má <u>mó</u> <b>tòm</b> íré	'they sent <u>him</u> '
tò <u>mà</u> <b>tóm</b> íré	'we sent <u>them</u> '	má <u>má</u> <b>tóm</b> íré	'they sent <u>them</u> '

- Take a minute to ascertain the basic facts—on what does the tone of the tense suffix *ìré/íré* depend? On what do the tones of the two verb roots (in **bold**) depend? On what do the tones of the object suffixes (underlined) depend?
- Ideas for how we can account for this with linear representations and rules (assume a feature [hi tone])?

<sup>1</sup> As before, the evidence as to what is actually highly valued comes, in practice, mainly from typology—even though typological evidence can be problematic.

In the “autosegmental” notation proposed by Goldsmith, we can write a rule thus (Goldsmith 1990’s (9)—“T” stands for any tone, such as H [high] or L [low] in this language):

$$\left[ \begin{array}{c} C_0 \ V \ C_0 \ V \\ \text{---} \\ T \end{array} \right] \quad \text{peninitial association}$$

Yes, it is a rule! Its structural description is

$$\left[ \begin{array}{c} C_0 \ V \ C_0 \ V \\ T \end{array} \right]$$

(i.e., everything except the dashed line), and the structural change it requires is insertion of the association line that is shown dashed.

We need two more rules for the rest of the tones:

$$\begin{array}{c} V \ C_0 \ V \\ | \quad \text{---} \\ T \quad T \end{array} \quad \text{association convention}^2$$

$$\left[ \begin{array}{c} C_0 \ (\textcircled{V}) \\ \text{---} \\ T \end{array} \right] \quad \text{initial association}$$

The circle is part of the structural description, and means “not associated to anything on the other tier”.

- Let’s apply this grammar fragment to derive ‘we looked at them’—what must we assume about the association status of tones in underlying forms?

All three rules are typical of the kind of thing you see in tone languages, and all three rules are some of the simplest that could be written in this notation.

- Compare this to the linear analysis we developed above: do the linear rules look simple compared to other, less plausible linear tone rules we could write? [It’s not whether the autosegmental rule looks simpler than the linear rule that matters.]

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<sup>2</sup> For Goldsmith, association conventions actually derive from universal principles, and don’t need to be specified on a language-particular basis.

## 5. Beginnings and ends of contour tones

Hakha Lai (Hyman & VanBik 2004; aka Haka Chin, Sino-Tibetan language from Chin State, Burma & adjacent areas of India & Bangladesh, w/ 130,000 speakers) forbids certain tone sequences:

	+ <i>falling</i>	+ <i>rising</i>	+ <i>low</i>
<i>falling</i> +	falling +falling → falling+low	OK	OK
<i>rising</i> +	OK	rising+rising → rising+falling	rising+low → low+low
<i>low</i> +	low+falling → low+low	OK	OK

- Let's first try to treat this linearly: we'll have to choose a feature system and then use it to express the constraint(s) at work.
- Let's re-write these representations autosegmentally. Is it easier to express the constraint?

## 6. Autosegmentalism in OT

Whether representations are linear or autosegmental is (pretty much) orthogonal to whether the grammar consists of rules or constraints or both.

For example, if we were to re-cast the analysis of Kikuyu in OT with autosegmental representations, we could have a constraint like

$$* \begin{bmatrix} C_0 & V & C_0 & V \\ | & & | & \\ T & & T & \end{bmatrix} \quad \text{"don't associate the first two vowels to two separate tones"}$$

## 7. Something else that autosegmentalism is good for: tonal stability

*Margi* (Hoffman 1963, via Kenstowicz 1994) aka Marghi Central, Afro-Asiatic language from Nigeria with 158,000 speakers

sál	sál-àrì	'man'	-àrì/-ǎrì = definite suffix
kùm	kùm-àrì	'meat'	
ǎímí	ǎímj-àrì	'water'	
kú	kw-àrì	'goat'	
tágú	tágw-àrì	'horse'	
tì	tj-ǎrì	'morning'	
hù	hw-ǎrì	'grave'	
ú?ù	ú?w-ǎrì	'fire'	

- What's the underlying form of the suffix?
- How could we describe the tonal alternation in rules?
- What about with constraints—what's the problem with using IDENT(tone)?

If we really are treating tones not as features (properties of segments) but as segments, then it makes sense to let the MAX and DEP constraints refer to them, just as they refer to Cs and Vs:

/hu + ari/ L H L	ONSET	IDENT(syll)	MAX-Tone
a hu . ari       L H L	*!		
b hwari ^ \ L H L		*	
c hwari     H L		*	*!

### 8. An even more extreme example of tonal stability

*Etsako* (Elimelech 1978, via ?) aka Yekhee, Niger-Congo lang. from Nigeria w/ 274,000 speakers

ìkpà	‘cup’	ìkp-ìkpà	‘every cup’
ówà	‘house’	ów-ówà	‘every house’
òyèdé	‘banana’	òyèd-òyèdé	‘every banana’

### 9. Something else autosegmental representations are good for: floating tones

*Igbo*, from Goldsmith 1976. Niger-Congo language from Nigeria with 18,000,000 speakers  
Assume that LH becomes mid. Igbo H tone marks subordinate clauses:

ònù	‘yam’	ònù [rèré èré]	‘the yam [that is rotten]’
áẓù	‘fish’	áẓù [rèré èré]	‘the fish [that is rotten]’
ánù	‘meat’	ánù [rèré èré]	‘the meat [that is rotten]’
àkwhá	‘eggs’	àkwhá [rèré èré]	‘the eggs [that are rotten]’

- Where does the H tone attach? What does the input representation of one of these complex DPs look like?

### 10. Tones behaving as a block

*Shona* (Odden 1980), Niger-Congo language with 7,000,000 speakers in Zimbabwe and Zambia

mbwá	‘dog’	né-mbwà	‘with dog’
hóvé	‘fish’	né-hòvè	‘with fish’
mbúndúdzí	‘army worm’	né-mbùndùdzì	‘with army worm’
hákátá	‘diviner’s bones’	né-hàkàtà	‘with diviner’s bones’
bénzìbvùnzá	‘inquisitive fool’	né-bènzìbvùnzá	‘with inquisitive fool’

⇒ sequences of the same tone undergo a rule together, as though they were a single tone.

Let’s assume there is some reason why H → L after né-, and only consider outputs that do so:

- Why [né-hòvè] and not \*[né-hòvé]? What must be the surface representation of [hóvé]?
- Why [né-bènzìbvùnzá] and not \*[né-bènzìbvùnzà]?
- Richness of the base: what if there were an input like  $\begin{smallmatrix} \text{hove} \\ \text{H H} \end{smallmatrix}$  ?

The OCP (Obligatory Contour Principle) constraint says that adjacent identical elements (such as two Hs in a row) are not permitted. Does this help with the Richness of the Base question?

- We'll still have a puzzle if we add né- to hypothetical  $\begin{smallmatrix} \text{hove} \\ \text{H H} \end{smallmatrix}$  ... Will strata help?

## 11. What about East-Asian-type tone? (examples taken from Kenstowicz 1994, ch. 7)

Seems to be different from African-type<sup>3</sup> tone:

- often more than three levels (5 is typical)
- often transcribed with Chao numbers (Chao 1930): [ma<sup>214</sup>] means tone starts lowish (2), then dips to the bottom of the range (1) then goes up nearly to the top (4)
- contour tones often behave as a unit.

Various proposals (see Yip 2007 for overview). A simple one: features [hi register] and [lo register].

register	("contour") tone	resulting pitch
high	H	5
	M	4
	L	3
mid	H	4
	M	3
	L	2
low	H	3
	M	2
	L	1

hence many phonetic tone levels are phonologically ambiguous; it's typically assumed that the register stays constant for the whole syllable,<sup>4</sup> so this can help disambiguate—e.g., V<sup>42</sup> must be mid register.

$$\begin{array}{c}
 \text{H} \quad \text{L} \\
 \backslash \quad / \\
 \text{V} \\
 | \\
 \text{high.register}
 \end{array}
 = \text{V}^{53}$$

- Allows the register of an entire contour to change by just changing one feature, e.g. 53 → 31 (What is register, articulatorily? *Maybe* something like stiff vs. slack vocal folds)
- Sometimes register is also associated with voice quality.
- The feature [contour] has also been proposed—we have to then regulate whether [+contour] gets implemented as falling or rising.

<sup>3</sup> Of course these labels are very approximate, and there are many other regions of the world with lots of tone languages.

<sup>4</sup> As Thomas points out, this is problematic for Mandarin 3<sup>rd</sup> tone, commonly claimed to be 214. See, e.g. Zhang & Lai 2006 ([www2.ku.edu/~ling/faculty/Dr\\_Zhang/wug-mandarin-KWPL-2006.pdf](http://www2.ku.edu/~ling/faculty/Dr_Zhang/wug-mandarin-KWPL-2006.pdf)) for a 213 transcription (p. 79).

*Example:* distribution of tones in **Songjiang** dialect of suburban Shanghai (Bao 1990, via Kenstowicz 1994; apparently a northern dialect of Wu Chinese, which in turn is a Sino-Tibetan language from China with 77 million speakers; example words from Chen 2000)

voiced onset, unchecked syll.	voiced onset, checked syll.	voiceless onset, unchecked syll.	voiceless onset, checked syll.
<b>22</b> di <sup>22</sup> ‘younger brother’	<b>3</b> baŋ <sup>3</sup> ‘white’	<b>44</b> ti <sup>44</sup> ‘bottom’	<b>5</b> paŋ <sup>5</sup> ‘hundred’
<b>31</b> di <sup>31</sup> ‘lift’		<b>53</b> ti <sup>53</sup> ‘low’	
<b>13</b> di <sup>13</sup> ‘field’		<b>35</b> ti <sup>35</sup> ‘emperor’	

“checked” syllable = syllable that ends in a glottal stop

- Write out the representation of each tone.
- What markedness constraints can we develop to explain the inventory?

*Example: Tibetan* compounds (data from Meredith 1990, via Kenstowicz 1994; dialect is what Meredith calls “Refugee Standard Tibetan”, “the lingua franca of the Tibetan refugee community in Nepal and India”, “loosely based on Lhasa dialect, with many elements of Tsang speech”. This would make RST roughly a dialect of Central Tibetan, a Sino-Tibetan language from China, Tibet, Bhutan, India, and Nepal)

(I am simplifying some of the tones!! For instance, 3 is really 2. Sorry for missing data; Meredith gives the pattern in schematic form, pp. 60-61, then works through some examples)

- Propose representations for the members of the tone inventory: 5, 53, 3, 31
- Develop an analysis of the tone changes that occur in compounds—you can invent some arbitrary morphological restrictions on the feature values that first and second members of a compound should have.

<i>1st member</i>	<i>2nd member</i>	<i>compound</i>	
5	5	5-5	
53	5	<b>5-5</b>	
yum 3	chẽẽ 5	yum-chẽẽ 3-5	‘mother- <i>hon.</i> ’ (mother+great)
31	5	<b>3-5</b>	
5	53	5-53	
thuu 53	caa 53	thuu-caa <b>5-53</b>	‘iron banner fixture’ (banner+iron)
3	53	3-53	
31	53	<b>3-53</b>	
5	3	<b>5-5</b>	
see 53	yöö 3	see yöö <b>5-5</b>	‘intellectual’ (knowledge+possessor)
phöö 3	mi 3	phöö-mi <b>3-5</b>	‘Tibetan’ (Tibet+person)
ree 31	see 3	ree-see <b>3-5</b>	‘cotton robe’ (cotton+robe)
cu 5	kẽẽ 31	copkẽẽ <b>5-53</b>	‘eighteen’ (eight+ten)
53	31	<b>5-53</b>	
3	31	<b>3-53</b>	
31	31	<b>3-53</b>	

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