

Class 15: Autosegmental/non-linear representations, part I

To do:

- Due Friday: lexical phonology in Spanish; next problem will be posted tonight
- Study questions on Goldsmith due Tuesday
- Project: meet with me again by the end of next week (syllabus says this week)

Overview: SPE treats a phonological representation as a sequence of segments, with features as properties. We'll see reasons to make the phonological representation closer to the phonetics.

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:

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

- We could even put every feature on its own “tier”:

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

2. This starts to resemble a “gestural score”—though not all features are gestures (Browman & Goldstein 1986; Browman & Goldstein 1989; Browman & Goldstein 1992)

- When phoneticians look at what the articulators actually do, it looks more like that last one:

	m	ã	ĩ	ã	b
lips	closed	<i>(idle)</i>			closed
tongue tip/blade	<i>(idle)</i>				
tongue body	low front		hi front	low front	
velum	down				up
glottis	voicing				

- If a series of segments has the same feature value, they may share a single gesture
- Vowel tongue-body gestures tend to extend through consonants
- We can distinguish positive “commands” like *close lips* from the absence of any command.

3. 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 correctly¹ distinguishing highly valued from lowly valued grammars.
- As in SPE, the claim is that rules that can be expressed in a simple form (though we won't spell out how rule simplicity is to be calculated in this new notation) are highly valued.
- So, we're interested in cases where old theory says that Rule A is simpler than Rule B, but new theory says the reverse.

4. 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

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

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

5. Argument: "features" moving around

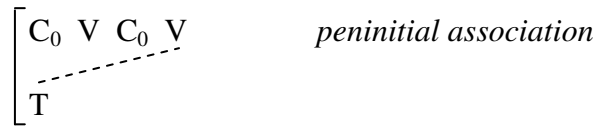
- **Kikuyu** (Niger-Congo language from Kenya with about 5.3 million speakers; discussion here based on Goldsmith 1990, whose data come from Clements & Ford 1979)

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

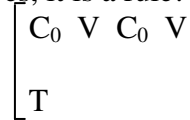
- Take a minute to ascertain the basic facts—on what does the tone of the tense suffix *ìré/íré* depend? On what do the tones of the two verb roots (in **bold**) depend? On what do the tones of the object suffixes (underlined) depend?
- Ideas for how we can account for this with linear representations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

¹ As usual, 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):

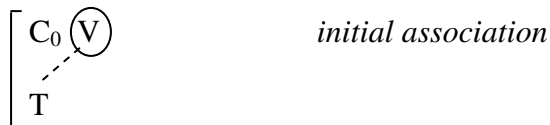
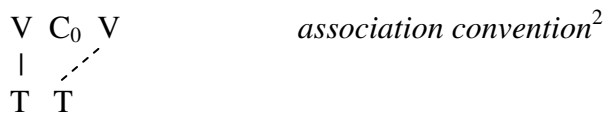


- Yes, it is a rule! Its structural description is



(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:



- 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.]

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

6. Autosegmentalism in OT

- Whether representations are linear or autosegmental is (pretty much) orthogonal to whether the grammar consists of rules, constraints, or both. See (Zoll 1996), (Zoll 2003) for a framework.
- 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. Argument: features persisting even after the segment they move from changes

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

sál	sál-á-rì	‘man’	-á-rì/-ǎ-rì = definite suffix
kùm	kùm-á-rì	‘meat’	
ʔímí	ʔímj-á-rì	‘water’	
kú	kw-á-rì	‘goat’	
tágú	tágw-á-rì	‘horse’	
tì	tj-ǎ-rì	‘morning’	
hù	hw-ǎ-rì	‘grave’	
úʔù	úʔw-ǎ-rì	‘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...
 - they have correspondence indices (that we sometimes write, sometimes don’t write)
 - it makes sense to have the MAX and DEP constraints refer to them:

/hu + ari/ L ₁ H ₂ L ₃	ONSET	IDENT(syll)	MAX-Tone
a hu . a . ri L ₁ H ₂ L ₃	*!		
☞ b hw . a . ri ^ \ L ₁ H ₂ L ₃		*	
c hwa . ri H ₂ L ₃		*	*!

8. Argument: morphemes that consist of nothing but a feature

- **Igbo** ((Goldsmith 1976); Niger-Congo; 17,000,000 speakers; Nigeria)
- Subordinate clauses are preceded by a complementizer that is nothing but a H tone:

òṅ̀ù	‘yam’	òṅ̀ù [rèrè èré]	‘the yam [that is rotten]’
áẓ̀ù	‘fish’	áẓ̀ù [rèrè èré]	‘the fish [that is rotten]’
áǹù	‘meat’	áǹù [rèrè èré]	‘the meat [that is rotten]’
àkwhá	‘eggs’	àkwhá [rèrè èré]	‘the eggs [that are rotten]’

○ Fill in the tableau (gives you an idea of some typical OT autosegmental constraints)

/ aẓ̀ù + + rere + ere/ H ₁ L ₂ H ₃ L ₄ H ₅ L ₆ H ₇	NO UNATTACHED TONES	DEP-V	MAX- TONE	*>1TONE PERTBU	IDENT(tone)/ first syll of word	UNIFORMITY- TONE
<i>a</i> a ẓ̀ù r e r e e r e H ₁ L ₂ H ₃ L ₄ H ₅ L ₆ H ₇						
<i>b</i> a ẓ̀ù r e r e e r e \ H ₁ L ₂ H ₃ L ₄ H ₅ L ₆ H ₇						
<i>c</i> a ẓ̀ù r e r e e r e H ₁ M _{2,3} L ₄ H ₅ L ₆ H ₇						
<i>d</i> a ẓ̀ù r e r e e r e H ₁ L ₂ M _{3,4} H ₅ L ₆ H ₇						
<i>e</i> a ẓ̀ù a r e r e e r e H ₁ L ₂ H ₃ L ₄ H ₅ L ₆ H ₇						
<i>f</i> a ẓ̀ù r e r e e r e H ₁ L ₂ L ₄ H ₅ L ₆ H ₇						

[What prefers M_{2,3} over H_{2,3} or L_{2,3}? It seems like maybe we do need tonal features after all....]

9. A non-tonal example: Japanese

- Rendaku ('sequential voicing') happens in compounds (data from (Ito & Mester 2003))³

eda + ke	→	eda-ge	'split hair' (branch+hair)
unari + koe	→	unari-goe	'groan' (groan+voice)
me+tama	→	me-dama	'eyeball' (eye+ball)
mizu + seme	→	mizu-zeme	'water torture' (water+torture)
ori+kami	→	ori-gami	'origami' (weave+paper)
neko+çita	→	neko-ðzita	'aversion to hot food' (cat+tongue)

- What's the compound-forming morpheme?

10. Argument: Beginnings and ends of contours

- Recall that **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?

³ It's been argued that historically, the genitive-like particle [no] 's' occurred in the middle of most compounds (eda+no+ke 'branch's hair'). Then, the vowel deleted in most cases (eda+n+ke) and the *n* merged with the following consonant, which became voiced (for the same reason that, as we saw, many languages don't allow a sequence of *nasal+voiceless*, many languages also disallow voiceless prenasalized voiceless obstruents): [eda-ⁿge]. Later, the prenasalization was lost.

11. Argument: features behaving as a block

- **Shona** ((Odden 1980), via Kenstowicz; Niger-Congo; 7,000,000 speakers; 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’

- Warm-up: draw autosegmental representations for all the items

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

- Let’s assume there is some reason why $H \rightarrow L$ after né-, and consider only outputs that do so (breaking our usual practice of always including a faithful candidate):
 - How can we rule out *[né-hòvé] (c) in the tableau?
 - This will force us into a decision about whether the real winner is (a) or (b).

ne hove \ / H H ₁	
<i>a</i> ne hove H L ₁ L ₁	
<i>b</i> ne hove \ / H L ₁	
<i>c</i> ne hove H L ₁ H ₁	

- Make a tableau for [né-bènzìbvùnzá]

Next time: A bit about the features themselves (feature geometry, privativity), then using the tools of autosegmentalism to solve or at least ameliorate some of our previous problems.

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