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

To do:
- Due Tuesday: lexical phonology in Malayalam
- Next problem will be posted tonight, due Tues., Nov. 22, may require material from this Tuesday to solve
- Study questions on Goldsmith due Monday
- Project: meet with me again by the end of next week (syllabus says this week). Be working on an analysis!

0. Planning for exam week

1. Mopping up from last time

- The problem with attempting a factorial typology on the example I chose is actually pointed out by McCarthy (2002). So here's a better example:

	/akpa/	***targeted*** NoCoda	Max-C
a	[ak.pa]		
b	[a.ka]		
c	[a.pa]		
	pref. relation		

  - Targeted NoCoda: prefers *x* to *y* is *x* has fewer codas than *y*, **and**, of all the candidates with fewer codas than *y*, *x* is the one that is the most perceptually similar to *y*.

2. Answer #3: Evolutionary Phonology (Blevins 2003)

- Blevins gives a very important caution about using typological data:
  - Does final devoicing prevail because learners prefer it?
  - Or simply because it tends to arise diachronically?
- Moreton 2008 refers to this distinction as analytic bias vs. channel bias.

- Assume the same perception facts that Steriade does, except assume that speakers don't internalize perceptual facts, and instead simply misperceive.
  - Suppose there is a language that tolerates final voiced obstruents: /rad/ → [rad].
  - Suppose that the most common misperception of [rad] is as [rat].
  - Then learners will think they're hearing a certain amount of alternation like [rad-im] ~ [rat], and not much, e.g., [rad-im] ~ [radə] or [rad-im] ~ [ran].
  - If this happens enough and catches hold, the language will eventually acquire final devoicing (rather than epenthesis after final voiced obstruents), but not because learners prefer it.

- What can we do then to understand what analytic bias, if any, exists?
  - A popular approach is to put speakers in a position where their behavior is not constrained by their language-specific learning (see lit reviews in Moreton 2008, Zuraw 2007, Hayes et al. 2009, Moreton & Pater 2012 for examples).

Where we've been

- Basic OT and basic SPE
- Comparing their predictions for process application and interaction
- Seeing some other rule theories (intrinsic or variable ordering, directional application...)
- But two things held us back
  - Our theory of morphology-phonology interaction was primitive ("concatenate morphemes, then do all the phonology")
    - We improved this (focusing on Lexical Phonology and Morphology)
    - Certain cases of directionality, opacity, or rule-ordering paradoxes go away
  - Our theory of representations is still primitive: sequence of feature matrices
    - We attack this now, with better representations "below" the segment (features)
    - We'll continue in weeks 8, 9, and 10 with better representations "above" the segment (syllables and bigger constituents)

Overview of today and next time: 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.

3. Tiers

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

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

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

$$\begin{array}{c}[\quad\quad\quad +\text{nas} \quad\quad\quad] \; [-\text{nas}\quad]\\ \begin{bmatrix}+\text{cons}\\+\text{labial}\\\dots\end{bmatrix}\begin{bmatrix}-\text{cons}\\+\text{lo}\\\dots\end{bmatrix}\begin{bmatrix}-\text{cons}\\+\text{hi}\\\dots\end{bmatrix}\begin{bmatrix}-\text{cons}\\+\text{lo}\\\dots\end{bmatrix}\begin{bmatrix}+\text{cons}\\+\text{labial}\\\dots\end{bmatrix}\end{array}$$

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

[+nas][–nas]
[+cons][–cons][+cons]
[+labial] [+labial]
[+lo][–lo][+lo]
[–hi][+hi][–hi]

4. 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	j̃	ã	b
lips	closed	*(idle)*			closed
tongue tip/blade	*(idle)*				
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.

5. 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[1] 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.

[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.

- So, we're interested in cases were old theory says that Rule A is simpler than Rule B, but new theory says the reverse.

6. 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)
  - ǎ = [a] with rising tone (low then high)

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

7. Argument: "features" moving around

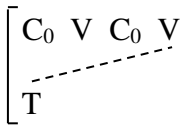
- **Kikuyu** (Niger-Congo language from Kenya with about 5.3 million speakers; discussion here based on Goldsmith 1990, whose data come from Clements & Ford 1979)

tò **rɔ̀r** ìré	'we **looked at**'	má **rɔ́r** ìré	'they **looked at**'
tò mò **rɔ̀r** ìré	'we **looked** at him'	má mó **rɔ̀r** ìré	'they **looked at** him'
tò mà **rɔ́r** ìré	'we **looked** at them'	má má **rɔ́r** ìré	'they **looked at** them'
tò **tòm** íré	'we **sent**'	má **tóm** íré	'they **sent**'
tò mò **tòm** íré	'we **sent** him'	má mó **tòm** íré	'they **sent** him'
tò mà **tóm** íré	'we **sent** them'	má má **tóm** íré	'they **sent** them'

- 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?

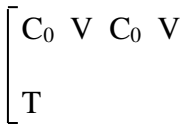
- Ideas for how we can account for this with linear representations and rules (assume a feature [hi tone])?

- 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):



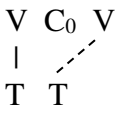
peninitial association

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

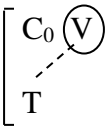


(i.e., everything except the dashed line), and the structural change it requires is insertion of the association line that is shown dashed.

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



association convention[2]



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 draw some derivations on the board. (You'll have to make decisions about the association status of tones in underlying forms.)

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

- 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.]

8. 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

$$* \begin{bmatrix} C_0\ V\ C_0\ V \\ \quad |\quad\ | \\ \quad T\quad\ T \end{bmatrix}$$

"*don't associate the first two vowels to two separate tones*"

9. 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-árì	'man'	-árì/-ărì = definite suffix
kùm	kùm-árì	'meat'	
ʔímí	ʔímj-árì	'water'	
kú	kw-árì	'goat'	
tágú	tágw-árì	'horse'	
tì	tj-ărì	'morning'	
hù	hw-ărì	'grave'	
úʔù	úʔw-ărì	'fire'	

- What's the underlying form of the suffix? A: árì, B: ărì

- How could we describe the tonal alternation in rules with features?

- 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

  - Fill in the tableau. What's the winner? A, B, C

/hu + ari/ L_1 H_2L_3	ONSET	IDENT(syll)	MAX-Tone
a hu . a . ri | | | L_1 H_2 L_3			
b hwa . ri /\ \ L_1H_2 L_3			
c hwa . ri | | H_2 L_3			

10. 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:

ọ̀nụ̀	'yam'	ọ̀nū [rèré èré]	'the yam [that is rotten]'
ázụ̀	'fish'	ázū [rèré èré]	'the fish [that is rotten]'
ánụ́	'meat'	ánṵ́ [rèré èré]	'the meat [that is rotten]'
àkwhá	'eggs'	àkwhá [rèré èré]	'the eggs [that are rotten]'

- Fill in the tableau (gives you an idea of some typical OT autosegmental constraints). What's the winner? A, B, C, D.

	/ aʒ̬u̬ + + 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
a	a ʒ̬ u̬ r e r e e r e | | | | | | H_1 L_2 H_3 L_4 H_5 L_6 H_7						
b	a ʒ̬ u̬ r e r e e r e | | ＼ | | | | H_1 L_2 H_3 L_4 H_5 L_6 H_7						
c	a ʒ̬ u̬ r e r e e r e | | | | | | H_1 $M_{2,3}$ L_4 H_5 L_6 H_7						
d	a ʒ̬ u̬ r e r e e r e | | | | | | H_1 L_2 $M_{3,4}$ H_5 L_6 H_7						
e	a ʒ̬ u̬ a r e r e e r e | | | | | | | H_1 L_2 H_3 L_4 H_5 L_6 H_7						
f	a ʒ̬ u̬ 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 $L_{2,3}$? Maybe we do need tonal features too...]

11. 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+ɕita	→	neko-d͡ʑita	'aversion to hot food' (cat+tongue)

- What's the compound-forming morpheme?

[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 dissallow voiceless prenasalized voiceless obstruents): [eda-^{n}ge]. Later, the prenasalization was lost.

12. 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:

	+*falling*	+*rising*	+*low*
falling+	falling +falling → falling+low	OK	OK
rising+	OK	rising+rising → rising+falling	rising+low → low+low
low+	low+falling → low+low	OK	OK

  - Let's re-write these representations autosegmentally (board). Is it easier to express the constraint?

13. 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'
hákátà	'diviner's bones'	né-hàkàtà	'with diviner's bones'
bénzíbvùnzá	'inquisitive fool'	né-bènzìbvùnzá	'with inquisitive fool'

  - Warm-up: draw autosegmental representations for all the items (board)

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

- Let's assume there is some reason why H → 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). A or B?

ne hove | \ / H H_1	
a ne hove | | | H L_1 L_1	
b ne hove | \ / H L_1	
c 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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