

Class 16: Structure below the segment—Autosegmental representations

To do

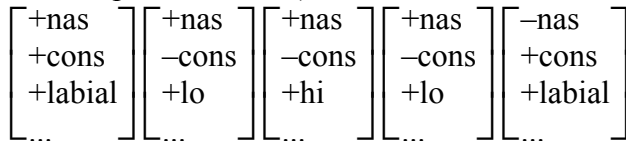
- Fijian assignment is due a week from tomorrow (Mar. 6)
- Be working on project

Overview: SPE treats a phonological representation as a sequence of feature matrices. Goldsmith (1990, 1976, 1979, and others): this is inadequate; we must move tones and some other features onto their own “tiers”. Next time we’ll look at how this relates to the phonetics.

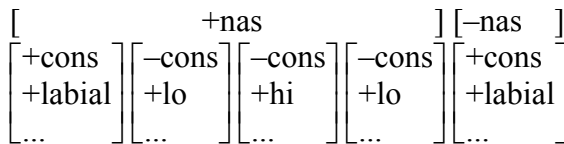
0. A few remarks on Kalinga

1. Tiers

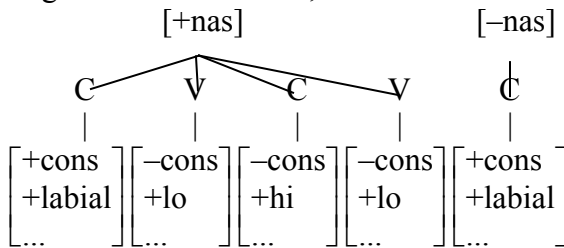
- A “linear representation” (i.e., what we’ve been using till now) of [mãjãb] might look like:



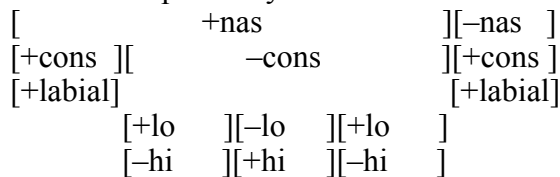
- but we could imagine a reasonable notation system where we write instead:



- Adding a C-V skeleton tier, as Goldsmith does:



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



2. This starts to resemble a “gestural score”—though not all features are gestures

(Browman & Goldstein 1986; Browman & Goldstein 1989; Browman & Goldstein 1992)

	m	ã	ĩ	ã	b
lips	closed				closed
tongue tip/blade					
tongue body	low front		hi front	low front	
velum	down				up
glottis	voicing				

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)
 - ã = [a] with rising tone (low then high)
- } contour tones
- When a language has no mid tone, often the highs (and contours) are marked, but not the lows.

5. Tonal association

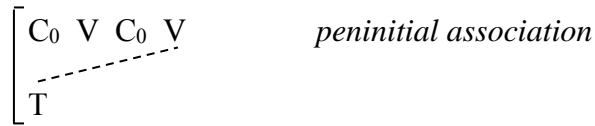
- Kikuyu (Niger-Congo language from Kenya with about 5.3 million speakers; discussion here based on Goldsmith 1990, whose data come from Clements & Ford 1979)

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

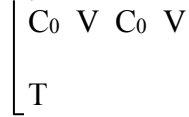
- Take a minute to ascertain the basic facts—on what does the tone of the tense suffix ìré/íré depend? On what do the tones of the two verb roots (in **bold**) depend? On what do the tones of the object suffixes (underlined) depend?
- Ideas for how we can account for this with linear representations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

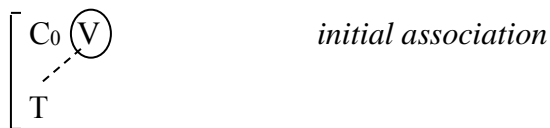
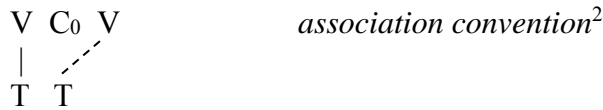


- Yes, it is a rule! Its structural description is



(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. 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?

7. Autosegmentalism in OT

- Whether representations are linear or autosegmental is (pretty much) orthogonal to whether the grammar consists of rules or constraints or both. See Zoll (1996) for a framework; also Zoll 2003.
- For example, if we were to re-cast the analysis of Kikuyu in OT with autosegmental representations, we could have a constraint like

$$* \left[\begin{array}{ccc} C_0 & V & C_0 & V \\ & | & & | \\ & T & & T \end{array} \right] \quad \text{“don't associate the first two vowels to two separate tones”}$$

- Within OT, how do we decide whether linear reps. or autosegmental reps. are better?

8. 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-ári	‘man’	-ári/-ări = definite suffix
kùm	kùm-ári	‘meat’	
ʔímí	ʔímj-ári	‘water’	
kú	kw-ári	‘goat’	
tágú	tágw-ári	‘horse’	
tì	tj-ări	‘morning’	
hù	hw-ări	‘grave’	
úʔù	úʔw-ări	‘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 . ari L ₁ H ₂ L ₃	*!		
☞ b hwari ^ \ L ₁ H ₂ L ₃		*	
c hwari H ₂ L ₃		*	*!

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

Igbo (Goldsmith 1976; Niger-Congo; 17,000,000 speakers; Nigeria)

- Subordinate clauses are preceded by a complementizer morpheme that is nothing but a H tone:

òṅù	‘yam’	òṅṹ [rèré èré]	‘the yam [that is rotten]’
áẓù	‘fish’	áẓṹ [rèré èré]	‘the fish [that is rotten]’
ánù	‘meat’	ánṹ [rèré èré]	‘the meat [that is rotten]’
àkwhá	‘eggs’	àkwhá [rèré èré]	‘the eggs [that are rotten]’

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

/ aẓù + + 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 ẓ ù 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 ẓ ù 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 ẓ ù r e r e e r e H ₁ M _{2,3} L ₄ H ₅ L ₆ H ₇						
<i>d</i> a ẓ ù r e r e e r e H ₁ L ₂ M _{3,4} H ₅ L ₆ H ₇						
<i>e</i> a ẓ ù 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 ẓ ù 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....]

10. Tones 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-mbùndùd̀zì	‘with army worm’
hákàtà	‘diviner’s bones’	né-hàkàtà	‘with diviner’s bones’
bénzìbvùnzá	‘inquisitive fool’	né-bènzìbvùnzá	‘with inquisitive fool’

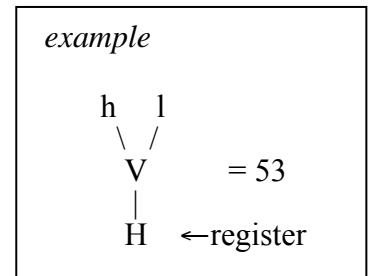
⇒ sequences of the same tone undergo a rule together, as though they were a single tone.

- Let’s assume there is some reason why $H \rightarrow L$ after né-, and consider only 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 $\begin{matrix} /hove/ \\ H H \end{matrix}$?
 - 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 $\begin{matrix} /hove/ \\ H H \end{matrix}$ / ... Will strata help?

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

- Seems to be different from African-type³ tone:
 - often more than three levels (5 is typical)
 - often transcribed with Chao numbers (Chao 1930): [ma²¹³] means tone starts lowish (2), then dips to the bottom of the range (1) then goes up to the middle (3)
 - contour tones often behave as a unit rather than combination of H&L
- Various proposals—here’s a simple one (Yip 1989): add another tier with features [hi register] and [lo register].

register	tone (aka “contour”)	resulting pitch
[+hi register] [-lo register] (H register)	h m l	5 4 3
[-hi register] [+lo register] (L register)	h m l	3 2 1



- Allows the register of an entire contour to change by just changing one feature, e.g. 53 → 31
- What is register, articulatorily?
 - It’s been proposed to correspond to stiff vs. slack vocal folds. But often this is true only in the language’s history & not synchronically.
 - Can be associated with a voice quality difference, e.g. L is breathy
- How do you know whether a 3 is H & l or L & h?
 - Normally the whole syllable has the same register tone. So if you see 53, 34, etc., it must be H; if you see 13, 32, etc., it must be L.
- But what if it’s just 3 or 33?
 - You will have to use other facts about the language to deduce the right representation.

12. Example: distribution of tones in Songjiang

(Bao 1990, via Kenstowicz 1994; apparently a Shanghai-area dialect of Wu Chinese [Sino-Tibetan; China; 77 million speakers] example words from Chen 2000)

voiced onset, unchecked syll.	voiced onset, checked syll.	voiceless onset, unchecked syll.	voiceless onset, checked syll.
22 di ²² ‘younger brother’	3 baʔ ³ ‘white’	44 ti ⁴⁴ ‘bottom’	5 paʔ ⁵ ‘hundred’
31 di ³¹ ‘lift’		53 ti ⁵³ ‘low’	
13 di ¹³ ‘field’		35 ti ³⁵ ‘emperor’	

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

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

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

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

13. Exercise: Terena

- Arawakan language from Brazil with 15,000 speakers. Bendor-Samuel 1970, 1966, which transcribe NCs differently.

- Propose underlying forms for the first- and second-person affixes.

e'moʔu	'his word'	ẽ'mõʔũ	'my word'		
'ayo	'his brother'	'ãỹõ	'my brother'		
'owoku	'his house'	'õwõõngu	'my house'		
'ahyaʔaʃo	'he desires'	ã'nʒaʔaʃo	'I desire'		
'piho	'he went'	'mbiho	'I went'	'pihe	'you went'
'tuti	'his head'	' ⁿ duti	'my head'	'tiuti	'your head'
'nokone	'his need'	'nõ ⁿ gone	'my need'	'nekone	'your need'
o'topiko	'he cut down'			yo'topiko	'you cut down'
'ayo	'her brother'			'yayo	'your brother'
ku'rikena	'his peanut'			ki'rikena	'your peanut'
'piho	'he went'			'pihe	'you went'
'nene	'his tongue'			'nini	'your tongue'
'xerere	'his side'			'xiriri	'your side'
'paho	'his mouth'			'peaho	'your mouth'

- Let's play with AGREE and ALIGN constraints

14. Exercise: Tibetan compounds

- Data from Meredith (1990). (I am simplifying some of the tones!! For instance, 3 is really 2. Sorry for missing data; Meredith often doesn't give concrete examples, just schematics)
 - Draw representations for tones 5, 53, 31 (there's also 3 but worry about that later)
 - Look at the data and develop an analysis of the tone changes that occur in compounds
 - You'll need to invent a constraint on tones in non-word-final syllables
 - You'll need to invent a quite arbitrary constraint on tones in the second member of a compound.

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

To sum up

- Many features seem to behave not as properties of segments but as entities in their own right.
- This can be captured by autosegmental representations (and, in OT, including autosegments in correspondence relations).

Next week

- Relation to phonetics: locality, gestural scores, feature geometry, excrescent vowels, illusory deletion...

References

- Bao, Zhi-ming. 1990. On the Nature of Tone. MIT.
- Bendor-Samuel, J. 1970. Some problems of segmentation in the phonological analysis of Terena. In F. R Palmer & F. R Palmer (eds.), *Prosodic Analysis*, 214–21. London: Oxford University Press.
- Bendor-Samuel, John T. 1966. Some prosodic features in Terena. In C.E. Bazell, J.C. Catford, M.A.K. Halliday & R.H. Robins (eds.), *In memory of J. R. Firth*, 30–39. London: Longmans, Green and Co.
- Browman, Catherine P & Louis M Goldstein. 1986. Towards an Articulatory Phonology. *Phonology Yearbook* 3. 219–252.
- Browman, Catherine P & Louis M Goldstein. 1989. Articulatory gestures as phonological units. *Phonology* 6. 201–251.
- Browman, Catherine P & Louis M Goldstein. 1992. Articulatory phonology: An overview. *Phonetica* 49. 155–180.
- Chao, Yuen-ren. 1930. A system of tone-letters. *Le Maître Phonétique* 45. 24–27.
- Chen, Matthew Y. 2000. *Tone sandhi: patterns across Chinese dialects*. Cambridge: Cambridge University Press.
- Clements, G. N & K. C Ford. 1979. Kikuyu tone shift and its synchronic consequences. *Linguistic Inquiry* 10. 179–210.
- Goldsmith, John. 1976. *Autosegmental Phonology*. Massachusetts Institute of Technology.
- Goldsmith, John. 1979. The aims of autosegmental phonology. In Daniel Dinnsen (ed.), *Current Approaches to Phonological Theory*, 202–22. Bloomington: Indiana University Press.
- Goldsmith, John. 1990. *Autosegmental and Metrical Phonology*. Blackwell.
- Hoffman, Carl. 1963. *A Grammar of the Margi Language*. London: Oxford University Press.
- Hyman, Larry M & Kenneth L VanBik. 2004. Directional rule application and output problems in Hakha Lai tone. *Language and Linguistics* 5(4). 821–861.
- Kenstowicz, Michael. 1994. *Phonology in Generative Grammar*. 1st ed. Blackwell Publishing.
- Meredith, Scott. 1990. Issues in the Phonology of Prominence. MIT.
- Odden, David. 1980. Associative tone in Shona. *Journal of Linguistic Research* 1. 37–51.
- Yip, Moira. 1989. Contour Tones. *Phonology* 6(01). 149–174. doi:10.1017/S095267570000097X.
- Zhang, Jie & Yuwen Lai. 2006. Testing the role of phonetic naturalness in Mandarin tone sandhi. *Kansas Working Papers in Phonetics*(28). 65–126.
- Zoll, Cheryl. 1996. Parsing below the Segment in a Constraint-based Framework. University of California, Berkeley.
- Zoll, Cheryl. 2003. Optimal Tone Mapping. *Linguistic Inquiry* 34(2). 225–268.