Class 10: Structure below the segment III/downward interfaces again

To do
☐ McCarthy & Prince 1994 study question due Wednesday
☐ Chaha autosegmentalism homework due Friday

Overview: Further structure below the segment, relationship of sub-segment structure to phonetics.

1 Feature geometry

- We're not really using it in this course after today, but at least you'll know what it is

? Discuss: what are we really doing when use [place] in a rule or constraint?

Example—from McCarthy 1988, a systematic overview of feature geometry

? For each of these, let's fill in the features in the *A* → […] / __ […] rule

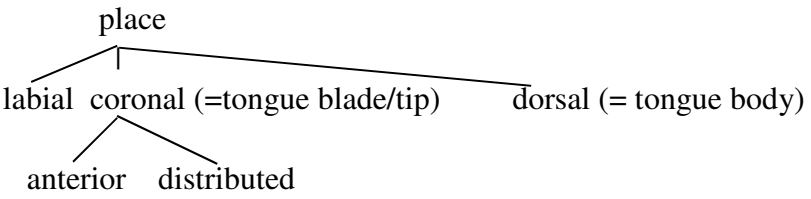
- *[anterior] can spread with all the place features*
  as in Malayalam (Dravidian language from India with about 36 million speakers)
  n → m / __ bilabials
  n̪ / __ dentals
  n̻ / __ alveolars
  ɳ / __ retroflexes
  ɲ / __ palatals
  ŋ / __ dorsals

- *[anterior] can spread with just the other tongue-tip/blade feature*
  English t,d,n ([+anterior, –distributed])
  → dental / __ θ, ð ([+anterior, +distributed])
  → palatoalveolar / __ tʃ, dʒ, ʃ, ʒ ([–anterior, +distributed])
  → retroflex[1] / __ ɻ ([–anterior, –distributed])

- *[anterior] can spread on its own*
  Navajo sibilant harmony
  s → ʃ / __ X_0 {tʃ, dʒ, ʃ, ʒ}
  ʃ → s / __ X_0 {ts, dz, s, z}

[1] for speakers who have a retroflex *r*

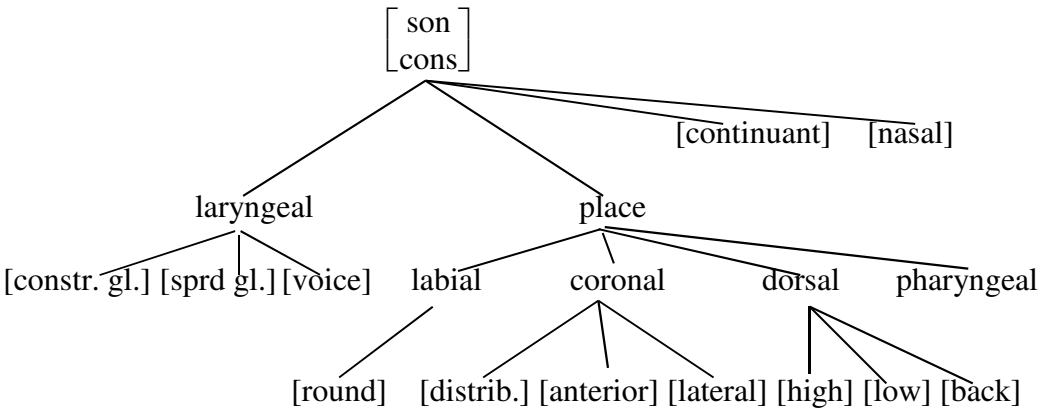
- This suggests a hierarchical organization of features:



The general idea

- Certain features seem to group together in their behavior.
- Such grouping gave rise to an elaborated theory of *feature geometry* in autosegmental representations.
  - The idea was that not only features can spread and delink, but also **nodes** that dominate multiple features, or nodes that dominate intermediate nodes.

- Here's a proposed full geometry, more or less the one in McCarthy 1988—the top, "root" node, is what attaches to the C-V skeletal tier (or to the syllable structure, for skeleton-less theories):



- McCarthy's **evidence** for each grouping comes from...
  - assimilation as a group (=spreading; see examples above for *coronal* and *place*)
  - deletion as a group (=delinking)

    debuccalization: Spanish dialects s → h / __ $]_{syll}$
    English dialects, some Ethiopian languages $C^{ʔ}$ → ʔ

    laryngeal neutralization: Korean obstruents have 3-way laryngeal distinction, collapsed to 1 value in codas

  - Obligatory Contour Principle (OCP) effects: adjacent (-on-their-tier) identical elements are prohibited.
    - Not only is two Hs in a row on the tone tier bad, two +s in a row on the [anterior] tier is bad too, and so is two +s in a row on the *coronal* tier.
    - Manifested as restrictions on allowable sequences (no two labials in an Arabic root), behaving as a block

2 Relationship to phonetics—my personal opinion

- Features that correspond to an articulatory gesture behave autosegmentally
  - [+nasal]: lower the velum
  - [+dorsal]: use the tongue body
  - [+back]: back the tongue body

- Features that don't correspond to a gesture really are just properties of a sound (true features), not autosegments
  - [–sonorant]: total or near-total obstruction of airflow
  - [+consonantal]: significant supraglottal interference with airflow

3 "Privative" features

- One more thing to know about features is that some researchers think that for some features, there's no [–F] vs. [+F] vs. nothing
  - but rather only [+F] (or "[F]") vs. nothing. (The idea goes way back—see Steriade 1995) for review.)
  - Such features are called privative or monovalent

- E.g., maybe there's no [–nas] in representations:
  - In linear rule theory: rules can only refer to [+nas], or not refer to nasality at all
  - In autosegmental rule theory: also no rules can insert, delete, or move [–nas]
  - In linear OT:s no markedness constraints can refer to [–nas]
  - In autosegmental OT: also no MAX([–nas]), DEP([–nas]), ALIGN([–nas])
  - A segment that previously was represented as [–nas] is now just **underspecified** for [nasal]

- Relationship to phonetics?
  - If the [–F] value is just the resting position, there's no need to specify its articulation
    - The articulator can just relax back towards its resting position
  - So features like [dorsal] or [voice] are likely to be privative/monovalent
  - Features like [sonorant] or [consonantal] are likely to be bivalent

4 If time: vowels vs. consonants in feature geometry (Clements & Hume 1995, Padgett 2011 for an overview)

- Do Vs and Cs share features? Sometimes Vs and Cs interact, sometimes they don't.
  - Spreading: in many languages, velar and labial consonants can become coronal before front vowels (so are front vowels coronal?)

Maltese: prefix vowel copies the stem vowel, unless stem begins with coronal consonant

kotor	jo-ktor	'to increase'
ʔasam	ja-ʔsam	'to break'
ħeles	je-ħles	'to set free'
daħal	ji-dħol	'to enter'
talab	ji-tlob	'to pray'
seħet	ji-sħet	'to curse'
d͡ʒabar	ji-d͡ʒbor	'to collect'

(Padgett 2011 p. ?—see there for references)

- OCP: in many languages, sequences of featurally-similar Vs and Cs are prohibited

Cantonese: round V can't occur after k^w, k^{hw}; round V can't be followed by a labial coda C (though there are also some C-V similarity requirements in Cantonese!)

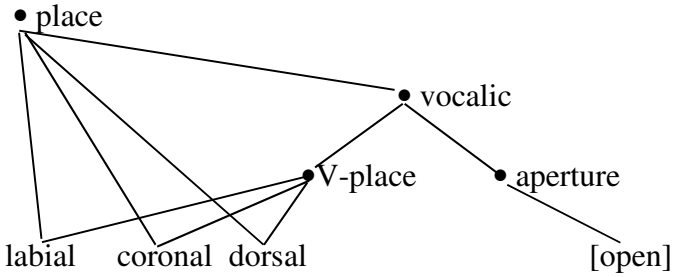
older speakers'	*becomes younger speakers'*		
[kʷɔ:k^{33}]	[kɔ:k^{33}]	'country'國	
[kʷu:n^{55}…]	[ku:n^{55}…]	'audience'觀(眾)	
[kʷʌj^{33}]	[kʷʌj^{33}] *no change*	'expensive' 貴	(Barrie 2003)

yes words like	pʰun	'a plate'
	pʰo^{21}	'an old lady' 婆

no words like	*Cup, *Com, *Cyw, *Cøp	(Cheng 1989)
	*Com	
	*Cyw	
	*Cøp	

- Yet vowel harmony generally skips right over consonants, suggesting that the consonants are underspecified for the features in question.

- Clements & Hume propose something along these lines:



- Explains why single consonantal features can skip vowels (as [anterior] in Navajo), but the whole Place node seems never to skip vowels (what would that look like?).

5 Long-distance effects

- Sibilant harmony in Navajo (Na-Dene language from the U.S. with about 149,000 speakers; discussion based on Martin 2004)

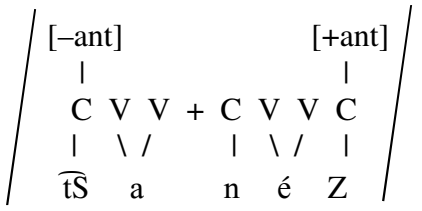
- Simple version: two [+strident] segments within a word must agree in [anterior]—the feature [anterior] is contrastive only among stridents (others are unspecified):

/sì + t͡ʃìd/	→	ʃì + t͡ʃìd	‘he is stooping over’
/sì + téːʒ/	→	ʃì + téːʒ	‘they two are lying’
/ji + s + léːʒ/	→	ji + ʃ + t͡ɬéːʒ/[2]	‘it was painted’
/ji + s + tiz/	→	ji + s + tiz/	‘it was spun’
/t͡sé + t͡ʃéːʔ/	→	t͡ʃʰé + t͡ʃéːʔ	‘amber’
/t͡ʃaː + néːz/	→	t͡saː + néːz	‘mule’

? Write a linear rule to account for this.

- The linear rule must skip over [–strid] segments
  - which happen to be, plausibly, just those segments that are <u>unspecified</u> for [anterior] in Navajo.
- But the rule gets no special credit for this
  - it is valued the same as a rule that skipped over all the [+voice] segments, say.
- This seems to miss something.
  - Cross-linguistically, <u>long-distance rules of assimilation seem to skip over segments that don’t bear the feature in question</u>
  - so we would like this kind of skipping to be valued more highly than other types.

- Autosegmental representation of ‘mule’s UR, assuming underspecification of nonstridents for [anterior]—IPA symbols stand for the rest of the features:



capitalization on this tier indicates agnosticism as to [ant]

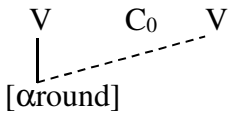
? Propose an autosegmental rule of strident harmony

? How about in OT?

[2] Not sure if there’s another process going on with /l/ vs. [t͡ɬ] or this is just a mistake. Sorry.

6 Phonetic basis of long-distance effects?

- Some researchers have argued most long-distance assimilations are, articulatorily, local. E.g. Gafos 1999.
- For instance, in a rounding-harmony system like this:



we could reasonably claim that (and test instrumentally whether) the *C*s that are skipped by the rule actually take on the lip-rounding value that spreads.

7 Locality: transparent vowels in Hungarian (Benus & Gafos 2007)

- Front non-round vowels in Hungarian allow front/back harmony to spread right over them:

Front		*Back*	
emír-nek [ɛm**iː**r-nɛk]	'emir-Dative'	papír-nak [p**ɔ**piːr-n**ɔ**k]	'paper-Dative'
zefír-ből [zɛf**iː**r-bøːl]	'zephyr-Elative'	zafír-ból [z**ɔ**fiːr-b**oː**l]	'sapphire-Elative'
rövid-nek [røv**i**d-nɛk]	'short-Dative'	gumi-nak [g**u**mi-n**ɔ**k]	'rubber-Dative'
bili-vel [bil**i**-vɛl]	'pot-Instrumental'	buli-val [b**u**li-v**ɔ**l]	'party-Instrumental'
művész-nek [myːv**eː**s-nɛk]	'artist-Dative'	kávé-nak [k**ɑː**veː-n**ɔ**k]	'coffee-Dative'
vidék-től [vid**eː**k-tøːl]	'country-Ablative'	bódé-tól [b**oː**deː-t**oː**l]	'hut-Ablative'

(p. 274)

? Let's draw some autosegmental representations, and maybe some gestural ones too

- B&G argue that the tongue actually remains in front or back(ish) position during the transparent vowel.
- So why does it still sound front? Because, especially for [i] (the most-transparent of the transparent vowels; see (Hayes et al. 2009)), the tongue has to get fairly back before it makes much acoustic difference.

8 Locality: Kinyarwanda coronal harmony (Walker, Byrd & Mpiranya 2008)

(3)	-sas-+i	→ [-ʂaʂi]	'bed maker'
		cf. [-sasa]	'make the bed (INF STEM)'
	-soːⁿz-+i	→ [-ʂoːⁿʐi]	'victim of famine'
		cf. [-soːⁿza]	'be hungry (INF STEM)'
	-sáːz-+i-e	→ [-ʂáːʐe]	'become old (PERF)'
	n-sáːz-+i-e	→ [ⁿʂaːʐe]	'I am old (PERF)'
		cf. [-sáːza]	'become old (INF STEM)'
	-úzuz-+i-e	→ [-úʐuʐe]	'fill (PERF)'
		cf. [-úzuza]	'fill (INF STEM)'
	βa-n-ziz-i+iʐe	→ [βaːⁿʐiʐiʐe]	'they punished me (for sth) (PERF)'
		cf. [βaːⁿziza]	'they punish me (for sth) (IMPERF)'

(p. 503)

- EMA study: receiver pellets attached to tongue tip and blade; magnetometer tracks their position (along with reference receivers on nose and gums).
- Result: tongue tip remains angled upward during intervening segments, as in [βa**ʂamáːʐ**e]
  - i.e., the retroflexness spreads to vowels too

9 Non-locality: Guaraní nasal harmony (Walker 1999)

(3)	a.	/ⁿdo-ɾoi-ⁿduˈpã-i/	→	[nõr̃õĩnũˈpãĩ]
		not + I-you + beat + NEG		'I don't beat you'
	b.	/ɾo-ᵐbo-poˈrã/	→	[r̃õmõpõˈr̃ã]
		I-you + CAUS + nice		'I embellished you'
	c.	/iᵈjaˌkãɾaˈku/	→	[ĩ̃ɲãˌkãr̃ãˈku]
				'is hot-headed'
	d.	/aˌkãɾaˈɣʷe/	→	[ãˌkãr̃ãˈɣʷe]
				'hair (of the head)'

(p. 9)

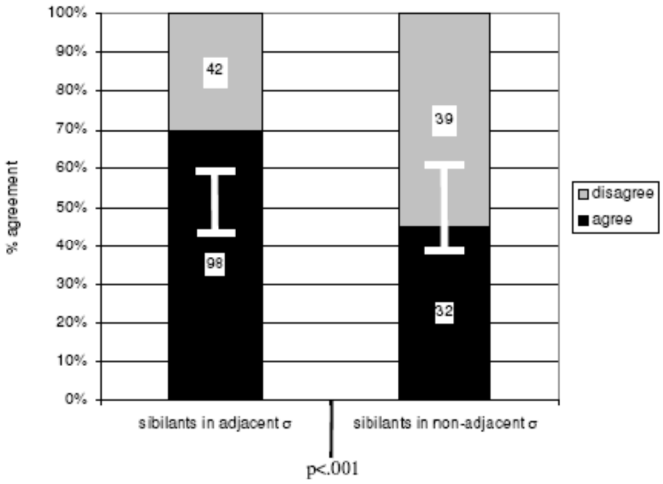
- Are the transparent Cs actually nasal?
- Acoustic study, but found no evidence for nasal airflow
  - if there was any, it wasn't enough to produce detectable turbulence
  - the stops did have a release burst, meaning air pressure was building up in the oral cavity, so it's unlikely to have been venting out the nose

? Let's discuss the theoretical implications (see Smith 2016)

10 A problem: gradient long-distance effects

- The autosegmental account above predicts that it doesn't matter how much material intervenes between the two stridents—they are still adjacent as far as the [anterior] tier is concerned.

- But Martin found that, in compounds, agreement is *gradient*: the more material intervenes between the two sibilants, the more likely they are to agree:



Martin 2004, p. 23

(There is an additional twist that I'll refer you to the thesis and to Martin 2007 for: much of the agreement in compounds comes not from alternation but from the underlying forms!)

- See Kimper 2011, Zymet 2014 for gradient distance effects in vowel harmony and even *dis*similation.

? Does this mean autosegments are all-or-nothing? Can gestures help?

11 Illusory assimilations and deletions

- We saw that Hall 2006 argues that a gap between consonants can lead to something that sounds like a vowel even though there's no vowel gesture.

? Let's review what such a representation looks like.

- Similarly, if two consonants are two overlapped, one may be inaudible though it was produced.
  ? Let's draw the gestural score for a famous one (Browman & Goldstein 1987), *perfect memory*, with the *t* being inaudible because of overlap by *k* and *m*

- Here's how the articulatory data looked:

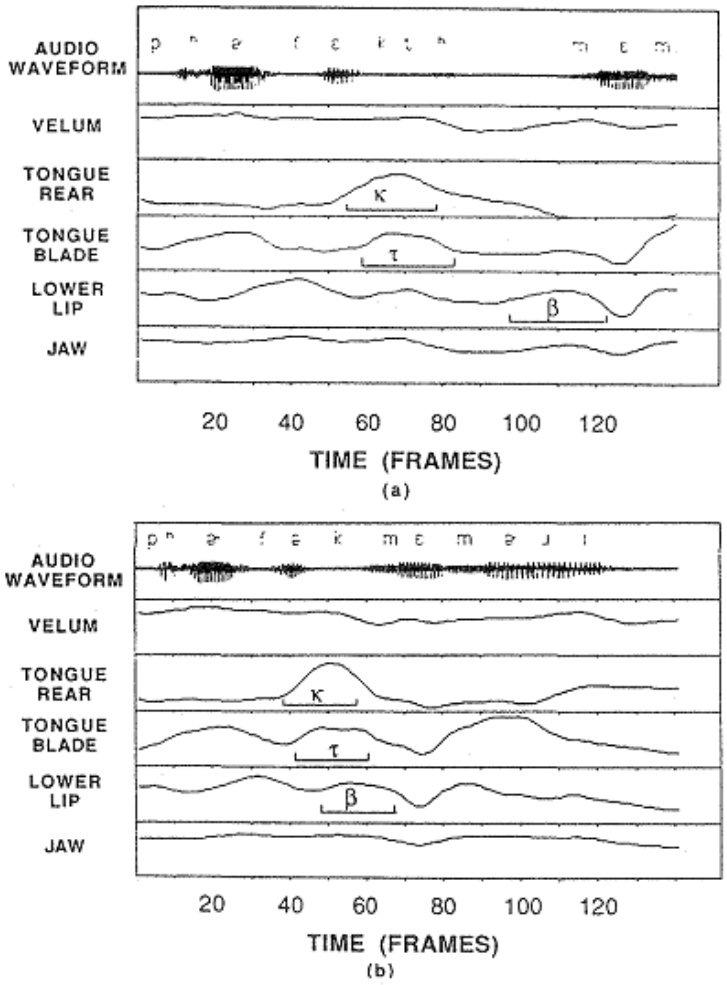
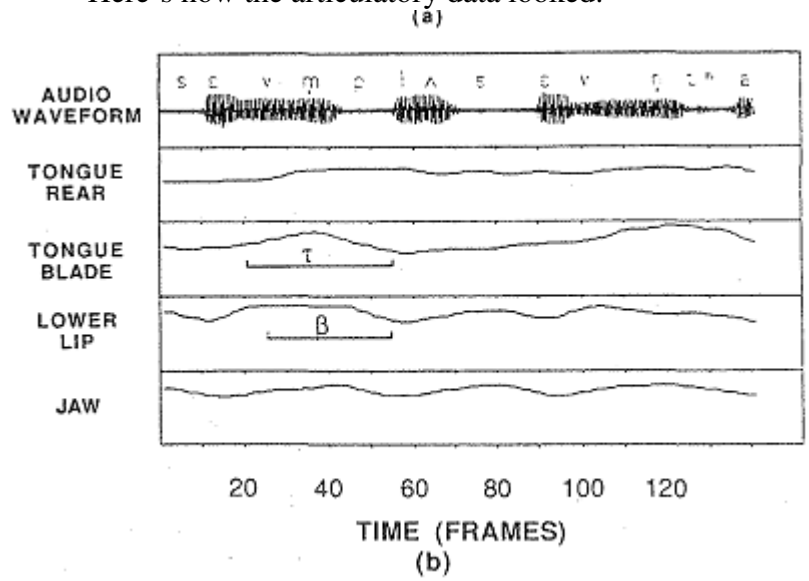


Figure 13. X-ray pellet trajectories for "perfect memory." (a) Spoken in a word list ([pəɾfɛkt#'mɛm...]). (b) Spoken in a phrase ([pəɾfɛk'mɛm...]). (p. 20)

- The same thing could happen in place assimilation.
  - ? Let's draw the autosegmental representation for another one from (Browman & Goldstein 1987), *seve[m] plus seven*.

- Here's how the articulatory data looked:



(p. 22)

12 If extra time: Tibetan compounds exercise

- 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.

1st member	*2nd member*	*compound*	
5	5	5-5	
53	5	**5**-5	
yum 3	chẽẽ 5	yum-chẽẽ 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	kɛɛ 31	co-pkɛɛ 5-**53**	'eighteen' (eight+ten)
53	31	**5**-**53**	
3	31	3-**53**	
31	31	**3**-**53**	

13 If extra time: Terena exercise

- 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.

eˈmoʔu	‘his word’	ẽˈmõʔũ	‘my word’		
ˈayo	‘his brother’	ˈãỹõ	‘my brother’		
ˈowoku	‘his house’	ˈõw̃õŋgu	‘my house’		
ˈahyaʔaʃo	‘he desires’	ãˈnʒaʔaʃo	‘I desire’		
ˈpiho	‘he went’	ˈmbiho	‘I went’	ˈpihe	‘you went’
ˈtuti	‘his head’	ˈⁿduti	‘my head’	ˈtiuti	‘your head’
ˈnokone	‘his need’	ˈnõ̰gone	‘my need’	ˈnekone	‘your need’
oˈtopiko	‘he cut down’			yoˈtopiko	‘you cut down’
ˈayo	‘her brother’			ˈyayo	‘your brother’
kuˈrikena	‘his peanut’			kiˈrikena	‘your peanut’
ˈpiho	‘he went’			ˈpihe	‘you went’
ˈnene	‘his tongue’			ˈnini	‘your tongue’
ˈxerere	‘his side’			ˈxiriri	‘your side’
ˈpaho	‘his mouth’			ˈpeaho	‘your mouth’

? Let’s play with AGREE and ALIGN constraints

To sum up

- There may be further structure within features (feature geometry)
- Not all segments are specified for all features
- Maybe locality of phonological processes is not just abstract (tier-adjacency), but totally concrete: an autosegment is a phonetic gesture that extends over a continuous span.
- But what about Walker’s nasal data from Guaraní? Maybe such cases shouldn’t be represented autosegmentally? (See Rose & Walker 2004, Zuraw 2002, Hansson 2001 for an alternative).
- We should think not just about the acoustics (do we hear a vowel between those Cs? do we hear a consonant that is underlying?) but also about the articulation underlying them.

Next time: turning to upward interfaces (phonology-morphology interface)

- Prosodic morphology
- Maybe some phonology & morphology revisited

(Rose & Walker 2004), (Zuraw 2002), (Hansson 2001)

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