Class 20 (Week 10, R)
Loose ends and course wrap-up

To do
☐ Work on your project, due Friday, Dec. 11 (hard copy preferred, PDF by e-mail is OK)
I have office hours today (Thurs., Dec. 4) 5:00-7:00 PM, plus next week Monday (Dec. 7) 4:00-5:00 and Wednesday (Dec. 9) 2:00-3:00.

Overview: A bit more on inducing features. Then some Evolutionary Phonology. Then course wrap-up.

1. Flemming (2005): putting features into the grammar

- Discuss: In OT, there is no phoneme inventory. What work was the phoneme inventory supposed to do in rule theories, and how does an OT grammar accomplish that work?

- In a similar move, Flemming proposes getting rid of the feature set, and shifting its responsibilities to the constraint inventory.

- An issue Flemming raises for natural classes: Suppose you have a vowel inventory /i,e,a,o,u/ and you want a rule-based grammar that deletes /i,a,u/ before V. What could you do? (no curly brackets allowed)

- Then if there are no such rule-based languages, how do we rule them out?

- How would we analyze the language in OT?

- Flemming's proposal: if we want to rule out this language, it has to by disallowing the constraints needed to capture it.
  - It won't suffice to just say that constraints can only refer to natural classes (why not?)
  - For example, "[i]f labials and coronals never pattern together as a natural class [*e.g., in post-nasal voicing*], it must be because there are no constraints that render them [*but not, say, velars*] marked in the same context." (p. 12 of ms. version)

- Suppose you have approximants, fricatives, and nasals looking like a class:

(17) Lithuanian (Kenstowicz, 1972: 12)

(a) No deletion of /n/ before stops.

sá:ndora	'covenant'	cf.	dorà	'virtue'
sá:ntaka	'confluence'		tekéːti	'to flow'
sá:mbuːris	'assembly'		buːrĩːs	'crowd'
sá:mpilas	'stock, store'		pĩlnas	'full'
sá:mbúːris	'assembly'		buːrĩːs	'crowd'
sá:ŋkaba	'coupling, clamp'		kãːbeː	'hook'

(b) Deletion of /n/ before glides, fricatives, liquids and nasals.

sá:juŋga	'union'	cf.	jùŋgas	'yoke'
sá:voka	'idea'		vóːkti	'understand'
sá:skambis	'harmony'		skambéːti	'ring'
sá:ʃlavos	'sweepings'		ʃlúoti	'sweep'
sá:ʒineː	'conscience'		ʒinóːti	'know'
sá:liːtis	'clash, contact'		líːti	'to rain'
sá:raʃas	'list, register		raʃíːti	'to write'
sá:mokslas	'conspiracy'		móːkslas	'skill'
sá:nariːs	'joint'		narĩːs	'link'

(p. 16)

  - Can we capture this with features? E.g., can we write a single n-deletion rule?

- If there are good reasons for three separate constraints to exists, *NAS-APPROX, *NAS-FRIC, *GEMINATE_NASAL, then it will seem as though {approximants, fricatives, nasals} is acting as a class
  - Flemming goes through typological data to justify the three constraints (plus *NAS-[h])
    - i.e., there are languages with one of the constraints high-ranked, but not the others
  - General principle: "sounds can pattern together as a natural class if they violate markedness constraints in the same environment, so given constraints *XA and *XB, A and B can form a natural class" (p. 2)

- "Classhood" is contingent
  - {approximants, fricatives, nasals} can pattern together—*after nasals*—because of the constraint set
  - But we don't expect them to pattern together in any other environment necessarily
  - Compare this to how features are supposed to work, including, I think, in Mielke's system where the learner induces the features from the observed pattern.

- How to get "subtraction"
  - First, recall what subtraction is (e.g., as used by Mielke)

  - Pharyngealization ([+RetractedTongueRoot]) spread in Palestinian Arabic
  - Spreads in both directions
  - But rightward spread is blocked by a high front vowel, a front glide, or a palato-alveolar C
    - all of those are [+high, -back] (well, in some feature systems)

(33)	a.	tˤuubak	'your blocks'	tˤwaal	'long (pl.)'
		ballaasˤ	'thief'	ʔabsatˤ	'simpler'
	b.	tˤiinak	'your mud'	sˤajjad	'hunter'
		ʕatˤʃaan	'thirsty'	ðˤaddʒaat	'type of noise (pl.)'

(p. 34)

  - What's the class of sounds that pharyngealization spreads to?

  - How could we capture that in OT? Like Flemming, let's use McCarthy's idea that the constraint responsible for stopping pharyngeal spread is *[+RTR, +hi, -back].

- In sum, we get subtraction when Markedness1 >> Markedness2

2. Evolutionary phonology (Blevins 2003 and others)

- Of all the topics we didn't cover in this course, this is probably the #1 one that we should at least have a look at so you know what the issues are

- When we say that, e.g., complex onsets are marked, what does that mean?
  - The idea predates generative linguistics, and seems to have varying interpretations:
    1. a structure is marked if it's rare cross-linguistically, or if its presence in a language implies the presence of an (unmarked) alternative
       - e.g., if a language allows complex onsets, it also allows simple onsets
    2. and/or a structure is marked if children acquire it later
       - e.g., children acquire simple onsets first, then complex
    3. and/or language learners and users actually disprefer the structure
       - not something we can observe directly

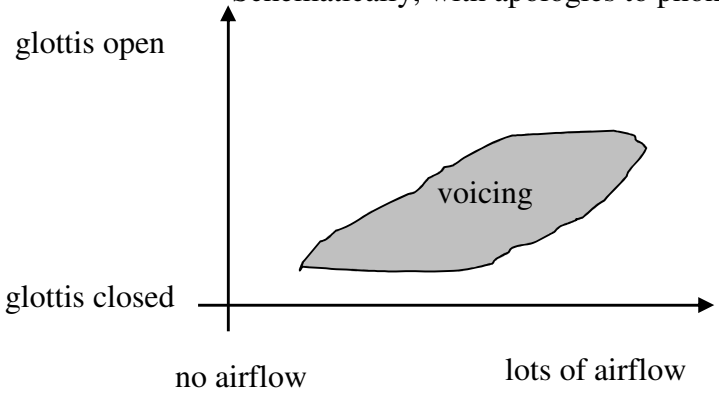
  - Controversies
    - Do 1 & 2 go together? If so, does 2 cause 1?
    - Is 3 responsible for 1 and/or 2? How can we test 3?

- Blevins's main point is that typological evidence (1) doesn't imply learner preference (3)
- Relatedly, Moreton (2008) talks about *analytic bias* (learner preferences) vs. *channel bias* (mind-external effects on what learning data children end up being exposed to)

3. Articulatory example: *NC̥

((Pater 1996; Pater 1999; Pater 2001); cf. (Archangeli, Moll & Ohno 1998))

- Some languages don't allow a sequence like *[ampa], though they do allow [amba] and [apa].
- Phonetic basis: (Hayes & Stivers 1996) (aerodynamic model simulations and experiments with English speakers): velar pumping and nasal leak
  - To have voicing, you need higher air pressure below the glottis than above (so that air flows), and the vocal folds in the right position.
    - What range counts as "the right position" depends on the pressure difference.
    - Schematically, with apologies to phoneticians:



- To stop voicing, you must move out of the zone.
- In a transition from [m] to [p], velum raises.
- The percept of nasality ends before velum actually makes closure → air is leaking out the nose, maintaining air pressure difference across the glottis → voicing is encouraged
- After velum does make closure, it tends to keep rising → "velar pumping": further encourages airflow across glottis by expanding oral cavity

- *Analytic bias theory*: humans are predisposed towards grammar that includes *NC̥
- *Channel bias theory (following* (Blevins 2003) Evolutionary Phonology*)*: Output of parents' phonology is [ampa], but often sounds a bit like [amba], so children may mistakenly induce *NC̥.

4. Perceptual example: IDENT(place)/__V ((Steriade 2001))

- Why do so many languages have /an+pa/ → [ampa] but not /an+pa/ → [anta], /ap+na/ → [apma]?
- Steriadean approach: in /an+pa/, /p/'s place is well cued (release burst, outgoing formant transition), while /n/'s isn't.
  - Learners apprehend this, and prefer to be faithful to the better-cued contrast (i.e., learners prefer rankings that respect the _____).

- Let's sketch how a channel-bias explanation would work instead. (See (Hayes & Steriade 2004) for a formulation and counter-argument)

5. The "too-many-solutions" problem

- Some markedness constraints have a variety of "solutions"
  - *NC̥ (see references above)
  - OCP-labial in various Western Austronesian languages ((Zuraw & Lu 2009))
  - *{ɪ,ʊ} in Romance metaphony ((Walker 2005))
  - *INITIALGEMINATE (Kennedy 2005)

⇨ This is what we expect in general in OT

- But some don't—the fact that these cases exist is the too-many-solutions problem for OT:
  - *CC deletes C_1, not C_2 in VC_1C_2V ((Wilson 2000; Wilson 2001))
  - *$\begin{bmatrix}-\text{son}\\+\text{voice}\end{bmatrix}$# causes final devoicing, but not deletion, epenthesis, etc.

⇨ predicted, if P-map imposes difficult-to-overturn ranking: MAX-C, DEP-V >> IDENT(voice)/__#

- I think a channel-bias account helps here too—discuss.

- Also to discuss (or just ponder, if we're running out of time): how does channel bias work in the many-solutions cases below?

  - **OCP-labial**: suppose having similar consonants nearby causes difficulties for motor planning (see (Frisch 1996; Frisch, Pierrehumbert & Broe 2004), (Walker, Nacopian & Taki 2002)).

    Attested changes:

    a. change place of stem: /p-um-.../ → [k-um...]; violates IDENT(place)/stem
    b. change place of infix: /p-m-.../ → [k-n...]; violates IDENT(place)/affix
    c. change consonantality of infix: /C-m-...p.../ → [C-w...p...]; violates IDENT(cons)
    d. fuse stem and infix consonants: /p-um-.../ → [m...]; violates UNIFORMITY
    e. move infix out of constraint's domain of application: /p-um-.../ → [mu-p...]; LINEARITY
    f. delete the infix: /p-m-.../ → [p...]; violates MAX, REALIZEMORPH
    g. paradigm gap: /p-m-.../ → *unpronounceable*; violates MPARSE ("pronounce the input")

  - ***{ɪ,ʊ}**: perhaps motivation is insufficient perceptual distance from [e,o], [i,u] (see (Flemming 1996))

    *Attested ways to handle *{ɪ,ʊ} in Romance metaphony when raising /ɛ,ɔ/ (*(Walker 2005)*):*

    h. /ɛ,ɔ/ raise to [i,u] (rather than expect [ɪ,ʊ]); violates IDENT(tense)
    i. /ɛ,ɔ/ fail to raise; violates LICENSE(high)
    j. /ɛ,ɔ/ raise to [e,o]; violates LICENSE(high)
    k. /ɛ,ɔ/ raise to [ie,uo] or [iɛ, uɛ]; violates INTEGRITY (no splitting)

  - ***INITIALGEMINATE**: This one's harder...

    Kennedy 2005:

    - In various Micronesian languages, initial geminate Cs were created by reduplication followed by vowel deletion (*pek* > *pepek* > *ppek*).
    - Word-initial position is a tough place to maintain a C-length distinction, especially for stops, because you need to perceive when the consonant begins ([pa] vs. [ppa], as opposed to [apa] vs. [appa])

Pohnpeian	*ppek	>	mpek	IDENT(nasal)
Marshallese—Ratak	*kkan	>	kekan	DEP-V/C__C
Marshallese—Ralik	*kkan	>	yekkan	DEP-V/#__C
Pingelapese	*ttil	>	iitil	IDENT(syllabic)
Woleaian	*kkaše *kaše	> >	kkaše xaše	 IDENT(continuant)

- The roles of channel and analytic bias remain controversial and under investigation.
  - You'll read many papers arguing that their data bear on the debate.

6. Course wrap-up

- Since I have a feeling we won't have much time left, I thought it would be fun to see how interrelated the readings ended up being.
  - Any other themes, ideas, tools, you can think of that kept coming up?

citation	***recap***	***syntactic domains?***	***paradigms***	***phono vs. lexicon***	***phono vs. processing***	***getting evidence***	***serialism***	***variation***	***learning algorithms***	***phonologization***	***inducing constraints***
Kaisse 1985, ch. 7	syntactic conditions for sandhi	*main*						✓			
Pak & Friesner 2006	conflicting domains for French accent and liaison	*main*			✓	✓		✓			
Lloret 2004	optimal paradigms in insular Catalan		*main*								
Pierrehumbert 2002	exemplar models of production (English VV vs. V?V)		✓	*main*	✓	✓		✓		✓	
Wagner 2012	speech planning and rule domains (English –ing/-in')	✓			*main*	✓		✓		✓	
Zhang, Lai & Sailor 2011	analytic bias in Taiwanese tone sandhi				✓	*main*		✓	✓		
Tessier & Jesney 2014	phonotactic learning in Harmonic Serialism (Punu vowels)						*main*		✓		
Moore-Cantwell & Pater submitted	learning type & token variation together (Dutch devoicing)			✓				*main*	✓		
Jarosz submitted	expectation-driven learning of hidden structure, including URs							✓	*main*		
Kirby 2013	phonologization of phonetic cues (Korean tonogenesis)				✓	✓		✓		*main*	
Hayes & Wilson 2006	phonotactic learning in MaxEnt					✓		✓	✓		*main*

7. Where can you go from here?

- PhonoFest next Tuesday: see what the 200A class has been up to.
- Phonology seminar—feel free to drop in even if not enrolled.
- Keep eye out for proseminars; currently I don't think there are any more ph ones this year
- Intonation in the spring—a very phonological area of phonetics

References

Archangeli, Diana, Laura Moll & Kazutoshi Ohno. 1998. Why not *NC. In M. Catherine Gruber, Derrick Higgins, Kenneth S Olson & Tamra Wysocki (eds.), *CLS 34, Part 1: The Main Session*, 1–26. Chicago: Chicago Linguistic Society.

Blevins, Juliette. 2003. *Evolutionary phonology. The emergence of sound patterns*. Cambridge: Cambridge University Press.

Flemming, Edward. 1996. Evidence for Constraints on Contrast: The Dispersion Theory of Contrast. *UCLA Working Papers in Phonology* 1. 86–106.

Flemming, Edward. 2005. Deriving natural classes in phonology. *Lingua* 115(3). 287–309.

Frisch, Stefan A. 1996. Similarity and Frequency in Phonology. Northwestern University.

Frisch, Stefan A, Janet B Pierrehumbert & Michael B Broe. 2004. Similarity Avoidance and the OCP. *Natural Language & Linguistic Theory* 22(1). 179–228.

Hayes, Bruce & Donca Steriade. 2004. Introduction: the phonetic basis of phonological markedness. In Robert Kirchner, Donca Steriade & Bruce Hayes (eds.), *Phonetically based phonology*. Cambridge University Press.

Hayes, Bruce & Tanya Stivers. 1996. *The phonetics of post-nasal voicing*.

Hayes, Bruce & Colin Wilson. 2006. A Maximum Entropy Model of Phonotactics and Phonotactic Learning.

Jarosz, Gaja. submitted. Expectation driven learning of phonology. UMass, ms.

Kaisse, Ellen M. 1985. *Connected Speech: The Interaction of Syntax and Phonology*. San Diego: Academic Press.

Kennedy, Bob. 2005. Reflexes of initial gemination in Western Micronesian languages. *Austronesian Formal Linguistics Association*. UCLA, Los Angeles, CA.

Kirby, James. 2013. The role of probabilistic enhancement in phonologization. In Alan C. L. Yu (ed.), *Origins of sound change*, 228–246. Oxford: Oxford University Press.

Lloret, Maria-Rosa. 2004. The phonological role of paradigms: the case of insular Catalan. *Contemporary approaches to Romance linguistics: selected papers from the 33rd Linguistic Symposium on Romance Languages (LSRL), Bloomington, Indiana, April 2003*, 275–298. John Benjamins Publishing.

Moore-Cantwell, Claire & Joe Pater. submitted. Gradient exceptionality in Maximum Entropy Grammar with lexically specific constraints.

Moreton, Elliott. 2008. Analytic Bias and Phonological Typology. *Phonology* 25(01). 83–127.

Pak, Marjorie & Michael Friesner. 2006. French Phrasal Phonology in a Derivational Model of PF. In Christopher Davis, Amy Rose Deal & Zabbal (eds.), *Proceedings of NELS 36*, vol. 2.

Pater, Joe. 1996. *NC. In Jill Beckman (ed.), *Proceedings of the North East Linguistics Society 26*, vol. 26, 227–239. Amherst, Mass.: GLSA Publications.

Pater, Joe. 1999. Austronesian nasal substitution and other NC effects. In René Kager, Harry van der Hulst & Wim Zonneveld (eds.), *The Prosody-Morphology Interface*, 310–343. Cambridge: Cambridge University Press.

Pater, Joe. 2001. Austronesian nasal substitution revisited: What's wrong with *NC (and what's not). In Linda Lombardi (ed.), *Segmental Phonology in Optimality Theory: Constraints and Representations*, 159–182. Cambridge: Cambridge University Press.

Pierrehumbert, Janet. 2002. Word-specific phonetics. *Laboratory Phonology VII*. Berlin: Mouton de Gruyter.

Steriade, Donca. 2001. Directional asymmetries in place assimilation: a perceptual account. In Elizabeth Hume & Keith Johnson (eds.), *The Role of Speech Perception in Phonology*. San Diego: Academic Press.

Tessier, Anne-Michelle & Karen Jesney. 2014. Learning in Harmonic Serialism and the necessity of a richer base. *Phonology* 31(01). 155–178.

Wagner, Michael. 2012. Locality in phonology and production planning. In A McKillen & J Loughran (eds.), *Proceedings of the Montreal-Ottawa-Toronto (MOT) Phonology Workshop 2011. Phonology in the 21st Century: In honour of Glyne Piggott. McGill Working Papers in Linguistics 22(1).*

Walker, Rachel. 2005. Weak Triggers in Vowel Harmony. *Natural Language & Linguistic Theory* 23(4). 917–989.

Walker, Rachel, Narineh Nacopian & Mariko Taki. 2002. Nasal consonant speech errors: implications for "similarity" and nasal harmony at a distance. *Collected papers: First Pan-American/Iberian Meeting on Acoustics*. Mexican Institute of Acoustics.

Wilson, Colin. 2000. Targeted Constraints: An Approach to Contextual Neutralization in Optimality Theory. Johns Hopkins University.

Wilson, Colin. 2001. Consonant Cluster Neutralisation and Targeted Constraints. *Phonology* 18(1). 147–197.

Zhang, Jie, Yuwen Lai & Craig Sailor. 2011. Modeling Taiwanese speakers' knowledge of tone sandhi in reduplication. *Lingua* 121. 181–206.

Zuraw, Kie & Yu-An Lu. 2009. Diverse repairs for multiple labial consonants. *Natural Language and Linguistic Theory* 72. 197–224.