Linguistics 201A Winter 2023
Phonological Theory I B. Hayes

Class 5, 1/24/2023: Acquisition II; Learnability I

1. Assignments

- Please hand in your summaries of Menn.
- New homework: Modern Hebrew. Due in class Thursday Feb. 2.
- For Tues, 1/19/2023: read
  - Jarosz, Gaja (2019) Computational modeling of phonological learning. *Annual Review of Linguistics*.
  - on course web site

2. Office hours reminder

- They are Tues. 3-4, Thurs. 2-3
- Time to start thinking about term paper topics; you can come by to brainstorm.

DOING PHONOLOGY WITH SOFTWARE

3. This is a small preview of the unit on Learnability

- See Jarosz reading for a careful survey.

4. What might we want software to do for us concerning Classical OT?

- Apply Recursive Constraint Demotion so we know:
  - That the constraints *can* be ranked to derive the desired outcomes from your candidate set.
  - A set of strata that — very roughly — tell you what sort of rankings will work.
    Caution: every constraint placed as high as it will go, even if analysis will work if it is lower.
  - Whether the analysis will still work if we remove a constraint.
    Caution: Faithfulness constraints violated by winners should always be included for rigor — something had better outrank them!

- Apply FreD (Prince and Brasoveanu 2011, *NLLT*) so we know the ranking arguments for sure; this can also produce a Hasse diagram.
  - and also a T-order (Anttila)

5. Some comments on software in phonology

- **Power**: We've seen fields get liberated when the participants move beyond paper-and-pencil solutions (statistics, meteorology, molecular biology).

- **Reliability**: Paper-and-pencil analysis even in Standard OT is not 100% trustable, as use of FReD can tell us.
- **Long term explanatory goals**: If you a true Chomskian (i.e. think that solving the acquisition problem is the central goal of theoretical linguistics), then you should hope that at some point all grammars will be learned by algorithm, not created by hand.

6. Software caveats

- We, who have brains, should continue to think about leading ideas, mechanisms, algorithms, letting the software be only our *servant*.
- Bugs
- Difficulties in sharing software with a small market and meeting its users's needs (See Kie Zuraw and Connor Mayer's current software-archive project for a sensitive approach.)

7. What I will do

- Try to arrive at a sensible account of the Ilokano, starting just with the program.
- I encourage you to participate Socratically.
- We might try more than one analysis, focusing on P-Map rankings.

IS CHILD MARKEDNESS THE SAME AS ADULT MARKEDNESS?

8. Some examples

a) Amahl, at age 2 years, 60 days, rendered all stops as voiceless unaspirated lenis initially, voiced in medial position, and voiceless finally; thus [ˈ**b̥**ebu] 'table', [a**ːt**] 'hard', [ˈwə**ːg**ɪn] 'working'. Cf. Lac Simon, Korean, German, respectively.

b) Amahl required every consonant to be either prevocalic or final, so he produced no consonant clusters. Cf. Gokana (Hyman 1982, 1985).

c) Some children impose gaps in their stop inventories at [p] or at [g] (Ferguson (1975), Macken (1980b). Cf. Arabic, Dutch, respectively.

d) Some children voice obstruents postnasally (Ferguson 1975, 11; Locke 1983, 120, also references in Kager text). Cf. Ecuadorian Quechua (Orr 1962), Eng. dial. *Washington* [ˈwɔʃɪŋ**d**ən].[1]

[1] References cited, and others relevant:

Donegan, Patricia Jane and David Stampe (1979) "The study of Natural Phonology," in Daniel A. Dinnsen, ed., *Current Approaches to Phonological Theory*, Indiana University Press, Bloomington, pp. 126-73.

Eimas, Peter (1996) "The perception and representation of speech by infants," in James L. Morgan and Katherine Demuth, eds., *Signal to Syntax: Bootstrapping from Speech to Grammar in Early Acquisition*, Lawrence Erlbaum Associates, Mahwah, NJ, pp. 25-39.

Ferguson, Charles (1975) "Sound patterns in language acquisition," in Daniel P. Dato, ed., *Developmental Psycholinguistics: Theory and Applications, Georgetown University Round Table on Languages and Linguistics*, 1975, Georgetown University Press, Washington, DC, pp. 1-16.

Hamp, Eric P. (1974) "Wortphonologie," *Journal of Child Language* 1, 287-288.

Hyman, Larry M. (1982) "The representation of nasality in Gokana," in Harry van der Hulst and Norval Smith, eds., *The Structure of Phonological Representations, Part I*, Foris, Dordrecht, pp. 111-130.

9. Theories of constraint origin: phonetic difficulty

- Background literature to this: efforts to deduce the constraint set from "maps" of phonetic difficulty.
  - Hayes, Bruce (1999) Phonetically-Driven Phonology: The Role of Optimality Theory and Inductive Grounding" in Michael Darnell, Edith Moravscik, Michael Noonan, Frederick Newmeyer, and Kathleen Wheatly, eds., *Functionalism and Formalism in Linguistics*, Volume I: General Papers, John Benjamins, Amsterdam, pp. 243-285
  - Steriade, Donca. 2009. The Phonology of Perceptibility Effects: the P-map and its consequences for constraint organization. in Kristin Hanson and Sharon Inkelas (eds.) *The Nature of the Word: Studies in Honor of Paul Kiparsky*, pp. 151-79.
  - others
- The [p]-gaps and [g]-gaps in children seem appealingly explained in this way.
- The tendency to place consonants next to vowels renders them maximally detectible.
  - If you're going to throw stuff away, increase your perceptibility by throwing away the least salient stuff.

10. Menn's interesting take on child-specific constraints

- Learning to talk is perhaps like learning to whistle — you explore, get lucky, find something that works.
- Such accidents lead to inter-child differences, meaning that environment is not deterministic.

11. Outright creativity in children

- Who would have the idea of moving all the sibilants to the end of a word? Eric Hamp's granddaughter: *step* = [pɛts] (*IJAL* 1985)
- Citing Priestly, Menn gives these mappings for little Christopher:

pillow	[pijal]
Brenda	[bajan]
tiger	[tajak]
rabbit	[rajat]
melon	[majan]
woman	[wajum]
dragon	[dajan] "Week 4", [dajak] "Week 5"

Locke, John L. (1983) *Phonological Acquisition and Change*, Academic Press, New York.

Macken, Marlys A. (1980) "Aspects of the acquisition of stop systems: a cross-linguistic perspective," in Grace H. Yeni-Komshian, James F. Kavanagh, and Charles A. Ferguson, eds., *Child Phonology, Volume 2: Production*, Academic Press, New York, pp. 143-168.

Orr, Carolyn (1962) "Ecuadorian Quichua phonology," in Benjamin Elson, ed., *Studies in Ecuadorian Indian Languages I*, Summer Institute of Linguistics, Norman, Okla.

Stampe, David (1973) *A Dissertation on Natural Phonology*, Ph.D. dissertation, University of Chicago. Distributed 1979 by Indiana University Linguistics Club, Bloomington.

These are not unlike the morphological templates of Semitic languages.

- Amahl Smith solved a phonological problem (pretonic initial syllables are tough) with a morphological solution:

  attack [riˈtæk]
  and: *re-range, re-turb, re-lastic, re-scape, re-jaffe, re-mometer*

NEAR-NEUTRALIZATION

12. Near-neutralization in adult phonology

- Near-neutralization is by now a widely-studied topic in adult phonology.
- Some familiar processes once though neutralizing but probably not:
  - Final Devoicing in German and Dutch
  - 3rd Tone Sandhi in Mandarin
  - North American English Tapping
- The literature can be accessed with a Google Scholar search on "incompletely neutralization phonology"

13. A classic case of near-neutralization in children: Macken and Barton on VOT in children (readings)

Macken, Marlys and D. Barton (1980) "A longitudinal study of the acquisition of the voicing contrast in American English word-initial stops, as measured by voice onset time," *Journal of Child Language* 7, 41-74.

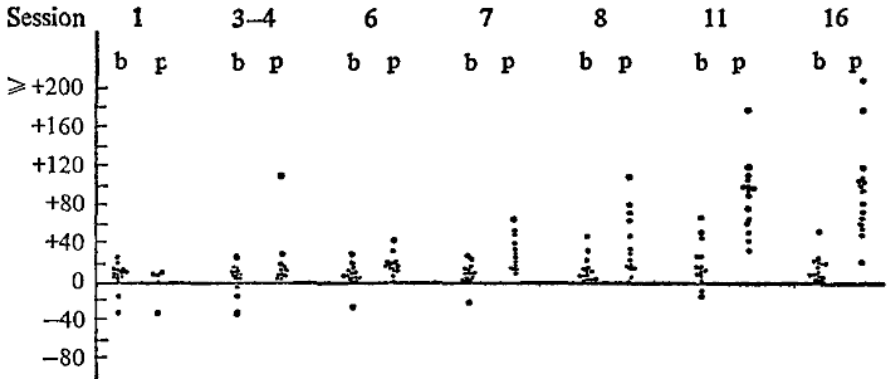
- Several kids played with a bunch of stop-initial toys in a recording booth,[2] in various sessions, as they got older.
- General age range was 1;5 to 2;4.
- Researchers measured Voice Onset Time for all the word-initial stops.

14. Results

- Early on: vegetative values, including reflection of "more voicing in fronter places," which has an articulatory explanation (Keating and Westbury, *J. Linguistics* 1986).
- Gradually: the clouds of data for the categories voiced/voiceless part, leaving an ever more perceptible distinction.
- During the middle stages: difference is statistically significant, but **transcribers can't hear it**.

[2] "If your family has a Piglet cuddly, please bring it."

15. Example: Little Tessa gradually gets it right



AVOIDANCE IN CHILD PHONOLOGY

16. This happens, though less often, for adults

/silly + ly/	*[I] + LY	*$VC_XəC_X\check{V}$	*NULL PARSE
☞ Null Parse			*
[ˈsɪləli]		*!	
[ˈsɪlili]	*!		

/happy + ly/	*[I] + LY	*$VC_XəC_X\check{V}$	*NULL PARSE
☞ [ˈhæpəli]			
Null Parse			*!
[ˈhæpili]	*!		

- Exceptions to *$VC_XəC_XV$: *canonization, classicist, diocesan, probable, indescribable*; all can be apologized for in some way.

17. More or less standard approach in OT: NullParse

- My favorite paper that addresses this idea is:
  - John J. and Wolf, Matthew, "Less than zero: Correspondence and the null output" (2007). *Modeling Ungrammaticality in Optimality Theory*. 22.

18. Avoidance is much more common for little kids

- To prove it you have to show that the kid knows a lot of words with the avoided sound or sequence; this has been done.

19. A tiny exercise: Jacob Hankamer's velar stops (Menn 18)

#k	→	#k
#g		don't try to say these words
k#	→	k#
g#	→	k or null

20. Null Parse and the Output Lexicon

- Presumably these are "entries"! Don't say this word at all.

LEARNING THE PARENTAL SYSTEM

21. The data we are responsible for

- Infancy: head-turn preference and similar results, shedding light on:
  - Phonemic contrasts
  - Phonotactics
  - Segmentation (sentences into words, words into morphemes)
  - Alternations (does Junior detect Morpheme X when it appears as a particular surface form?)
- Early childhood: Here we can wug-test, as Berko (1958) did
  - A nice recent paper of this type: Young-Ah Do (2018) Paradigm uniformity bias in the learning of Korean verbal inflections, in *Phonology*.
  - I'm not sure we can blick-test, but perhaps …
- Don't forget the adults!
  - Very often we don't know what adults would do when given similar probes to what we give to infants and kids.

22. Research methods

- Write grammars that make sense of the infants and little kids' intuitions and behavior.
- Collaborate with computationalists in trying to model the learning process itself.
  - This is going on here at UCLA; e.g. Hunter with Perkins, Sundara with Hayes and Ph.D. Breiss[3]

23. Computation and linguistics

- Its role is clearly increasing (job market!), but there are cultural barriers:
  - Computationalists often have their own goals and prestige system, not necessarily directed toward advancing scientific work in linguistics

[3] The latter case shows that the computationalists can be consumers, rather than inventors.

24. Collaboration is nice

- I self-assess as an amateurish programmer with (I hope) a better-than-average sense of what the software needs to do from the viewpoint of the phonologist.
- I have had tremendous luck finding more-computationally-sophisticated collaborators.
- In general, I think it wise for the field to seek collaboration between people with computational riffs and linguistic insight — the latter need to keep up the pressure on the former to direct the work toward scientific ends.

25. Generalities about empirical research in learning the adult grammar

- Given what we have seen, we need to get data despite the filtering effect of the child's production system.[4]
  - It's a good thing that testing methodology for babies and little kids has become so sophisticated.
- We also might want to be sure to **test the adults** before we turn to the children — only a few languages, like Japanese, are currently the subject of a full-scale research program, with
  - formal analysis
  - corpus study
  - productivity experiments
- To my knowledge, the really glorious phonologies, with tons of alternation, are not yet on the table for investigation.

WHAT MIGHT BE A PLAUSIBLE ACQUISITION ROUTE?

26. There are lots of tasks to be carried out by the child

- Figure out the phoneme inventory, perhaps also the allophonic distribution.
- Determine the words/morphemes that are present in the data.
- Figure out the phonotactics (of words and other domains)
- Establish the UR's of morphemes (more than one, if allomorphs)
- Establish the constraints (Markedness, Faithfulness) that govern phonotactics and alternations (unless they are innate).
- Establish how these constraints are ranked or weighted.
- Often, the latter tasks will require further hidden structure: syllabification, feet, phrasing

27. The tension of stepwise vs. all-at-once: all at once works better

- Linguists love components and like to work one component at a time
- Goldwater (2018[5]): all at once is *in principle, better*: don't ignore data
- The normal term for this is **joint learning**

[4] E.g.: does the child omit articles simply because she omits initial stressless syllables?
[5] Talk given at the inaugural meeting of the Society for Computation in Linguistics.

- A well-known paper is
  - Feldman, Naomi H., Thomas L. Griffiths, Sharon Goldwater, and James L. Morgan. "A role for the developing lexicon in phonetic category acquisition." Psychological review 120, no. 4 (2013): 751.

28. A simple example of the virtue of joint learning: phonotactics and word learning

- Lots of results from Anne Cutler and other psycholinguists show word segmentation is aided by phonotactics.
  - E.g. English iambic words (*balloon*, *believe*) are rare.
  - Children tend to split them up in segmenting: *the gui* | *tar is.*[6]
  - Not so for other languages.
- Finnish kids can use "vowel harmony breaks"; Suomi, McQueen, & Cutler, 1997[7]
- So, it pays to simultaneously detect words in utterances, and detect phonotactics of words.

29. The trouble with all-at-once

- Modern learning systems typically define a *search space* and specify a criterion for *best member of search space* — this guides learning in a systematic way.
- Joint learning multiplies out the candidate hypotheses for each component, eventually making the search space too big to handle.

[6] Jusczyk, P. W., Houston, D. W., & Newsome, M. (1999). The beginnings of word segmentation in english-learning infants. Cognitive Psychology, 39(3-4), 159-207.

[7] Suomi, K., McQueen, J. M., & Cutler, A. (1997). Vowel harmony and speech segmentation in Finnish. *Journal of Memory and Language*, 36, 422-444.