Class 6, 1/26/2023: Learnability; Variation I

1. Assignments

- Modern Hebrew homework is due in class Thursday Feb. 2.
- New reading for Tues. 1/22:
  - William Labov (1972) "The isolation of contextual styles", Chapter 3 of his *Sociolinguistic Patterns*, University of Pennsylvania Press. On course web site.
  - Do a half-page summary
  - Due Tues. Jan 31.

TWO PRODUCTION PHENOMENA SHARED BY CHILDREN AND ADULTS

NEAR-NEUTRALIZATION

2. Near-neutralization in adult phonology

- **Near-neutralization** is by now a widely-studied topic in adult phonology:
  - "[A]" derived from /B/ is not the same as [A] derived without change, or derived from /C/.
- Some familiar processes that are likely non-neutralizing:
  - Final Devoicing in German[1]
  - 3rd Tone Sandhi in Mandarin[2]
  - North American English Tapping[3]
  - The empirical literature can be accessed with a Google Scholar search on "incomplete neutralization phonology".
  - A nice theoretical approach, with MaxEnt phonetics, is in the work of Aaron Braver at Texas Tech. https://www.aaronbraver.com/
- Methodologically: it pays to measure, if you think you have a phonological neutralization.
- It's not clear that a near-neutralizing process in an opacity configuration is actually opaque.

3. Near-neutralization in children

- It is probably ubiquitous — diary studies mostly can't detect it.

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[1] Fourakis, Marios, and Gregory K. Iverson. "On the 'incomplete neutralization'of German final obstruents." Phonetica 41, no. 3 (1984): 140-149.
[2] Yuan, J. H., and Yiya Chen. "3rd tone sandhi in standard Chinese: A corpus approach." Journal of Chinese Linguistics 42, no. 1 (2014): 218-237.
[3] Braver, Aaron. "Incomplete neutralization in American English flapping: A production study." University of Pennsylvania Working Papers in Linguistics 17, no. 1 (2011): 5.

- Smith, using just his ear, sometimes was able to spot it.

4. A classic experimental study of near-neutralization in children: Macken and Barton on VOT in children

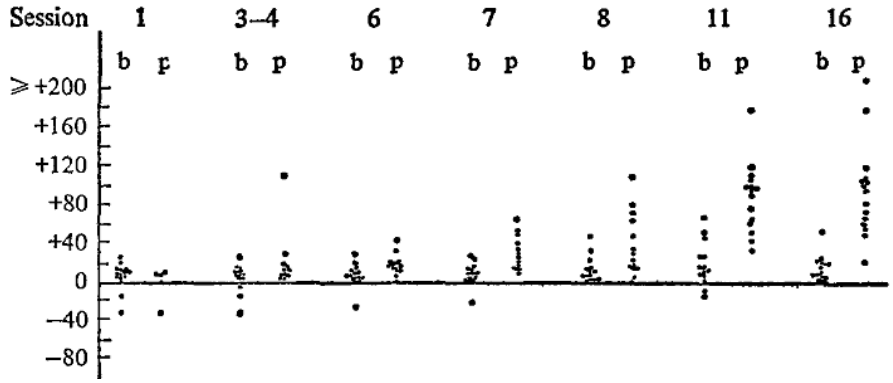
> ➢ Macken, Marlys and D. Barton (1980) A longitudinal study of the acquisition of the voicing contrast in American English word-initial stops, as measured by voice onset time. *Journal of Child Language* 7:41-74.

- Several kids played with a bunch of stop-initial toys in a recording booth,[4] 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.

5. 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**.

6. Example: Little Tessa gradually gets it right



AVOIDANCE IN CHILD PHONOLOGY

7. This happens, though less often, for adults

- Here is a possible case.
- The Null Parse candidate means, "shut up, say nothing". No constraints other than *NULL PARSE are violated.

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

/happy + ly/	*[I] + LY	*$VC_xəC_xV̆$	*NULL PARSE
☞ [ˈhæpəli]			
Null Parse			*!
[ˈhæpili]	*!		

vs.

/silly + ly/	*[I] + LY	*$VC_xəC_xV̆$	*NULL PARSE
☞ Null Parse			*
[ˈsɪləli]		*!	
[ˈsɪlili]	*!		

- Exceptions to *$VC_xəC_xV$: *canonization, classicist, diocesan, probable, indescribable*; all are in derived forms. I don't know how to allow these but forbid **sillily*.

8. A reference for NULLPARSE

- There are other papers that take this on but my favorite is:
  - McCarthy, John J., and Matthew Wolf. "Less than zero: Correspondence and the null output." Linguistics Department Faculty Publication Series (2007): 22.

9. Avoidance is probably 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.

10. Jacob Hankamer's velar stops (Menn reading p. 18)

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

- Faithfulness is characteristically very high in initial position (often though to be for psycholinguistic reasons; see Noah Elkins UCLA M.A. or Becker et al. 2021[5])
- Avoidance might be a way to avoid both markedness and faithfulness violations.

[5] Becker, Michael, Andrew Nevins, and Jonathan Levine. "Asymmetries in generalizing alternations to and from initial syllables." Language (2012): 231-268.

```
/#k/:
             Ident(voice)-Initial|*g|*NullParse|Ident(voice)
1 >k                             |  |          |
2  NullParse                     |  |          |
3  g                             |  |          |


/#g/:
             Ident(voice)-Initial|*g|*NullParse|Ident(voice)
4 >NullParse                     |  |          |
5  g                             |  |          |
6  k                             |  |          |


/k#/:
             Ident(voice)-Initial|*g|*NullParse|Ident(voice)
7 >k                             |  |          |
8  NullParse                     |  |          |
9  g                             |  |          |


/g#/:
              Ident(voice)-Initial|*g|*NullParse|Ident(voice)
10 >k                            |  |          |
11  NullParse                    |  |          |
12  g                            |  |          |
```

LEARNING THE PARENTAL SYSTEM

11. (Some of) the data we are responsible for

- Infancy: head-turn preference and similar results
- Early childhood: Passive data still relevant, but we can also wait till Junior speaks clearly enough to inform us about her intuitions:
  - Wug-test, as in Berko (1958)
  - Just plain **elicitation** can be very informative! See Do (2018) for some nice methodology.[6]
  - I'm not sure we can blick-test, but perhaps …

12. 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[7]

[6] Young-Ah Do (2018) Paradigm uniformity bias in the learning of Korean verbal inflections, in Phonology.

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

- It seems, learnability, especially early learnability, has been a really fruitful area for computational participation in linguistic research.
  - Why so? The early stuff is amenable to simply **tracking distributions**, something computationalists are good at.

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

- Presentational scheme here:
  - learning task
  - representative modeling work (just a sample; with a tendency to UCLA-bias)

- Figure out the phoneme inventory
  - Kristine Yu dissertation
- Perhaps also the allophonic distribution.
  - Martin, Andrew, Sharon Peperkamp, and Emmanuel Dupoux. "Learning phonemes with a proto-lexicon." *Cognitive science* 37, no. 1 (2013): 103-124.
- Perhaps, figure out a language-specific feature system
  - Mayer, Connor, and Robert Daland. "A method for projecting features from observed sets of phonological classes." Linguistic Inquiry 51, no. 4 (2020): 725-763.
- Divide utterances into words and form a "proto-lexicon" (words that may not have definitions)
  - Goldwater, Sharon, Thomas L. Griffiths, and Mark Johnson. "A Bayesian framework for word segmentation: Exploring the effects of context." Cognition 112, no. 1 (2009): 21-54.
- Armed with a set of words, and perhaps meaning, find what affixes are present
  - Goldsmith, John. "Linguistica: An automatic morphological analyzer." In Proceedings of 36th meeting of the Chicago Linguistic Society. 2000.
- Figure out the phonotactics (of words and other domains)
  - Hayes, Bruce, and Colin Wilson. "A maximum entropy model of phonotactics and phonotactic learning." *Linguistic inquiry* 39, no. 3 (2008): 379-440.
- Establish the UR's of morphemes (more than one, if allomorphs)
  - For a partial bibliography, see Yang Wang and Bruce Hayes (in progress, borrowable) "Learning underlying representations: An approach guided by the Kenstowicz-Kisseberth UR Hierarchy"
- Discover the constraints (Markedness, Faithfulness) that govern phonotactics and alternations (unless they are innate).
  - see Yang and Hayes paper for bibliography
- Establish how these constraints are ranked or weighted.
  - Bruce Tesar and Paul Smolensky (2000 *Learnability in Optimality Theory*) — classical OT
  - Paul Boersma 1998 dissertation, published — Stochastic OT
  - Goldwater, Sharon, Mark Johnson, Jennifer Spenader, Anders Eriksson, and Östen Dahl. "Learning OT constraint rankings using a maximum entropy model." In Proceedings of the Stockholm workshop on variation within Optimality Theory, vol. 111, p. 120. 2003.
- Often, the latter tasks will require further hidden structure: syllabification, feet, phrasing
  - Jarosz, Gaja. "Learning with hidden structure in optimality theory and harmonic grammar: Beyond robust interpretive parsing." Phonology 30, no. 1 (2013): 27-71. Also, secret 2015 ms., borrowable from Bruce

14. 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[8]): all at once is *in principle, better*: don't ignore data
- The normal term for this is **joint learning**
- 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.
  - Jointly learn the vocabulary and the phonemes

15. Another 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.*[9]
  - Not so for other languages.
- Finnish kids can use "vowel harmony breaks"; Suomi, McQueen, & Cutler, 1997[10]
- So, it pays to simultaneously detect words in utterances, and detect phonotactics of words.

16. 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.

VARIATION IN PHONOLOGY

17. Classifying phonological variation

- **Type variation**: different lexical items differ according to how they undergo particular phonological or processes. E.g. *serene* [səˈɹ**iː**n] undergoes Trisyllabic Shortening[11] in [səˈɹ**ɛ**nəti], *obese* does not ([oʊˈb**iː**s], *obesity* [oʊˈb**iː**səti])
- **Token variation**: the very same morpheme can be pronounced differently on different occasions by the very same speaker—often in response to speaking styles (*talk* [tʊək, tɔk], Labov readings)

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[8] Talk given at the inaugural meeting of the Society for Computation in Linguistics.

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

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

[11] For Americans this is [aɪ, eɪ, iː, oʊ] → [ɪ, æ, ɛ, ɑ] when a non-final atonic syllable follows. Many alternations triggered by suffixes, e.g. *-ical*, *-ity*.

TOKEN VARIATION

18. Who are the experts here?

- Sociolinguists
- Some references:
  - *Sociolinguistics*, by Peter Trudgill, a short text
  - *Sociolinguistic Patterns* (source of your reading) and *Language in the Inner City*, early classics by William Labov. I find these very useful for getting oriented; though everything they say was subjet to later amendment.
  - Labov's magnum opus, *Principles of Linguistic Change*, in four volumes
- Sociolinguistics has evolved since the readings paper
  - Massive infusion of statistical modeling
  - Broader range of societal interests and focus on personal identity

19. Readings

- Covers some techniques used to gather forms in free variation
  - Note the extreme contradiction between the scientific goal of controlled study and the goal of accessing the vernacular forms
- Claims considerable systematicity for the patterns thus obtained.

20. The crucial variable phonological phenomena of New York City English

R Dropping

"(r-0)" *beard* is [biəd], r-less;

"r-1" *beard* is [biɹd], r-ful

- Notes:
  - Labov thinks /ɹ/ is **underlyingly present**, learned from nondeleted tokens in the ambient language.
  - i.e. language learners can distinguish "always [sɔ]" from "sometimes [sɔ], sometimes [sɔɹ]" (*saw*/*sore*)
  - This would not *not* be true, I suspect, of people like Standard British speakers, who hear no variation in these forms during childhood.

/æ/ Diphthongization

"eh-1" *bad* [bi͡əd]

"eh-4" *bad* [bæd]

/ɔ/ Diphthongization

"oh-1" *coffee* [ˈkʊ͡ɔfi]

"oh-5" *coffee* [ˈkɔfi]

/θ/ and /ð/ Hardening

"th-3"	*thin* [t̪ɪn]	"dh-3" *this*	[d̪ɪs]
"th-2"	[t̪͡θɪn]	"dh-2"	[d̪͡ðɪs]
"th-1"	[θɪn]	"dh-1"	[ðɪs]

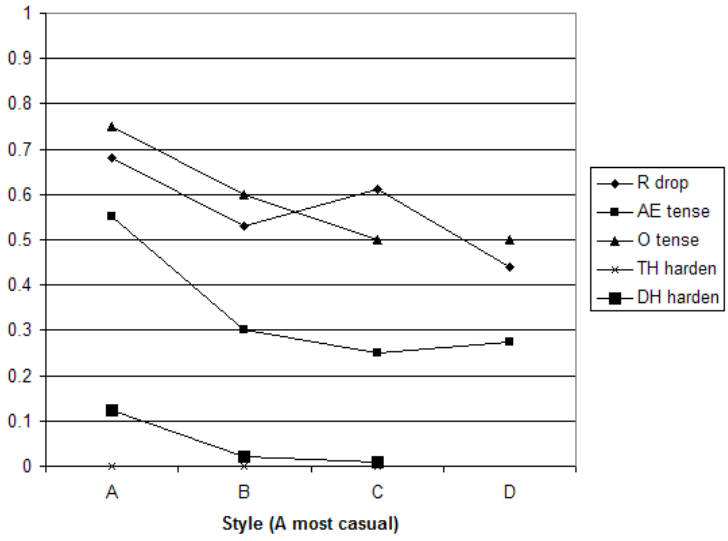
Claim: these often **vary in lockstep** by speaking style. It's like there is a **knob**, controlling all of the grammar at once.

21. The informal meter of style

A free conversation with interviewer
B interview
C read paragraph
D read words from a list

22. Phonological free variation in the speech of Miriam

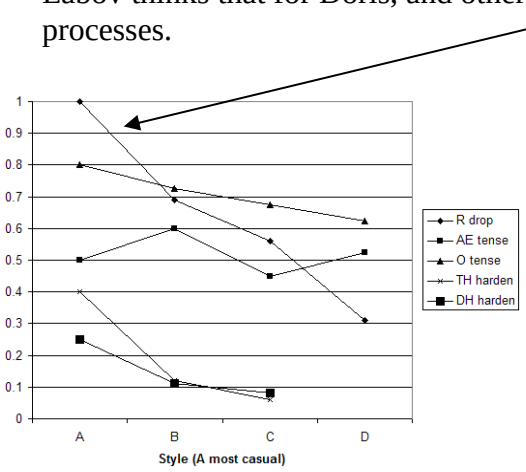
- Miriam is 35 years old, graduated Hunter College and St. John's law school, works as lawyer.



23. Variation in the speech of Doris

- Doris is 39, homemaker, African-American.
- She doesn't have perfect lockstep

- Labov thinks that for Doris, and others, r-dropping is more sensitive to style than other processes.



24. Free variation in society is structured as well

- Fig. 4.2 from William Labov (1972) *Sociolinguistic Patterns*

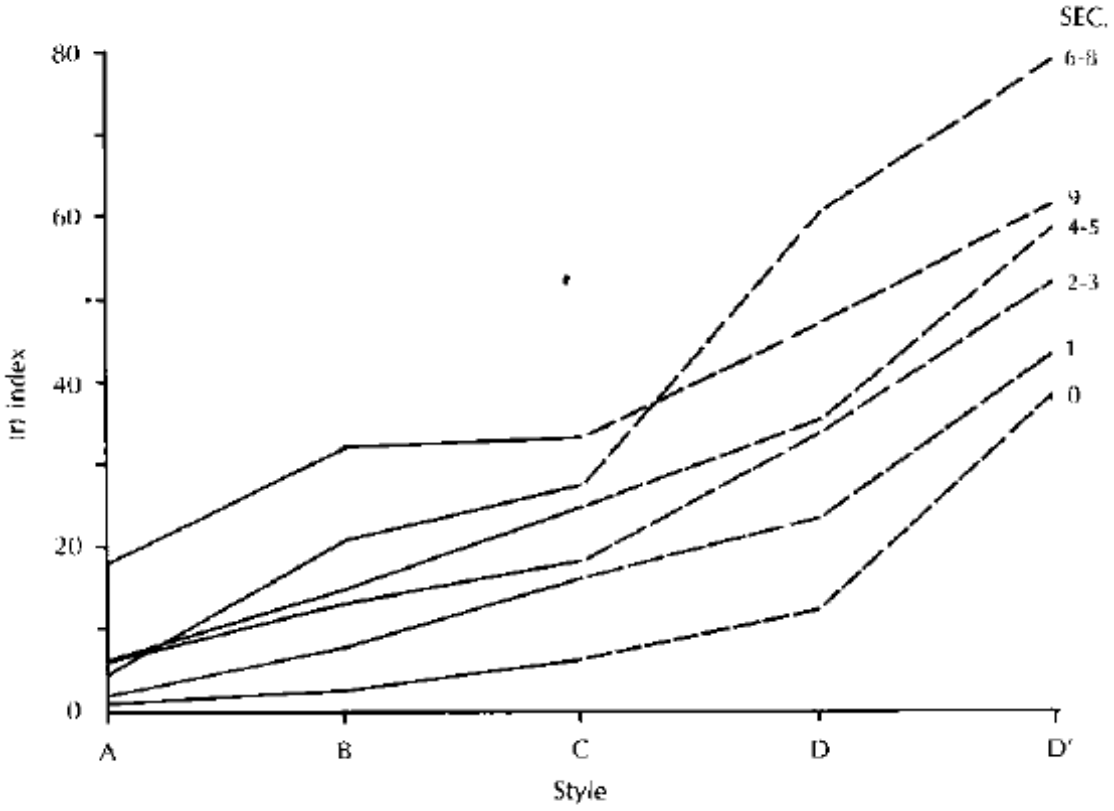


Fig. 4.2. **Class stratification of a linguistic variable in process of change:** (r) in *guard, car, bear, beard, board,* etc. SEC (Socio-economic class) scale: 0–1, lower class; 2–4, working class; 5–6, 7–8, lower middle class; 9, upper middle class. A, casual speech; B, careful speech; C, reading style; D, word lists; D′, minimal pairs.

- from 81 native speakers of New York City English

- Vertical axis: what percentage of underlying /ɹ/ are retained in the output?
- An independent investigation sorted the speakers into their social classes.
- The "leaping up" of the lower-middle-class speakers in the formal styles is found in other studies, and is claimed to reflect a social insecurity independently diagnosed by other tests.[12]

25. More on knobs

- It is sensible, at least metaphorically, to see the linguistic system as a whole is attached to "knobs" — external factors that cause its output to vary.
- Here are some knobs:
  - style (casual-formal, per Labov reading)
  - speaking rate
  - frequency of words being said

26. The claim of true randomness

- Claim: even when we include the knobs, speakers are essentially stochastic devices — we can predict the distribution of outputs in a large sample, but not the outcome in each speaking occasion.
- Here, we will start with just the stochastic-device idea, and later discuss the rather small amount of theoretical work that has been done with knobs.

27. A case of speakers acting as stochastic devices

- Hayes and Londe (*Phonology* 2009)
- Hungarian stems whose last vowels are [+back], then [eː] go both ways with harmony.
  - Mostly, stem-by-stem
  - A few individual stems are vacillators.

- We wug-tested [haːdeːl] and [koleːn]
  - Options for dative: [haːdeːl-nɔk, haːdeːl-nɛk], [koleːn-nɔk, koleːn-nɛk]
- "In a series of chi-square tests, we found that consultants who gave [haːdeːl-nɔk] were no more likely to give [koleːnnɔk] than consultants who gave [haːdeːl-nɛk]. We obtained similar results for all other pairs where enough data were available for testing."

28. An informal observation

- Speakers who make such a random decision often feel that their choice was correct.
- [Try this yourself on past tense of *spling*]
- Psychologists might call this "self-priming".

[12] For example: series of questions: "how do you say this word? … how should this word be said?", total cases of difference.