

Class 12: Phonologization

To do

- Samoan assignment (on last week's material) is due Friday
- Next reading is Hall 2006 (due Tuesday)
- Project: turn in report this week
- We need to talk about a mini-conference date!

Overview: Though phonetics is an important driver of phonology (through analytic bias, channel bias, or both), the phonetic patterns seem to get smoothed out in the phonology.

1 Beautiful example from Hayes 1999

Many factors affect how much aerodynamics favors voicing vs. voicelessness (see Ohala 1983, Westbury & Keating 1986) (Hayes p. 8)

- place of articulation: fronter closure → bigger oral chamber → more room for the air → airflow across glottis encouraged for longer
- closure duration: as time passes during the closure, more air pressure in oral chamber → airflow across glottis discouraged
- being after a nasal: as we saw last time, nasal leak and velar pumping encourage airflow
- being phrase/utterance-final: subglottal pressure is lower → airflow across glottis discouraged

Hayes constructs the following “difficulty landscape” using an aerodynamic model (Keating 1984): 0 means there's no problem having voicing; bigger numbers mean it's difficult.

(2) Landscape of Difficulty for Voiced Stops: Three Places, Four Environments

	b	d	g	
[-son] ___	43	50	52	
# ___	23	27	35	
[+son, -nas] ___	10	20	30	
[+nas] ___	0	0	0	contour line: 25

(p. 9)

The thing is, there is no language that draws the line at 25. Instead, languages draw vertical or horizontal lines that partly contradict the phonetics:

- *g (as in Dutch): ignores the fact that initial [g] is easier than post-obstruent [d]

This can lead to seeming markedness contradictions in the corners:

- *p (as in Arabic): even in geminates, you get only [bb], not *[pp]
- *VOICEDGEMINATE (as in non-loan Japanese): only [pp], not *[bb]

2 Hayes's proposed solution [assumes analytic bias]

The learner...

- ...compiles a difficulty map like the above
- ...constructs constraints according to certain templates (*[αF], *[αF][βG], *[αF,βG], etc.)
- ..evaluates constraints according to how often they correctly predict that one item in the map is harder than another
 - e.g., *g is correct about g/[-son]__ vs. d/[-son]__, but wrong about g/#__ vs. d/[-son]__
 - collect % of pairs for which prediction is correct
- ...to be accepted, a constraint must do better on the above test than all its “neighbors” that are equally or less complex
 - constraints are neighbors if they differ in just one symbol (whatever counts as a symbol in your theory).
 - e.g., *[coronal, +voice] and *[dorsal, +voice] are neighbors, equally complex
 - *g and *#g are neighbors; *g is less complex than *#g

Result: The learner add complex constraints only if they justify themselves.

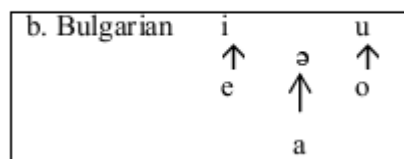
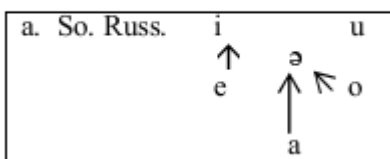
This has echoes of our recent discussion of overfitting: in this model there is a built-in bias against great complexity (which would allow a closer fit to the data).

In the voicing example, Hayes ends up with constraints like *[dorsal, +voice] and *[+nasal][-voice], but nothing more complex.

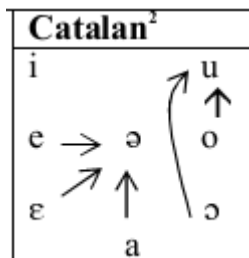
3 Some other cases similar in spirit

- Crosswhite 1999: When stressed syllables have shorter duration, there's less time for jaw opening, so low vowels are disfavored.¹
 - In some languages, result is neutralization with another V category, not just raising
 - Which category a V is neutralized with can be language-specific:

(6) Examples of Prominence-reducing (“Extreme”) Reduction



(Crosswhite 2000a, p. 4)



(Crosswhite 2000b, p. 3)

⇒ Despite shared phonetic motivation, different faithfulness rankings. These patterns aren't just an automatic result of reduced jaw lowering.

¹ That's not the only type of vowel reduction in unstressed syllables; Crosswhite also discusses the contrast-enhancement type.

- Zhang 2000: languages with contour tones (falling, rising, dipping) often restrict where those contours can appear, including
 - long vowels only
 - stressed syllables only
 - final syllables only
 - monosyllables only
- syllables that will “canonically” have longer duration in the sonorous portion of their rime are favored sites for contour tones.

Moreover, Zhang found that language-specific facts about, e.g., how much features of a coda consonant affect duration, affect where the contour tones can occur in that language.

But the “**canonically**” is key: based on some typical speech rate and style, or averaged/normalized over speaking rates and style.

If we had a constraint like simply

*CONTOUR/<200 msec

Then the winning candidate would change according to speech rate. While some contours that are normally acceptable *might* get wiped out in fast speech, extra-slow speech doesn’t (I think) allow additional contrasts.

4 Incomplete neutralization

Famously, phonetically driven “neutralization” isn’t always real neutralization:

- Warner et al. 2004 (and many others): final devoicing, as in Dutch, leaves behind (only partly reliable) durational differences
- Zsiga 1995: the “[ʃ]” in *miss you* different from the one in *fish* or *impression*, both acoustically and articulatorily (electropalatography study)

A glimpse into phonologization in progress?

Ellis & Hardcastle 2002 had speakers say sentences like these:

*It’s hard to believe the **ban** cuts no ice*

*I’ve heard the **bang** comes as a big surprise* (p. 379)

Subjects wore electropalates in their mouths—like a retainer, but electrodes in it record whether they’re being contacted (by the tongue).

- Some tokens of /n k/ had full alveolar contact
- Some had partial alveolar contact
- Some lacked alveolar contact but still showed evidence of a partial alveolar gesture
- Some had no evidence of an alveolar gesture at all

Some speakers always or never lost the alveolar gesture; some varied.

- Let’s discuss what these speakers’ grammars could look like.

To sum up

- Regardless of how phonetic bias works, we need to explain cases in which it’s not direct—what do they tell us about the language apparatus?

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