Class 7: Downward interfaces II, phonologization

To do
☐ Manam assignment due Friday (Feb. 2)
☐ Next reading (study question due Monday) is Hall 2006

Overview: Phonological processes often have a phonetic explanation. But they’re somewhat abstracted from it—how does that happen?

1 First, I think we have time for one leftover
- Last time we talked about natural vs. unnatural phonological processes
  - the controversy being whether natural rules are really preferred by humans
  - …or just more likely to arise diachronically
- So what about real phonology that is unnatural?

Bach & Harms 1972: “crazy rules”
- E.g., Japanese coronals undergo affrication before certain vowels:

  \[
  \begin{align*}
  t\text{ʃ}i & \quad tsu \\
  da & \quad dʒi \\
  s\text{ʃ}i & \quad su \\
  za & \quad zu
  \end{align*}
  \]

  \[
  \begin{align*}
  \alpha_{\text{continuant}} & \quad \alpha_{\text{anterior}} \\
  +\text{sonorant} & \quad +\text{coronal} \\
  -\text{strident} & \quad +\text{del rel} \\
  -\text{high} & \quad +\text{voice}
  \end{align*}
  \]

- Affrication before [u] seems very unnatural.
- B&H propose the following series of events.

  1. Somebody innovates a rule that’s phonetically reasonable:\(^1\)

  \[
  \begin{align*}
  \alpha_{\text{continuant}} & \quad \alpha_{\text{anterior}} \\
  -\text{sonorant} & \quad +\text{coronal} \\
  +\text{strident} & \quad +\text{del rel} \\
  -\text{high} & \quad +\text{voice}
  \end{align*}
  \]

  \[
  \begin{align*}
  +\text{high} & \quad +\text{back}
  \end{align*}
  \]

  \[
  \begin{align*}
  V & \quad \text{syllable inventory}
  \end{align*}
  \]

  ? What does the syllable inventory look like now?

---

\(^1\) I hope this is right—I’m changing what I think was a typo from old notes; I don’t have the chapter handy.
2. The rule gets generalized a little in a way that’s structurally (if not phonetically) reasonable:

\[
-\text{sonorant} \quad \rightarrow \quad \{\begin{array}{c}
+\text{del rel} \\
+\text{strident} \\
\alpha\text{anterior}
\end{array}\} \quad / \quad \{\begin{array}{c}
V \\
+\text{high} \\
\alpha\text{back}
\end{array}\}
\]

What does the syllable inventory look like now?

3. Now a new, also reasonable rule is innovated…

\[
-\text{sonorant} \quad +\text{strident} \quad +\text{voice} \quad +\alpha\text{anterior} 
\rightarrow \quad [+\text{continuant}]
\]

4. …then generalized:

\[
-\text{sonorant} \quad +\text{strident} \quad +\text{voice} \quad +\alpha\text{anterior} 
\rightarrow \quad [+\alpha\text{continuant}]
\]

5. And it all gets collapsed into the one “unholy” rule (p. 15).

- So each step is reasonable, but the result is rather unnatural.

Let’s discuss what constraints we’d need for an OT analysis—some of them might be phonetically unmotivated.

- The dream of a universal constraint set probably can’t be completely fulfilled. We probably need to equip the learner with the ability to learn constraints (see Hayes & Wilson 2006).
2 **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 effort needed to produce voicing
  - bigger numbers mean it’s more difficult

![Diagram of Landscape of Difficulty for Voiced Stops](image)

- 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]*
3 Hayes’s proposed solution [assumes analytic bias]

• The learner...
  1. ...compiles a difficulty map like the above
  2. ...constructs constraints according to certain templates (*[aF], *[aF][βG], *[aF,βG], etc.)
  3. ...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
  4. ...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.
• Hayes ends up with constraints like *+[nasal][–voice] and *[dorsal, +voice], but nothing more complex.

4 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.²
  ▪ In some languages, result is neutralization with another V category, not just raising
  ▪ Which category a V is neutralized with can be language-specific:

(Crosswhite 2000a, p. 4)

(Crosswhite 2000b, p. 3)

² That’s not the only type of vowel reduction in unstressed syllables; Crosswhite also discusses the contrast-enhancement type.
Despite shared phonetic motivation, different faithfulness rankings. These patterns aren’t just an automatic result of reduced jaw lowering

- 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.

❔ What would be some of the (dubious?) predictions of a constraint like this: *CONTOUR/<200 msec

5 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).

(there was also an EMA study)

- Some tokens of /n k/ had full alveolar contact
- Some tokens had partial alveolar contact
- Some tokens lacked alveolar contact but still showed evidence of a partial alveolar gesture
  - as seen by the tongue contact along the sides of the palate
  - Some tokens had no evidence of an alveolar gesture at all
• Some speakers always or never lost the alveolar gesture; some varied
• Even among those speakers who varied, there were different patterns of variation
  ▪ Some speakers showed a smooth continuum from no assimilation to full assimilation
    ▪ looks like gradient gestural overlap
  ▪ Other speakers were bimodal: either no assimilation or full assimilation
    ▪ looks like an optional phonological process

❓ 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?

Next time
• Structure below the segment: features, gestures, autosegmentalism in OT
References


