Case study of phonological typology in practice: final devoicing (e.g. Polish <snob> [snop]) and the Too Many Solutions problem (why not deletion? why not final voicing?).

- what exactly is final devoicing and where does it occur
- why does it happen
- how might it be repaired
- how is it repaired cross-linguistically?
- why only in this particular way(s)?...
- larger implications for typology and theory
What is “final devoicing” (FD)?

- **normal answer:** consonants devoice in word-final position
- **fancier answer:** neutralization of laryngeal contrast in Coda obstruents, typically (but not always) in favor of voiceless unaspirated unglottalized allophone
- **example:** Turkish...
What is FD: Turkish

- phonemic voicing contrast in stops in Onset
  - word-initial \( \text{b} \) as ‘bass’ : \( \text{p} \) as ‘rust’
  - intervocalic \( \text{a} \)da ‘island’ : \( \text{a} \)ta ‘father’

- contrast neutralized in Coda
  - word-final \( \text{krep} \) ‘pancake’ : \( \text{krep} \)-\( \text{e} \) ‘pancake-DAT’
    \( \text{akrep} \) ‘scorpion’ : \( \text{akreb} \)-\( \text{e} \) ‘scorpion-DAT’
  - pre-consonantal \( \text{krep} \)-\( \text{ler} \) ‘pancakes’, \( \text{akrep} \)-\( \text{ler} \) ‘scorpions’

- Turkish FD is phonological rather than phonetic:
  - encoded in the orthography
  - feeds voicing assimilation
    - \( \text{akrep-} \)\( \text{te} \) ‘scorpion-LOC’ : \( \text{kekre-} \)\( \text{de} \) ‘astringent-LOC’

in native words; cf. Fr. etude ⇨ Tk. etüd [\( \text{et}^{h}\text{yd} \)], not *\([\text{et}^{h}\text{yt}] \)
Distribution of FD

- “soft universal”—‘configuration of data found in many languages’ (Kenstowicz 1994:495)
  - AAVE, Catalan, Czech, Dutch, German, Maltese, Occitan, Ojibwa, Polish, Russian, Sanskrit, Tok Pisin, Turkish, Wolof, etc.
  - SLA (Eckman 1981 etc.)
  - disordered speech (Hodson and Paden 1981, Archambault and Bergeron 1990)
  - drunken speech (Lester and Skousen 1974, Tanford et al. 1990)
- surveys: Mascaro 1987, Lombardi 1991
Why does FD happen?

- **perception**
  - paucity of key release cues in Coda (e.g. VOT) [but see Blevins 2004:103ff for problems]

- **production**
  - difficulty maintaining Bernoulli Effect necessary for voicing when vocal tract is significantly occluded (Vaux 1996, Ohala 2005)
  - domain-final lengthening can inhibit voicing (Blevins 2004:104ff)

- Put in Optimality-Theoretic terms, the configuration “voiced obstruent in Coda” is marked: *D_{\text{coda}}.*
Interesting manifestations in SLA

- asymmetry in ease of acquisition
  - English L1 speakers acquire FD system such as German more easily than vice versa
  - Markedness Differential Hypothesis (Eckman 1977): areas of the L2 that are different from the L1 will be difficult to acquire if they are also more marked than the L1. Aspects of the L2 that are different but less marked will not be difficult to acquire.

- interlanguage emergence of FD in cases where neither L1 nor L2 has FD (Eckman 1981a,b (Cantonese, Spanish), 1984 (Farsi); Altenberg and Vago 1983 (Hungarian); Cebrian 2000 (Catalan, Italian))

Key for our purposes: FD appears to be unmarked cross-linguistically.
### How might *D<sub>coda</sub> be repaired?

<table>
<thead>
<tr>
<th>repair</th>
<th>example for <code>/ad/</code></th>
</tr>
</thead>
<tbody>
<tr>
<td>epenthesis (V)</td>
<td>[adə]</td>
</tr>
<tr>
<td>epenthesis (C)</td>
<td>[adn]</td>
</tr>
<tr>
<td>deletion (C)</td>
<td>[a]</td>
</tr>
<tr>
<td>feature change ([son])</td>
<td>[ar]</td>
</tr>
<tr>
<td>feature change ([voi])</td>
<td>[at]</td>
</tr>
<tr>
<td>feature change ([nasal])</td>
<td>[an]</td>
</tr>
<tr>
<td>feature change ([cons])</td>
<td>[ai]</td>
</tr>
<tr>
<td>fusion</td>
<td>[ä]</td>
</tr>
<tr>
<td>metathesis</td>
<td>[da]</td>
</tr>
<tr>
<td>resyllabification</td>
<td>[a.dØ]</td>
</tr>
<tr>
<td>ineffability</td>
<td>[Ø]</td>
</tr>
<tr>
<td>etc.</td>
<td></td>
</tr>
</tbody>
</table>
How is $*D_{\text{coda}}$ be repaired?

Too many solutions?

- “The Too-Many-Solutions conundrum arises when the system of constraints and rankings predicts too many resolutions of a given phonotactic problem. ... [I]f the rule of final devoicing aims to eliminate final voiced obstruents, why aren’t there rules of final voiced obstruent nasalization, deletion, metathesis or post-voiced obstruent epenthesis? ... [T]he fact [is] that devoicing is the only available cure to violations of $[*D_{\text{coda}}]$.” (Steriade 2001:4)

Steriade, Donca. 2001. The Phonology of Perceptibility Effects: the P-map and its consequences for constraint organization. Ms., MIT.
Why is $\text{*D}_{\text{coda}}$ only repaired with FD?

- Steriade 2001: grammars designed to pick perceptually closest repair
- Problem: paragoge (word-final epenthesis) was found to produce a closer perceptual match than devoicing in one study of English listeners (Kawahara and Garvey 2010).

Why is $\text{D}_{\text{coda}}$ only repaired with FD?

- Lombardi 2001
  - assume laryngeal features are privative
    - e.g. [voice] vs. $\emptyset$, not $[\pm \text{voice}]$
  - assume that UG contains these constraints:
    - $\text{LAR}$: Don’t have Laryngeal features
    - $\text{IDENTONSET(LARYNGEAL)}$ ($\text{IDONSLAR}$): Onsets should be faithful to underlying laryngeal specification
    - $\text{MAXLAR}$: Every Laryngeal autosegment in the input has a correspondent in the output
    - $\text{MAX}$: Don’t delete segments
    - $\text{DEP}$: Don’t insert segments
  - “factorial typology”: assume that the set of permutations of these constraints is the set of possible grammars wrt FD:
Lombardi’s factorial typology

- **FD languages (German):** \(\text{IDO} \text{NS} \text{LAR} >> *\text{LAR} >> \text{MAX} \text{LAR}\)
- **voice-unrestricted languages (English):** \(\text{IDO} \text{NS} \text{LAR}, \text{MAX} \text{LAR} >> *\text{LAR}\)
- **voiceless-only languages (Hawaiian):** \(*\text{LAR} >> \text{IDO} \text{NS} \text{LAR}, \text{MAX} \text{LAR}\)

<table>
<thead>
<tr>
<th>/ad/</th>
<th>IDOnsLar</th>
<th>*Lar</th>
<th>MaxLar</th>
<th>Max</th>
<th>Dep</th>
</tr>
</thead>
<tbody>
<tr>
<td>[ad]</td>
<td>*</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>[at]</td>
<td>*</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>[adə]</td>
<td>*</td>
<td></td>
<td></td>
<td></td>
<td>*</td>
</tr>
<tr>
<td>[a]</td>
<td>*</td>
<td></td>
<td></td>
<td></td>
<td>*</td>
</tr>
</tbody>
</table>

**key:** no ranking of Max or Dep can produce epenthesis or deletion in response to \(*D\text{coda}\) because of harmonic bounding (e.g. adə has a superset of the violations of ad, so can never beat it)
Problems for Lombardi

- her FD ranking (IDOnsLar >> *Lar >> MaxLar) doesn’t actually work for prevocalic voiced obstruents:
  - IDENTOnset(LARYNGEAL) (IDOnsLar): Onsets should be faithful to underlying laryngeal specification

<table>
<thead>
<tr>
<th>/da/</th>
<th>IDOnsLar</th>
<th>*Lar</th>
<th>MaxLar</th>
<th>Max</th>
<th>Dep</th>
</tr>
</thead>
<tbody>
<tr>
<td>[da]</td>
<td></td>
<td>*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>[ta]</td>
<td></td>
<td>*</td>
<td>*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>[əda]</td>
<td></td>
<td>*</td>
<td></td>
<td>*</td>
<td></td>
</tr>
<tr>
<td>[a]</td>
<td></td>
<td>*</td>
<td>*</td>
<td>*</td>
<td></td>
</tr>
</tbody>
</table>
A selection of other problems for Lombardi’s analysis

- many languages (e.g. German, Turkish) produce voiceless ASPIRATES in the neutralizing position
- doesn’t get Polish voicing contrast before word-final sonorants + neutralization word-finally (Strycharczuk 2007)
  - kadr ‘frame’ : wiatr ‘wind’; izb [isp] ‘chamber’
- can’t get word-initial neutralization, like in Lac Simon
  - panan ‘banana’, etc.
- can’t get word-final voicing in Middle Persian
## Final voicing in Middle Persian

<table>
<thead>
<tr>
<th>Proto-Iranian</th>
<th>Pahlavi</th>
<th>gloss</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>p-</em></td>
<td>*pitar-</td>
<td>pidar</td>
</tr>
<tr>
<td><em>t-</em></td>
<td>*tū?</td>
<td>tō</td>
</tr>
<tr>
<td><em>k-</em></td>
<td>*kapauta-ka-</td>
<td>kabōd</td>
</tr>
<tr>
<td>*-p(V)</td>
<td>*āpa-</td>
<td>āb</td>
</tr>
<tr>
<td>*-t(V)</td>
<td>*āzāta-</td>
<td>āzād</td>
</tr>
<tr>
<td>*-k(V)</td>
<td>*parikā-</td>
<td>parīg</td>
</tr>
</tbody>
</table>

- presumably the MP system developed from an intermediate stage with postvocalic voicing...
- but the MP system (in which final voicing is synchronically active) remains underivable in Lombardi’s scheme.

Problem for all Too Many Solutions theories: attested repairs for $D_{\text{coda}}$

<table>
<thead>
<tr>
<th>repair</th>
<th>languages</th>
</tr>
</thead>
<tbody>
<tr>
<td>epenthesis (C)</td>
<td>Lancashire dialects (Jones 2001)</td>
</tr>
<tr>
<td>deletion (C)</td>
<td>Chinese (Anderson 1983, Xu 2004, Pennington &amp;Yu), Romance L2 Eng (Flege &amp; Davidian 1984), Kluge’s Law (Flynn 2007)</td>
</tr>
<tr>
<td>nasalization</td>
<td>Northern Batak, Berawan (Blust 2005:248), various (Flynn 2007)</td>
</tr>
<tr>
<td>metathesis</td>
<td>Old Spanish (Flynn 2007)</td>
</tr>
<tr>
<td>resyllabification</td>
<td>Irish, German (Flynn 2007)</td>
</tr>
<tr>
<td>blocking</td>
<td>wGmc apocope (van O), Konni, Maccan Arabic (Kiparsky 2004)</td>
</tr>
</tbody>
</table>

we’ll look at just a few of these cases here…
# Nasalization: Karo Batak

<table>
<thead>
<tr>
<th>Proto-Batak</th>
<th>Karo Batak</th>
<th>Gloss</th>
</tr>
</thead>
<tbody>
<tr>
<td>*abab</td>
<td>abam</td>
<td>fine burning ashes</td>
</tr>
<tr>
<td>*saŋkeb</td>
<td>saŋkem</td>
<td>lid of a clay or copper cooking pot</td>
</tr>
<tr>
<td>*alud</td>
<td>alun</td>
<td>to massage</td>
</tr>
<tr>
<td>*sahud</td>
<td>sahun</td>
<td>to take place</td>
</tr>
<tr>
<td>*sered</td>
<td>seren</td>
<td>stinger of an insect</td>
</tr>
<tr>
<td>*deleg</td>
<td>deleŋ</td>
<td>mountain</td>
</tr>
<tr>
<td>*talag</td>
<td>talanŋ</td>
<td>to be open</td>
</tr>
</tbody>
</table>

Epenthesis: Buggenhout Dutch

- forms ending in underlying voiceless stop surface unchanged
  - een schaap [ənsxɔːp]
- forms ending in underlying voiced stop insert final ə
  - ‘n bed [əmberə] ‘a bed’
  - ‘n rib [əmrebə] ‘a rib’

Blocking: West Germanic apocope

- Itô and Mester 2003 on West Germanic schwa apocope
  - süsse ‘sweet’ > süs, etc.
  - stems ending in a voiced obstruent resisted this longer than stems ending in other segments; German for example still has leise ‘quiet’, böse ‘angry’, träge ‘slow’.
Lombardi’s response

- “there is a strong effect of experimental task (Eckman 1981, Weinberger 1987, 1994, Edge 1991): epenthesis is found with elicitation by reading of word lists, whereas in spontaneous speech there tends to be deletion of all syllable-final consonants and/or final devoicing of voiced obstruents.”

- Problems
  - epenthesis also occurs in natural speech in e.g. Chinese English
  - Lombardi still can’t generate the deletion option or the Buggenhout case
primary use of typology in theoretical linguistics: restricting generative power of one’s model
this has pros (falsifiability, progress…) and cons (presumptuously shallow typologies ⇒ faulty theories of UG)
important to survey the field (and languages) responsibly, and to think about learnability issues.
References

- Kiparsky 2004
- Lombardi 1991 survey
- Mascaro 1987 survey
subtleties of FD not addressed here

- word-final vs. coda
- devoicing vs. licensing/assimilation
- [voice] vs. Laryngeal node (voice, aspiration, glottalization...)
- product of neutralization (unaspirated in Sanskrit vs. aspirated in Turkish, etc.)
- consonant vs. obstruent (Russian) vs. stop (Turkish)
- categorical/phonological vs. gradient/phonetic
- lenition/voice vs fortition/asp (Nicolae and Nevins)