Weeks 5-6 – Optimality Theory
Opacity

March 8, 2011

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1 The Derivational Residue

(1) Classical derivational phonology treated alternation as the fundamental problem of phonology, and leaves the problem of well-formedness to the background.

(2) OT treats well-formedness as the fundamental problem of phonology, and leaves the problem of alternation to the background.

(3) Does this perhaps leave behind a “derivational residue” of cases that don’t smoothly emerge from the rankings of markedness and faithfulness?
1.1 Residue

(4) Following Bruce Hayes, I think there are basically three.

a. Extravagant repair (counterbleeding)

/rowtʃ/ → [rərʃ], where [rərʃ] would avoid *at[-voice]

b. Counterfeeding chains

/n#/ → [♯], but /nt#/ → [n#] in Catalan

c. Saltation

/p/ → [β], where [b] would be fine.

1.2 Transparent Rule orderings in OT

1.2.1 Rule A “feeds” Rule B

(5) That is, Rule A applies first and creates the environment that allows Rule B to apply.

(6) Example: Catalan

A: Deletion

[−cont] → ∅ / [+nas] [σ] [σ] bin pans

B: Place assimilation

[+nas] → [a place] / [+cons a place] bim pans

★ If B had applied first, what would have happened?

(7) Feeding is easy in OT. If the markedness constraints driving the two changes are both high-ranked, then they both have to be satisfied, so both changes apply:

<table>
<thead>
<tr>
<th>bad because of nt</th>
<th>σ</th>
<th>/bint pans/</th>
<th>*[+nas][-cont] ]σ [σ *</th>
<th>[+nas a place]</th>
<th>[+cons −a place]</th>
<th>MAX-</th>
<th>IDENT</th>
<th>PLACE</th>
</tr>
</thead>
<tbody>
<tr>
<td>deleting [t] causes a new problem, [np]</td>
<td>bin pans</td>
<td>bint pans</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>both changes apply, fixing both problems</td>
<td>bim pans</td>
<td>bim pans</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
1.2.2 Rule A “bleeds” Rule B

(8) That is, Rule A applies first and takes away the environment that would have allowed Rule B to apply.

\[
\begin{array}{c|c|c|c}
\text{rule A: epenthesis} & \emptyset \rightarrow I / [+\text{sibilant}] & \text{[+sibilant]}# & /\text{bræntʃ+z/} \\
\text{rule B: voice assimilation} & [+\text{son}] \rightarrow [\text{a voice}] / [-\text{son} & \text{a voice}] & -
\end{array}
\]

★ If B had applied first, what would have happened?

(9) Bleeding is also easy in OT. If we can satisfy both markedness constraints by making just one change, then there’s no need to make 2 changes:

<table>
<thead>
<tr>
<th></th>
<th>/bræntʃ+z/</th>
<th>*+[sib][+sib]#</th>
<th>*-son a voice</th>
<th>-son -a voice</th>
<th>Dep- V</th>
<th>Ident (voice)</th>
</tr>
</thead>
<tbody>
<tr>
<td>doubly bad because of ʃz</td>
<td>bræntʃz</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>devoicing solves only one problem</td>
<td>bræntʃs</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>epenthesis solves both problems</td>
<td>bræntʃz</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>gratuitous voicing change</td>
<td>bræntʃs</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1.3 Counterbleeding

(10) Rule A fails to bleed Rule B because B applies first (“A counterbleeds B”)

(11) Malagasy

\[
\begin{array}{c|c|c|c|c}
\text{rule A: epenthesis} & \emptyset \rightarrow a / C & \text{[C]}# & /\text{batah/} \\
\text{rule B: final C neutralization} & h \rightarrow k / & \text{[k]}# & batak \\
\end{array}
\]

★ If A had applied first, what would have happened?
(12) Catalan

<table>
<thead>
<tr>
<th>B: Place assimilation</th>
<th>+[nas] → [a place]</th>
<th>——</th>
<th>+cons [a place]</th>
<th>/bEnk/ ‘I sell’</th>
</tr>
</thead>
<tbody>
<tr>
<td>A: Deletion</td>
<td>—[cont] → ∅</td>
<td>——</td>
<td>+nas []σ</td>
<td>bηγ</td>
</tr>
</tbody>
</table>

★ If A had applied first, what would have happened?

(13) Counterbleeding is hard to do in OT—we get the wrong winner, because if one change (deletion) can solve both problems, the other change (assimilation) has no reason to apply:

<table>
<thead>
<tr>
<th>/bEnk/</th>
<th>*+[nas][-cont] []σ</th>
<th>*</th>
<th>+[nas] a place</th>
<th>+[cons] a place</th>
<th>Max-C</th>
<th>IDENT (PLACE)</th>
</tr>
</thead>
<tbody>
<tr>
<td>doubly bad b/c of nk]σ</td>
<td>bɛŋk</td>
<td>*(!)</td>
<td>——</td>
<td>*(!)</td>
<td>——</td>
<td></td>
</tr>
<tr>
<td>assimilation fixes only one problem</td>
<td>bɛŋk</td>
<td>*!</td>
<td>——</td>
<td>——</td>
<td>——</td>
<td>*</td>
</tr>
<tr>
<td>deletion fixes both problems</td>
<td>♠ bɛŋ</td>
<td>*</td>
<td>——</td>
<td>——</td>
<td>——</td>
<td></td>
</tr>
<tr>
<td>apparently gratuitous [place] change</td>
<td>♠ bɛŋ</td>
<td>*</td>
<td>——</td>
<td>——</td>
<td>*!</td>
<td></td>
</tr>
</tbody>
</table>

(14) Hence counterbleeding is a process which appears to have a extravagant repair.

1.4 Counterfeeding

(15) Rule A fails to feed Rule B because B applies first. (In that case, we can say “A counterfeeds B”.)

(16) Catalan has alternations like:
   a. [kɔtəlan-ə] [kɔtəla] ‘Catalan, f., m.’
   b. [bint-e] ‘20th’ [bin] ‘20’
   c. There appears to be word-final [n] and [t] deletion.

★ What must the ordering of [n] and [t] deletion be in Catalan?
(17) Here’s a classic one: Bedouin Arabic
a. [a] normally raises to [i] in open syllables: /katab/ → [ki.tab]
b. But...

| B: Raising in open syllables | a → i / i σ | /gabr/ |
| A: Epenthesis in complex codas | [Ø → u / C C σ] | gabur |

★ If A had applied first, what would have happened?

★ To get /katab/ → [ki.tab], what’s the ranking of *a]σ vs. IDENT(hi), IDENT(lo)?

<table>
<thead>
<tr>
<th>/katab/</th>
<th>*a]σ</th>
<th>*COMPLEX CODA</th>
<th>DEP-V</th>
<th>IDENT (hi)</th>
<th>IDENT (lo)</th>
</tr>
</thead>
<tbody>
<tr>
<td>❌ ka.tab</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ki.tab</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(18) Counterfeeding is also hard to do in OT. If making one change (epenthesis) creates a problem (a]σ) that is normally not tolerated, that problem should get solved by making another change (raising):

<table>
<thead>
<tr>
<th>/gabr/</th>
<th>*a]σ</th>
<th>*COMPLEX CODA</th>
<th>DEP-V</th>
<th>IDENT (hi)</th>
<th>IDENT (lo)</th>
</tr>
</thead>
<tbody>
<tr>
<td>bad b/c of brσ</td>
<td>gabr</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>epenthesis fixes one problem but creates a new one</td>
<td>♠ ga.bur</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>raising fixes the new problem</td>
<td>❌ gi.bur</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

★ Why can’t we just rank *a]σ lower?

(19) Patterns like these, where a → b and b → c, but a / c, are often called counterfeeding chains.
1.5 Saltatory alternations

(20) The intuition here is that a saltatory alternation is one kind of “over-fixing” of a phonotactic problem—the repair is less faithful than it need be to solve the problem.
   a. In this way it is like the ‘extravagant repair’ in counterbleeding cases.
   b. It is different because there are not necessarily two interacting processes.

(21) A Saltatory Alternation is an alternation that leaps across a phonologically legal point on a gradually divergent phonetic path to another phonologically legal point.

(22) Examples of gradually divergent phonetic paths:
   (g, k, x) (changes [voice], then [continuant])
   (g, y, x) (changes [continuant], then [voice])

(23) As far as I know, Bruce Hayes is the only person who uses the term “saltation”, but the alternative is much less explicit.\(^1\)

(24) An example of a saltatory alternation: Campidanian Sardinian

(25) Intervocalic lenition of voiceless stops /p, t, k/ and the voiceless affricate /\(\tilde{t}\)/ (underlying forms justified by appearance in isolation):

\[
\begin{align*}
/bɛːlu\ pɛːzi/ &\quad \rightarrow \ [bɛːlu\ βɛːzi] \quad ‘nice fish’ \\
/su\ trɛntaduzu/ &\quad \rightarrow \ [su\ ðrɛntaduzu] \quad ‘the thirty-two’ \\
/de\ kuat\-ru/ &\quad \rightarrow \ [de\ yuat\-ru] \quad ‘of four...’ \\
/su\ \tilde{t}ɛl\-u/ &\quad \rightarrow \ [su\ ʒɛlu] \quad ‘the heaven’
\end{align*}
\]

(26) Preservation of underlying intervocalic /b, d, g/: 

\[
\begin{align*}
/sa\ bia/ &\quad \rightarrow \ [sə\ bia] \quad ‘the road’ \\
/su\ gat\-u/ &\quad \rightarrow \ [su\ ɡat\-u] \quad ‘the cat’ \\
/donja\ domini\-y\-u/ &\quad \rightarrow \ [dɔnja\ domini\-y\-u] \quad ‘every Sunday’
\end{align*}
\]

These are optionally deleted, but only in certain words; we’ll return to this point later.

(27) Bolognesi, p. 36, “Speakers not only do not spirantize voiced stops, but judge this ... as entirely ungrammatical, instead. For them a phrase such as, for example, səa \(\beta\)otta could only be the output of underlying səa \(\beta\)orta (‘the door’), and never of səa borta (‘the time’). They claim the second interpretation to be wrong.”

(28) The Campidanian saltatory alternation is productive:

\(^1\)OED “saltate”: to leap, to jump, to skip
Other examples of salutation

a. /g/ → [x] finally, but final /k/ remains [k]. (Colloquial Northern German; Ito and Mester 1999)²

b. L tone in Suma become H in a context where M remains (Bradshaw 1999)³

c. Standard German: final stressless /ɪɡ/ vaults over /ɪk/ to land at [ɪx].⁴
   (i) kräftig [kʁeftɪʊ] ‘strong’ kräftige [kʁeftɪɡə] ‘strong-fem./pl/etc.’
   (ii) zierlich [ʦɪɛrlɪx] ‘elegant’ [ʦɪɛrlɪɡə] ‘elegant-fem./pl/etc.’
   (iii) [plastɪk] ‘plastic’

Saltations were not thought of as a problem in the rule era, since rules can easily express salutation.

★ Express the saltatory rule for Campidanian.

They are an outstanding problem for OT, which posits minimal repair of all phonotactic violations.

★ Work out a grammar in which /apa/ surfaces as [aβa]. (What features change?) Submit /aba/ to this grammar.

2 Trimming away claimed instances of opacity

How are sure are we have an opaque interaction between processes?

2.1 Near-neutralization

If what Polish has is not


/b,d,g/ → [p,t,k] /word
but

/b,d,g/ → [b,d,g] /word
then [b,d,g] can be included in the triggers for Raising, and the process is not opaque.

On this possibility, see


As far as I know, most claimed phonological neutralizations have not been checked to see if they are really near-neutralizations.

2.2 Lack of productivity

The Polish example has been empirically attacked by Nathan Sanders\(^5\) as suffering from exceptions and lack of productivity.

His two speakers do not extend the alternation in a “generative” (as opposed to “choice”) Wug-test.

A further hint: “I am only concerned here with the [o]∼[u] alternation in masculine nominative nouns. The same alternation exists in the feminine and neuter genitive, in which the plural is opaque. I have been informed that the genitive alternation is fully productive (Anna Lubowicz and Jerzy Rubach, p.c.), though I have not yet verified this claim through experimentation.”

General point: if we are developing a theory of the internalized grammar of the speaker, and not of the patterns in a dictionary, we may want to check on the productivity of opacity cases before analyzing the speaker that way.

2.3 Moral: Diagnose opacity carefully

Perhaps it is a subset of the counterfeeding (repair related to derivational source) and counterbleeding (extravagant repair) cases that are problematic for OT.

Purifying the inventory of examples: e.g. remove

a. Cases where an independently needed constraint makes the winner transparent (OO correspondence)

b. Cases where non-neutralization (i.e. near-neutralization) implies that the output is not opaque.

c. Cases where the phonology involved is not productive.

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\(^5\)“Preserving synchronic parallelism: Diachrony and opacity in Polish”, Chicago Linguistic Society 37
3 Strategies to address the derivational residue in OT

3.1 Overview

(42) There are many approaches that have been tried in OT.
  • Sympathy (John McCarthy)
  • Comparative markedness (John McCarthy)
  • Candidate chains (John McCarthy)
  • Harmonic Serialism (John McCarthy)
  • Targeted constraints (Colin Wilson)
  • Constraint conjunction (Paul Smolensky, Robert Kirchner, Ania Lubowicz, and others)
  • Output-output correspondence (Katherine Crosswhite, Laura Benua, and others)
  • Two level constraints/turbid representations (Paul Smolensky, Matt Goldrick, Orhan Orgun, Diana Archangeli, Keiichiro Suzuki, and others)
  • Allomorph listing (Nathan Sanders)

(43) Clearly this is not settled! (Note also some of these only address some of the derivational residue, not all of it.)

(44) These approaches tend to fall into two classes:
  a. enriching faithfulness
  b. introducing derivations into OT

(45) I am going to try to review what I consider to be major approaches, in particular:
  • Constraint conjunction
  • Output-to-Output Correspondence
  • Stratal OT
  • Harmonic Serialism