

## Class 11: Process interaction II

### To do

- Tomorrow: Hakha Lai assignment is due (after that, you have a week off from problem sets)
- Tuesday: Primary-vs-secondary source report due
- Tuesday: K&K ch. 10, Kiparsky reading questions due

**Overview:** We'll look more carefully at the types of process interaction that (might) exist, and which theories can handle them.

### 1. Where we were last time

- Koutsoudas, Sanders, & Noll 1974: Simultaneous repeated application  
Plus “proper inclusion precedence”:

“For any representation R, which meets the structural descriptions of each of two rules A and B, A takes applicational precedence over B with respect to R if and only if the structural description of A properly includes the structural description of B.” (p. 9)

### 2. What this theory predicts in general

- Feeding (rather than counterfeeding) and counterbleeding (rather than bleeding)
- So what about real cases of bleeding?

- Schaffhausen dialect of Swiss German:

|   |        |        |           |           |
|---|--------|--------|-----------|-----------|
|   | /bogə/ | /bodə/ | /bogə+PL/ | /bodə+PL/ |
| 1. V → [-back] / <i>complicated ‘umlaut’ context, including plurals</i> | ----   | ----   | bøgə      | bødə      |

|   |      |      |      |      |
|---|------|------|------|------|
| 2. o → ɔ / $\left[ \begin{array}{l} +\text{cons} \\ +\text{cor} \\ -\text{lat} \end{array} \right]^1$ | ---- | bødə | ---- | ---- |
|---|------|------|------|------|

- Why is this ordering crucial?
- What happens if we use the Koutsoudas & al. approach?
- K & al. propose that in all apparent cases of bleeding (and counterfeeding?), the rules need to be revised. In this case, they propose a context-free rule  $\text{æ} \rightarrow \text{ø}$  (remember Myers’s persistent rules, which apply everywhere in the derivation that they can).
- Apply this solution to /bodə+PL/.
- What additional fact needs to be true in Schaffhausen for this to work?

<sup>1</sup> In the original it’s not [+cor] but [-grave]. *Grave* is an acoustic feature (roughly, lower frequencies are stronger for [+grave] segments), not much used these days. Labials and velars are [+grave]; dentals and alveolars are [-grave] (a.k.a. *acute*).

### 3. Another intrinsic ordering idea: the Elsewhere Condition (Anderson 1969, Kiparsky 1973...)

- Recall once more disjunctive ordering of the rules that a schema expands into:

$$V \rightarrow [+stress] / \_ C_0(VC_0)\# \Rightarrow \begin{array}{l} V \rightarrow [+stress] / \_ C_0VC_0\# \\ \text{else } V \rightarrow [+stress] / \_ C_0\# \end{array}$$

- Kiparsky argues that disjunctive ordering doesn't really have anything to do with expansion conventions. He proposes that what really drives disjunctive ordering is...

- Elsewhere Condition (revised in later Kiparsky works)*

(p. 94) "Two adjacent [in the ordering] rules of the form

$$A \rightarrow B / P \_ Q$$

$$C \rightarrow D / R \_ S$$

are disjunctively ordered if and only if:

(a) the set of strings that fit [are nondistinct from]  $PAQ$  is a subset of the set of strings that fit  $RCS$ , and

(b) the structural changes of the two rules are either identical or incompatible"

- We also need to define 'incompatible'—probably it means that the results of applying the two rules are *distinct*, in our technical sense.

- What does the Elsewhere Condition say about the pair of stress rules above?
- How does the Elsewhere Condition compare to proper inclusion precedence? Are there cases where the two conditions apply differently? (Let's try Spanish and English from last time)

### 4. Anderson 1974 ch. 10: natural order

- Example from Icelandic (Indo-European language from Iceland with 250,000 speakers)

- *syncope, roughly*: certain unstressed  $Vs \rightarrow \emptyset / C \_ \{l,r,n,\delta,s\}+V$
- *u-umlaut*:  $a \rightarrow \ddot{o} / \_ C_0 u$  (where "u" usu. = [ʏ], "ö" = [œ])

|        |                       |         |                       |
|--------|-----------------------|---------|-----------------------|
| barn   | 'child'               | börn+um | 'child-dat.pl.'       |
| svangt | 'hungry-neut.nom.sg.' | svöng+u | 'hungry-neut.dat.sg.' |
| kalla  | '[I] call'            | köll+um | '[we] call'           |

(*lax, unstressed vowels delete*  $\_V$ )

|         |             |         |                     |
|---------|-------------|---------|---------------------|
| hamar   | 'hammer'    | hamr+i  | 'hammer-dat.sg.'    |
| fífill  | 'dandelion' | fífl+i  | 'dandelion-dat.sg.' |
| morgunn | 'morning'   | morgn+i | 'morning-dat.sg.'   |

(*ll, nn* stand for long *ls* and *n*; syncope is meant to be applicable)

- If syncope precedes umlaut, what kind of process interaction results for the UR /katil+um/ ‘kettle-dat.pl’? For /jak+ul+e/ ‘glacier-dat.sg.’?
- What about umlaut before syncope for /katil+um/? /jak+ul+e/ (see data below)?

➔ Whether a rule ordering is feeding, bleeding, etc. depends on the particular forms involved

|         |              |                |                      |                         |
|---------|--------------|----------------|----------------------|-------------------------|
|         | <i>+r/∅</i>  |                | <i>+um</i>           |                         |
| /katil/ | ketil+l      | ‘kettle’       | kötl+um              | ‘kettle-dat.pl’         |
| /ragin/ | regin        | ‘gods’         | rögn+um              | ‘gods-dat.pl’           |
| /alen/  | alin         | ‘ell of cloth’ | öln+um               | ‘ell of cloth-dat.pl’   |
|         | <i>+ul+r</i> |                | <i>+ul+e, +ul+an</i> |                         |
| /bagg/  | bögg+ul+l    | ‘parcel’       | bögg+l+i             | ‘parcel-dat.sg.’        |
| /jak/   | jök+ul+l     | ‘glacier’      | jök+l+i              | ‘glacier-dat.sg.’       |
| /pag/   | þög+ul+l     | ‘taciturn’     | þög+l+an             | ‘taciturn-masc.acc.sg.’ |

- If the rules are right, we have an ordering paradox!
- Here’s how Anderson resolves it:
  - Some pairs of rules are left unordered by a language’s grammar and so apply in their **natural order** in each case.
  - Other rules are ordered, but only pairwise (so ordering is not transitive, for instance).

“where only one of the two possible orders for a given pair of rules is feeding, the feeding order is the natural one; and that where only one of the two possible orders is bleeding, the other order [i.e. counterbleeding] is the natural one. In all other cases [...] no natural order is (yet) defined.” (p. 147)

- Is this different from the Koutsoudas & al. proposal? (Let’s apply their theory to the crucial forms.)
- If a grammar consists of a list of rules and some statements about their orderings, what does a diachronic change from, say, counterfeeding to feeding involve? (Notice the extension of the evaluation metric to rule orderings, and not just the rules themselves.)
- See Kiparsky 1984 for a totally different analysis of Icelandic in Lexical Phonology.

Now let's examine the process-interaction typology in more detail

### 5. The classic interaction typology, for reference

| <i>interaction</i>  | <i>definition</i>                                 | <i>schematic derivation</i>   | <i>result</i>  |
|---------------------|---|---|--|
| R1 feeds R2         | R1 creates environment for R2 to apply to         | $d \rightarrow \emptyset / \_ \#$<br>$n \rightarrow \emptyset / \_ \#$  | /bind/<br>bin<br>bi<br>[bi]<br>transparent:<br>• no [d#] on the surface<br>• no [n#] on the surface                                |
| R1 counterfeeds R2  | R1 applies too late to create environment for R2  | $n \rightarrow \emptyset / \_ \#$<br>$d \rightarrow \emptyset / \_ \#$  | /bind/<br>--<br>bin<br>[bin]<br>opacity— <i>underapplication</i> :<br>• [n#] on surface, despite rule targeting <i>n#</i>          |
| R1 bleeds R2        | R1 destroys environment for R2 to apply to        | $d \rightarrow \emptyset / \_ \#$<br>$\emptyset \rightarrow i / C\_C\#$ | /bind/<br>bin<br>--<br>[bin]<br>transparent:<br>• no [d#] on the surface<br>• no [i] inserted, because no surrounding <i>C\_C#</i> |
| R1 counterbleeds R2 | R1 applies too late to destroy environment for R2 | $\emptyset \rightarrow i / C\_C\#$<br>$d \rightarrow \emptyset / \_ \#$ | /bind/<br>binid<br>bini<br>[bini]<br>opacity— <i>overapplication</i> :<br>• [i] inserted, despite lack of surrounding <i>C\_C#</i> |

- A rule *underapplies* if there are surface instances of its structural description.
  - A rule *overapplies* if there are instances in which it has applied, although the non-affected part of the structural description (the environment) is no longer present.
- (The terms *underapplication* and *overapplication* come from Wilbur's (1973) discussion of reduplication. McCarthy 1999 adapts them for discussing opacity.)

### 6. Baković 2007, Baković 2011: dissociating opacity-vs-transparency from interaction type

Baković argues that the typology is **not**...

|                  | transparency | underapplication opacity | overapplication opacity |
|------------------|--------------|--------------------------|-------------------------|
| feeding          | ✓            |                          |                         |
| bleeding         | ✓            |                          |                         |
| counter-feeding  |              | ✓                        |                         |
| counter-bleeding |              |                          | ✓                       |
| non-interaction  | ✓            |                          |                         |

...but rather (at least)...

|                  | transparency | underapplication opacity | overapplication opacity |
|------------------|--------------|--------------------------|-------------------------|
| feeding          | ✓            | ✓                        | ✓                       |
| bleeding         | ✓            |                          |                         |
| counter-feeding  | ✓            | ✓                        |                         |
| counter-bleeding | ✓            |                          | ✓                       |
| other            | ✓            | ✓                        |                         |

...so process-interaction types actually don't account for opacity vs. transparency.

**Let's go through Baković's typology:**

**7. Counterfeeding-on-environment<sup>2</sup> → underapplication**

*Bedouin Arabic*

|                |      |           |  |
|----------------|------|-----------|--|
| UR             | badw |           |  |
| a → i / __ σ   | n/a  | = P       |  |
| G → V / C __ # | badu | = Q       |  |
| SR             | badu | 'Bedouin' | (Baković 2007, p. 222; from McCarthy 1999) |

- What would be the transparent outcome?

**8. Counterfeeding-on-focus → underapplication**

*Bedouin Arabic again*

|              |       |            |  |
|--------------|-------|------------|--|
| UR           | katab |            |  |
| i → ∅ / __ σ | n/a   | = P        |  |
| a → i / __ σ | kitab | = Q        |  |
| SR           | kitab | 'he wrote' | (Baković 2007, p. 222; from McCarthy 1999) |

- What would be the transparent outcome?
- Both of these counterfeedings are hard for OT (why?). But counterfeeding-on-focus is not so bad, as we've seen. Let's review some options...

**9. "Surface-true counterfeeding" → transparency!**

*Educated Singapore English*: Baković 2011 p. 16; from Mohanan 1992, Anttila et al. 2008

Epenthesis: /reɪz + z/ → [reɪz + əz] (and, I infer, /reɪs/ → [reɪs + əz])

Deletion: /test/ → [tes] cf. /test+ɪŋ/ → [tɛst+ɪŋ]

no data, but Degemination "deletes one of two tautosyllabic near-identical consonants" (p. 16)

/lɪst+z/ → [lɪs]

- In an SPE analysis, what rule order do we need to get [lɪs]? Why does B. call this result "transparent"?
- OT analysis?

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<sup>2</sup> Term from McCarthy 1999.

## 10. Underapplication without counterfeeding (Baković 2011 p. 8ff.)

### “Disjunctive blocking” (p. 8)

- How would this rule schema apply to these words:  $V \rightarrow [+stress] / \_ (C_2V)C_0 \#$  ?

/badupil/

/pikomsak/

Remember how expansion conventions work—abbreviates two rules, disjunctively ordered.

- In what sense does underapplication result?

Nonderived-environment blocking—we’ll save that till later, but essentially it’s when a rule can’t apply if its structural description was already met in the underlying form:

e.g.  $a \rightarrow i / \_ C\#$       /likat/ *fails to apply*      /noka+l/  $\rightarrow$  [nokil]

### Blocking by phonotactic constraint (p. 12)

- Think of vowel deletion in Yokuts, and the constraint that can block it. If we formulate the simple deletion rule (what was it?), then what would be some surface forms in which it underapplies?

### (Non-)triggering by phonotactic constraint (p. 13)

- Think of consonant deletion in Yokuts, and the constraint that triggers it. If we formulate the simple deletion rule (what was it?), then what would be some surface forms in which it underapplies?

### Restriction to certain morphological classes (Estonian V deletion in nominative singular only)

### Optionality (French schwas may or may not delete)

### Lexical exceptions (English *obesity* fails to undergo ‘trisyllabic shortening’)

## 11. “Fed counterfeeding”<sup>3</sup> on environment $\rightarrow$ underapplication

*Lardil*

|   |                |               |              |
|---|----------------|---------------|--------------|
|   | a. /dibirdibi/ | b. /yiliyili/ | c. /wangalk/ |
| <b>Apocope:</b> $V \rightarrow \emptyset / \sigma \sigma \_ \#$ | $\emptyset$    | $\emptyset$   |              |
| <b>Deletion:</b> $[-apical] \rightarrow \emptyset / \_ \#$      | $\emptyset$    |               | $\emptyset$  |
|   | [dibirdi]      | [yiliyil]     | [wangal]     |

Glosses: (9a) ‘rock cod’, (9b) ‘oyster species’, (9c) ‘boomerang’  
(Baković to appear, p. 6; from Hale 1973)

- Why “fed counterfeeding” here?
- Ways to do this in OT?

<sup>3</sup> Baković gets the term from Kavitskaya & Staroverov 2009



**14. Counterbleeding by mutual bleeding → transparent!***Lardil*

|  |  |                |
|--|--|----------------|
|  | a. /papi+ uɿ/                              | b. /tʲæmpæ+uɿ/ |
| Epenthesis: $\emptyset \rightarrow w / i \_ \_ u$  | w  |                |
| Elision: $V \rightarrow \emptyset / V \_ \_$   |  | ∅              |
|  | [papi+wuɿ]                                 | [tʲæmpæ+ɿ]     |
| <u>Glosses:</u> (25a) ‘father’s mother (acc. fut.)’, (25b) ‘mother’s father (acc. fut.)’ | (Baković to appear, p. 22; from Hale 1973) |                |

- In what sense is this mutual bleeding?
- OT analysis?

**15. “Self-destructive feeding” → overapplication!***Turkish*

|   |          |     |                |            |              |
|---|----------|-----|----------------|------------|--------------|
| UR  | bebek+n  |     |                |            |              |
| $\emptyset \rightarrow i / C \_ \_ C\#$                   | bebekin  | = P | cf. /ip+n/     | → [ipin]   | ‘your rope’  |
| $k \rightarrow \emptyset / V \_ \_ +V$                    | bebein   | = Q | cf. /bebek+i/  | → [bebei]  | ‘baby (ACC)’ |
| SR  | bebein   |     |                |            | ‘your baby’  |
| (Baković 2007, p. 226; from Sprouse 1997)                 |          |     |                |            |              |
| UR  | ajak+suw |     |                |            |              |
| [+cont] → ∅ / C _ _                                       | ajakuw   | = P | cf. /aruw+suw/ | → [arusuw] | ‘his bee’    |
| $k \rightarrow \emptyset / V \_ \_ +V$                    | ajauw    | = Q | cf. /ajak+u/   | → [ajauw]  | ‘foot (ACC)’ |
| SR  | ajauw    |     |                |            | ‘his foot’   |
| (Baković 2007, p. 227; from Kenstowicz & Kisseberth 1979) |          |     |                |            |              |

- How does this remind you of the Korean assignment?
- What would be the transparent outcome?
- What the problem for OT?

**16. Here’s another one from Lee 2007**

Javanese (Austronesian from Indonesia with about 84 million speakers; data originally from Dudas 1976; Lee 1999)

|                                       |            |              |           |  |
|---------------------------------------|------------|--------------|-----------|--|
|                                       | ‘skin’     |              |           |  |
| $n \rightarrow \emptyset / C \_ \_$   | /kulit+ne/ | /sekolah+an/ | /omah+ne/ |  |
| $h \rightarrow \emptyset / V \_ \_ V$ | kulit+e    | --           | omah+e    |  |
|                                       | --         | sekola+an    | oma+e     |  |
|                                       | [kulite]   | [sekolaan]   | [omae]    |  |

- Would this work in Harmonic Serialism?



### 17. “Non-gratuitous feeding” → overapplication

Classical Arabic

|  |        |                   |                                |
|--|--------|-------------------|--------------------------------|
| UR   | ktub   |                   |                                |
| $\emptyset \rightarrow V_i / \# \_ \text{CCV}_i$ | uktub  | = P               |                                |
| $\emptyset \rightarrow \text{ʔ} / \# \_ V$       | ʔuktub | = Q               | cf. /al-walad-u/ → [ʔalwaladu] |
| SR   | ʔuktub | ‘write (MASC SG)’ | ‘the boy (NOM)’                |

(Baković 2007, p. 231; from McCarthy 2007b)

- What would be the transparent outcome?
- Ideas for how to do this in OT?

### 18. “Cross-derivational feeding” → overapplication, in a sense

Lithuanian: Baković 2007, p. 234ff.; see there for references

prefix obstruents assimilate in voicing and palatalization :

|              |               |                  |                            |
|--------------|---------------|------------------|----------------------------|
| at-ko:pʲtʲi  | ‘to climb up’ | ap-kalʲbʲetʲi    | ‘to slander’               |
| ad-gautʲi    | ‘to get back’ | ab-gautʲi        | ‘to deceive’               |
| atʲ-pjʲautʲi | ‘to cut off’  | apʲ-tʲemʲdʲi:tʲi | ‘to obscure’               |
| adʲ-bʲekʲtʲi | ‘to run up’   | abʲ-gʲi:dʲi:tʲi  | ‘to cure (to some extent)’ |

(p. 234)

epenthesis between stops of the same place (also palatalization before [i]):

|                |                    |                |                         |
|----------------|--------------------|----------------|-------------------------|
| atʲi-taikʲitʲi | ‘to make fit well’ | apʲi-putʲi     | ‘to grow rotten’        |
| atʲi-tʲeisʲtʲi | ‘to adjudicate’    | apʲi-pʲi:lʲtʲi | ‘to spill something on’ |
| atʲi-duotʲi    | ‘to give back’     | apʲi-barʲtʲi   | ‘to scold a little bit’ |
| atʲi-dʲetʲi    | ‘to delay’         | apʲi-bʲerʲtʲi  | ‘to strew all over’     |

(234)

- Baković 2005 argues that the right analysis here (and in English epenthesis before /-d/ and /-z/) should capture the idea that epenthesis occurs where a geminate *would have occurred* (because of assimilation).
  - Assimilation would have fed epenthesis (which in Baković’s analysis is only triggered between identical segments), but assimilation doesn’t end up needing to apply (bleeding).
- He’s proposing a typological prediction:
  - OCP constraints are strict: they penalize only perfect identity, not near-identity
  - So, there’s no reason for epenthesis to break up near-identical clusters...
  - ...unless an independently occurring assimilation process would have made them identical.
- Let’s try to reconstruct Baković’s OT analysis.
- Any ideas for how to capture Baković’s idea in SPE? Are we stuck with an epenthesis rule that recapitulates the assimilation facts?

That completes our tour of Baković's typology (I skipped "concealed free rides"). But here are a couple more animals for the menagerie:

### 19. Wolf 2011: "mutual counterfeeding" in Hindi-Urdu

Indo-European from India w/ about 240 million speakers [Lewis 2009], data and analyses originally from Narang & Becker 1971, Bhatia & Kenstowicz 1972.

- Fill in the SPE-style derivation, including predicted surface form for 'mind':

|   | /nikəl-na:/                 | /nikəl-a:/              | /angən-on/                        | /ma:nəsi/        |
|---|-----------------------------|-------------------------|-----------------------------------|------------------|
| schwa deletion: ə → ∅ / VC__CV  |                             |                         |                                   |                  |
| V nasalization: $\begin{matrix} V & C \\ 1 & [+nas] \\ & 2 \end{matrix} \rightarrow \begin{matrix} 1 \\ [+long] \end{matrix}$ |                             |                         |                                   |                  |
|   | [nikəlna:]<br>'to come out' | [nikl-a:]<br>'came out' | [ã:gən-õ:]<br>'courtyard-obl.pl.' | ?<br>'mind-adj.' |

- Problem: surface form is actually [ma:nsi].
- What rule ordering does this require? What's the problem?
- What outcome do we get if both rules apply simultaneously to the input (no iteration)?
- See Bhatia & Kenstowicz (or Wolf) for arguments that the V nasalization rule doesn't actually exist in this language—nasal vowels are just underlying, so the problem goes away.

### 20. Wolf 2010: counterfeeding from the past

- The name comes from Wilson 2006.
- See the Wolf paper for more cases that would be good term-paper topics (Tachoni?).

|  |  |         |
|--|--|---------|
| Samothraki Greek, Kaisse 1975:                   | 'carry-past.theme-1.pl'                        | 'day'   |
| <i>feeding:</i> $r \rightarrow \emptyset / V\_V$ | /fér+a+me/                                     | /mér+a/ |
| $\{a,e\} \rightarrow i / \_+ \{a,o\}$            | fé+a+me  | mé+a    |
|  | fí+a+me  | mí+a    |
|  | [fíami] (other rules apply to last V, I guess) | [mía]   |

|                                       |           |           |       |
|---------------------------------------|-----------|-----------|-------|
| <i>feeding:</i>                       | 'Greek'   | 'old'     | 'one' |
|                                       | /romé+os/ | /palé+os/ | /mía/ |
| $\{a,e\} \rightarrow i / \_+ \{a,o\}$ | romí+os   | palí+os   | --    |
| $V \rightarrow [-syll] / \_+V$        | romj+ós   | palj+ós   | mjá   |
|                                       | [romjós]  | [paljós]  | [mjá] |

- What's the problem here for putting all three rules in an order? (Hint: \*[fjámi])
- Gliding somehow doesn't get to apply if it was originally fed by *r*-deletion. None of our theories predict this (I think), but "OT with candidate chains" does.

## 21. Paper-topics recap

Here's a summary of areas we've seen so far where different theories make different predictions, or differ in how easily they can handle cases:

- (self-)feeding vs. (self-)counterfeeding—but there are many sub-types
- (self-)bleeding vs. (self-)counterbleeding—but there are many sub-types
- miscellaneous exotic types of opacity
  - good search terms are “ordering paradox”, “non-transitive”
- iterative vs. non-iterative rule application
- interaction (or not) of multiple rule targets
- directional rule application
- optionality: global vs. local vs. unique-target; iterative vs. all-or-nothing
- look-ahead: myopic vs. ahead-looking derivations
  - Other good search terms: fell-swoop, global power, globality, peeking, sour grapes, chicken-or-egg problem, top-down

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