Class 7: The cycle, part I

To do
• Read Kiparsky 1982. SQs due Tuesday.
• Finish Kalinga (due Tuesday).

Overview: How are phonological rules ordered with respect to morphological operations?

1. SPE: the transformational cycle

“We assume as a general principle that the phonological rules first apply to the maximal strings that contain no brackets [i.e., morpheme or word boundaries], and that after all relevant rules have applied, the innermost brackets are erased; the rules then reapply to maximal strings containing no brackets, and again innermost brackets are erased after this application; and so on, until the maximal domain of phonological processes is reached.” (p. 15)

Classic example: Palestinian Arabic (data originally from Brame)

Verbs without objects

<table>
<thead>
<tr>
<th>subject</th>
<th>'study'</th>
<th>'understand'</th>
</tr>
</thead>
<tbody>
<tr>
<td>2sg. masc.</td>
<td>da.rås+t</td>
<td>fhìm+t</td>
</tr>
<tr>
<td>2sg. fem.</td>
<td>da.rås.+ti</td>
<td>fhìm.+ti</td>
</tr>
<tr>
<td>3sg. masc.</td>
<td>då.rås</td>
<td>fi.him</td>
</tr>
<tr>
<td>3sg. fem.</td>
<td>då.ra.s+at</td>
<td>fi.h.m+at</td>
</tr>
<tr>
<td>1pl.</td>
<td>da.rås.+na</td>
<td>fhìm.+na</td>
</tr>
<tr>
<td>2pl.</td>
<td>da.rås.+tu</td>
<td>fhìm.+tu</td>
</tr>
<tr>
<td>3pl.</td>
<td>då.ra.s+u</td>
<td>fi.h.m+u</td>
</tr>
</tbody>
</table>

- What’s the stress rule for this language, based on the ‘study’ paradigm?
- Give a rule for the V~Ø alternations.
- Determine the ordering of the two rules.

Verbs with objects

<table>
<thead>
<tr>
<th>object</th>
<th>'he understood X'</th>
<th>'she understood X'</th>
<th>'You (masc.) understood X'</th>
</tr>
</thead>
<tbody>
<tr>
<td>1sg.</td>
<td>fi.hìm.+ni</td>
<td>fi.h.m+át.+ni</td>
<td>fhìm+t.+ni</td>
</tr>
<tr>
<td>2sg. masc.</td>
<td>fi.h.m+ak</td>
<td>fi.h.m+a.t+ak</td>
<td>fhìm+.t+ak</td>
</tr>
<tr>
<td>2sg. fem.</td>
<td>fi.h.m+ik</td>
<td>fi.h.m+a.t+ik</td>
<td>fhìm+.t+ik</td>
</tr>
<tr>
<td>3sg. masc.</td>
<td>fi.h.m+u</td>
<td>fi.h.m+a.t+u</td>
<td>fhìm+.t+u</td>
</tr>
<tr>
<td>3sg. fem.</td>
<td>fi.hìm.+ha</td>
<td>fi.h.m+át.+ha</td>
<td>fhìm+t.+ha</td>
</tr>
<tr>
<td>1pl.</td>
<td>fi.hìm.+na</td>
<td>fi.h.m+át.+na</td>
<td>fhìm+t.+na</td>
</tr>
<tr>
<td>2pl.</td>
<td>fi.hìm.+kum</td>
<td>fi.h.m+át.+kum</td>
<td>fhìm+t.+kum</td>
</tr>
<tr>
<td>3pl.</td>
<td>fi.hìm.+hum</td>
<td>fi.h.m+át.+hum</td>
<td>fhìm+t.+hum</td>
</tr>
</tbody>
</table>
Step through the derivations of the following forms, using the convention from SPE given above (I know the brackets are fudged a bit—see Kiparsky 1982 reading for why):

\[
\begin{align*}
[fihim+\emptyset] & \quad [fihim+na] & \quad [(fihim+\emptyset)+na] & \quad [(fihim+\emptyset)+ak] & \quad [(fihim+at)+ni] & \quad [(fihim+at)+ak] & \quad [(fihim+t)+ni] \\
V & \quad he & \quad V & \quad we & \quad V & \quad he & \quad us & \quad V & \quad he & \quad you & \quad V & \quad she & \quad me & \quad V & \quad she & \quad you & \quad V & \quad you & \quad me
\end{align*}
\]

Which forms would be different if we did all the morphology first and then applied the phonological rules?

2. Two kinds of rules

<table>
<thead>
<tr>
<th>English “trisyllabic shortening”</th>
<th>English tapping (a.k.a. flapping)</th>
</tr>
</thead>
<tbody>
<tr>
<td>op[et]k</td>
<td>op[æ]city</td>
</tr>
<tr>
<td>s[et]ne</td>
<td>s[æ]nity</td>
</tr>
<tr>
<td>ser[i]ne</td>
<td>ser[ɛ]nity</td>
</tr>
<tr>
<td>obsc[i]ne</td>
<td>obsc[ɛ]nity</td>
</tr>
<tr>
<td>[ou]men</td>
<td>[o]minous</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>trisyllabic shortening</th>
<th>tapping</th>
</tr>
</thead>
<tbody>
<tr>
<td>creates new allophones that aren’t in the phoneme inventory?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>obvious to untrained native speaker?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>sensitive to morphology?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>exceptions?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>applies across word boundaries?</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
3. Explaining these properties with lexical phonology

Trisyllabic shortening is regarded as lexical, tapping as postlexical.

*Morphological sensitivity*
Once a rule goes to the postlexical phonology, all morphological labels are removed ("bracket erasure")—so flapping can’t see them.

"*Structure preservation*" (=non-creation of new allophones)
Because the result of applying a lexical rule has to be a legitimate lexical entry, it can’t contain anything that doesn’t belong to the phoneme inventory. (And this could possibly be extended to other properties of legal lexical entries besides segment inventory…)

*Exceptions*
Lexical rules can “see” the lexical entry to check if it has any information about being an exception. (We’ll consider an alternative below.) Postlexical rules can’t, because they just get a string of segments.

*Intuitions*
When making judgments about whether sounds are the same or different, speakers look at a lexical entry, not a surface form (that’s the theory here, anyway).

*Word boundaries*
Because lexical rules apply within the lexicon (i.e., they output a word, not a complex phrase or sentence), they can’t “see” other words in the environment—that those other words aren’t there yet.
This model makes strong predictions about ordering: all postlexical rules must follow all lexical rules.

- Discuss: How is this interleaving of phonology and morphology different from the SPE idea of the cycle?

4. **Observation: derived environments behave differently**

Many rules are sensitive to morphology—lexical rules, especially, have a tendency not to apply within morphemes (that is, when the target and environment are in the same morpheme):

**Finnish**

Ignore various other rules: vowel harmony, degemination, a~o…

<table>
<thead>
<tr>
<th>to X</th>
<th>Let him/her X!</th>
<th>‘active instructive infinitive II’</th>
<th>she/he was Xing</th>
</tr>
</thead>
<tbody>
<tr>
<td>halut+a</td>
<td>halut+koon</td>
<td>halut+en</td>
<td>halus+i</td>
</tr>
<tr>
<td>noet+a</td>
<td>noet+koon</td>
<td>noet+en</td>
<td>nokes+i</td>
</tr>
<tr>
<td>piet+æ</td>
<td>piet+køen</td>
<td>piet+en</td>
<td>pikes+i</td>
</tr>
<tr>
<td>filmat+a</td>
<td>filmat+køon</td>
<td>filmat+en</td>
<td>filmas+i</td>
</tr>
<tr>
<td>cf.</td>
<td></td>
<td>oll+a</td>
<td>oll+koon</td>
</tr>
<tr>
<td>aja+a</td>
<td>aja+koon</td>
<td>aja+en</td>
<td>ajo+i</td>
</tr>
<tr>
<td>puhu+a</td>
<td>puhu+koon</td>
<td>puhu+en</td>
<td>puhu+i</td>
</tr>
</tbody>
</table>

- Write a rule for the t~s alternation.

- Modify the rule to account for these cases:

  - tila ‘room’
  - lahti ‘Lahti’
  - saa ‘saw’
  - mæ ‘mæ’
  - silti ‘however’
  - limonaat ‘lemonade’
  - si ‘saw’
  - valtion ‘public’
  - kuusi ‘six’

- Another rule is needed to account for this vowel alternation:

  - joke+næ ‘river’ essive sg.
  - joki ‘river’ nom. sg.
  - mæke+næ ‘river’ essive sg.
  - mæki ‘hill’ nom. sg.
  - æiti+næ ‘mother’ essive sg.
  - æiti ‘mother’ nom. sg.
  - kahvi+næ ‘coffee’ essive sg.
  - kahvi ‘coffee’ nom. sg.

- How should the two rules be ordered, given these data? (ignore h~k alternation)

  - vete+næ ‘water’ essive sg.
  - vesi ‘water’ nom. sg.
  - kaete+næ ‘hand’ essive sg.
  - kæsi ‘hand’ nom. sg.
  - yhte+næ ‘one’ essive sg.
  - yksi ‘one’ nom. sg.

- What’s the problem in vesi?
Kiparsky refers to environments that are the result of morpheme concatenation or previous rule application as *derived environments*, and the failure of certain rules to apply outside those environments as *non-derived environment blocking (NDEB).*

5. Another example

Sanskrit “ruki”

\[ s \rightarrow /\{r, u, k, i\}/ \]

\[ \text{da+da:+si} \quad \text{‘you give’} \quad \text{bi+bhar+si} \quad \text{‘you carry’} \]

\[ \text{kram+sja+ti} \quad \text{‘he will go’} \quad \text{vak+sja+ti} \quad \text{‘he will say’} \]

Aside: Venneman 1972 proposes that this is because the coarticulations that \( r, u, k, i \) impose on a following \( s \) are acoustically similar (though articulatorily diverse). \( r \) is apparently retroflex, so it would induce retroflexion (); \( u \) would induce rounding; \( k \) would induce palatalization (because of back tongue position), and so would \( i \), as it does in many languages. All of these changes (to \( s \), \( s' \), and \( j' \)) would cause the fricative noise of \( s \) to lower in frequency (because the cavity in front of the tongue becomes bigger). It would therefore be difficult to maintain a contrast between \( [s] \) and \( [j] \) in the post-ruki environment.

- How is this like Finnish:
  
  \( \text{bisa} \) ‘lotus’
  \( \text{busa} \) ‘mist’
  \( \text{barsa} \) ‘tip’

  aba-\( \text{laut} \quad \text{sas} \quad \text{‘instruct’} \quad /\text{sas+ta}/ \rightarrow \text{sista} \rightarrow [\text{siṣ+}[a]} \]

  \( \text{V-deletion} \quad \text{ghas} \quad \text{‘eat’} \quad /\text{ga+ghas+anti}/ \rightarrow \text{dʒa+kṣ+anti} \rightarrow [\text{dʒa+kṣ+anti]} \quad \text{3 pl.} \]

6. Solution I: Mascaró’s Strict Cycle Condition (SCC)

Instead of trying to write morpheme boundaries or other information into a rule, make it a property of all grammars that cyclic (=lexical) rules can apply only when...

- The rule refers crucially to info that spans the (morpheme) boundary between what was there on the previous cycle and what has been added on the current one.

  or

- The rule crucially refers to information supplied by an earlier rule operating on the current cycle.

In other words...

- Cyclic rules can’t apply to the unchanged UR.
- If a word leaves a cycle and some cyclic rule hasn’t applied (maybe because it was counterfed, or maybe because this was the first cycle), it has lost its chance and doesn’t get to apply in a later cycle (unless some later morphology or phonology creates the rule’s structural description again).
7. The SCC and counterfeeding

Note that we need something like the SCC if cyclic rules are ever to interact in counterfeeding fashion (see Kiparsky 1985).

Polish (originally from Rubach): $\left[ +\text{cor} \begin{array}{c} +\text{strid} \end{array} \right] \rightarrow \text{c} / \left[ +\text{syl} \begin{array}{c} -\text{back} \end{array} +\text{high} \right]$ (in nouns) “nominal strident palatalization”

kapelu[s] ‘hat’ kapelu[c]+ik ‘little hat’ kapelu[c]+ik+o ‘big hat’
gro[s] (monetary unit) gro[c]+ik ‘little grosz’ gro[c]+iw+o ‘big grosz’

{k,g,x} $\rightarrow \left[ -\text{high} \begin{array}{c} +\text{cor} \begin{array}{c} +\text{strid} \end{array} \end{array} \right] / \left[ -\text{cons} \begin{array}{c} -\text{back} \end{array} \right]$ “first velar palatalization”

krzy[k] ‘a shout’ krzy[t]+e+c ‘to shout’
stra[x] ‘fear’ stra[j]+y+c ‘to frighten’
miaż[g]+a ‘squash’ miaż[d̩]+y+c ‘to squash’ miaż[d̩]+e ‘I squash’

o What’s the order of the rules?
gma[x] ‘building’ gma[z]+ysk+o ‘big building’ kapelu[c]+ik+o ‘big hat’
* gma[c]+ysk+o

o If both rules are cyclic (Rubach argues that they are), what prevents *gma[c]+ysk+o?

8. Problems for Strict Cycle Condition

Classic SPE example in favor of cyclicity from English
The vowel in comp[ɔ]nsation has to be unstressed schwa. In cond[ɛ]nsation, however, it is at least optionally a stressed [ɛ] (for me, anyway—speakers seem to differ).

stress rules on earlier cycle cόmp[ɛ]nsätè cond[ɛ]nse
add suffix cόmp[ɛ]nsätìon cond[ɛ]nsätìon
stress rules on later cycle—they cόmp[ɛ]nsätìon cόnd[ɛ]nsätìon
  can add new stresses or adjust primary vs. secondary stress, but
  not delete old stresses
  unstressed vowel reduction cόmp[ɔ]nsätìon

o Is the stress rule cyclic? Does it obey the SCC here?
Conservative European Spanish example (based on Harris)
Palatal and alveolar nasals and laterals contrast:

<table>
<thead>
<tr>
<th>Word</th>
<th>Sound</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>ka.na</td>
<td>'grey hair'</td>
<td>po.lo</td>
</tr>
<tr>
<td>ka.ña</td>
<td>'cane'</td>
<td>po.ʎo</td>
</tr>
</tbody>
</table>

But the contrast is neutralized in some environments

<table>
<thead>
<tr>
<th>Word</th>
<th>Sound</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>dez.δe.ɲ+ar</td>
<td>‘to disdain’</td>
<td>don.θe.ʎ+a</td>
</tr>
<tr>
<td>dez.δe.ɲ+o.so</td>
<td>‘disdainful’</td>
<td>don.θe.ʎ+a+s</td>
</tr>
<tr>
<td>dez.δen</td>
<td>‘disdain (N)’</td>
<td>don.θel</td>
</tr>
</tbody>
</table>

- Assume a rule of syllabification, but let’s not worry about how to write it. Write a rule for the neutralization that refers to syllable structure (we can use $[σ]$ and $]\sigma\$).

- Is the syllabification rule cyclic? Does it obey the SCC in the derivation of [dez.δen]?


Kiparsky proposes that every lexical entry comes with an identity rule—a very specific rule that maps that string of segments to itself.

/æi.ti/ comes with the context-free rule Æit → æiti

Remember the Elsewhere Condition? Here is Kiparsky’s (1982) revised version:

“Rules A, B in the same component [lexical vs. postlexical] apply disjunctively to a form $Φ$ if and only if
(i) The structural description of A (the special rule) includes the structural description of B (the general rule) [where ‘properly includes’ requires definition]
(ii) The result of applying A to $Φ$ is distinct from the result of applying B to $Φ$
In that case, A is applied first, and if it takes effect, then B is not applied.” (p. 136)

- Why is the Finnish t→s rule blocked in [æiti] now, on the first cycle and on any subsequent cycles ([æiti+nsæ] ‘his/her mother’)?

- Why is the rule allowed to apply in [vesi] and [halusi]?
10. How identity rules solve problems from 8
In English, stress is largely rule-governed. Therefore, lexical entries and their associated identity rules don’t include stress (except maybe for exceptionally stressed words)! Rules that assign stress are therefore said to be structure-filling, not structure-changing, when they apply to URs.

○ How does condensation work now?

○ How does [dez.đen] work now?

11. Epilogue
Mohanan & Mohanan (1984) argue for lexical rules in English and Malayalam that do not respect NDEB (e.g. j-insertion in words like cube; j-deletion (which counterbleeds palatalization) in words like racial; and n-deletion in words like solemn) and the whole issue of derived environments remains poorly understood.

○ Something to think about: If we have the SCC or some equivalent, do we ever need ‘+’ in a rule?

Bare-bones lexical phonology bibliography

• Pesetsky, David (1979). Russian morphology and lexical theory. MIT ms. Addresses the problem that morphology seems to demand bracket erasure after each WFR (later WFRs are blind to information from earlier stages), but phonological rules need those brackets. His solution was to interleave WFRs with the cyclic phonological rules, instead of starting with the full morphological output and then erasing brackets. All this happens “in the lexicon”. Postcyclic rules come later, after the syntax.


• Mohanan, K.P. (1982). Lexical phonology. MIT dissertation. Revised as Mohanan, K.P. (1986). The Theory of Lexical Phonology. Dordrecht: Kluwer. Like Kiparsky, proposes levels, but argues that some rules have to apply in more than one level (as long as those levels are adjacent).