Class 7: The cycle, part I

To do (no reading for next time!
- Finish Keley-i (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.rás+t</td>
<td>fhím+t</td>
</tr>
<tr>
<td>2sg. fem.</td>
<td>da.rás.+ti</td>
<td>fhím.+ti</td>
</tr>
<tr>
<td>3sg. masc.</td>
<td>dá.ras</td>
<td>fhím</td>
</tr>
<tr>
<td>3sg. fem.</td>
<td>dá.ra.s+at</td>
<td>fhím.m+at</td>
</tr>
<tr>
<td>1pl.</td>
<td>da.rás.+na</td>
<td>fhím.+na</td>
</tr>
<tr>
<td>2pl.</td>
<td>da.rás.+tu</td>
<td>fhím.+tu</td>
</tr>
<tr>
<td>3pl.</td>
<td>dá.ra.s+u</td>
<td>fhím.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.hím.+ni</td>
<td>fíh.m+át.+ni</td>
<td>fhím+t.+ni</td>
</tr>
<tr>
<td>2sg. masc.</td>
<td>fih.m+ak</td>
<td>fíh.m+a.t+ak</td>
<td>fhím+.t+ak</td>
</tr>
<tr>
<td>2sg. fem.</td>
<td>fíh.m+ik</td>
<td>fíh.m+a.t+ik</td>
<td>fhím+.t+ik</td>
</tr>
<tr>
<td>3sg. masc.</td>
<td>fíh.m+u</td>
<td>fíh.m+a.t+u</td>
<td>fhím+.t+u</td>
</tr>
<tr>
<td>3sg. fem.</td>
<td>fíh.hım.+ha</td>
<td>fíh.m+át.+ha</td>
<td>fhím+t.+ha</td>
</tr>
<tr>
<td>1pl.</td>
<td>fíh.hım.+na</td>
<td>fíh.m+át.+na</td>
<td>fhím+t.+na</td>
</tr>
<tr>
<td>2pl.</td>
<td>fíh.hım.+kum</td>
<td>fíh.m+át.+kum</td>
<td>fhím+t.+kum</td>
</tr>
<tr>
<td>3pl.</td>
<td>fíh.hım.+hum</td>
<td>fíh.m+át.+hum</td>
<td>fhím+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):
Which forms would be different if we did all the morphology first and then applied the phonological rules?

2. **Lexical phonology**

As you read, Kiparsky argues that this is not enough (see Pesetsky 1979 for an earlier proposal along the same lines). Different sub-grammars apply at different levels of morphology (in the lexical component), and an additional sub-grammar (postlexical) applying after the syntax.

(Should the root pass through the Level 1 rules first thing or go straight to WFR? Not clear.)
3. Properties of the lexical component: cyclicity

Within each level, the phonological rules apply after each morphological operation (thus the loops in the picture above).

Evidence/examples

- WFRs can be sensitive to derived phonological properties: e.g. –ize, which doesn’t apply to stems with final stress. Kiparsky’s interpretation is that stress rules apply to the stem on the previous cycle.

Internal brackets are erased after each level, so WFRs and phonological rules don’t have access to morphological information from the previous level. Postlexical rules don’t have access to any bracketing.

Evidence/examples

- Postlexical rules are automatic in the sense that they don’t admit of lexical exceptions, and don’t care about morphological information.

4. Properties of the lexical component: strict cycle condition

The idea was to allow lexical rules (at least those that change feature values, rather than filling in underspecified ones) to apply only to environments newly made, by either a morphological operation or a phonological rule in the same cycle. This phenomenon is known as non-derived environment blocking (NDEB).

Lexical phonology’s attempts to deal with NDEB were always kind of a mess, and I don’t think we’ve done much better since then, so rather than review the details of the proposals, I’d rather just give two classic examples, from Kiparsky:

**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+køön</td>
<td>piet+en</td>
<td>pikes+i</td>
</tr>
<tr>
<td>filmat+a</td>
<td>filmat+koon</td>
<td>filmat+en</td>
<td>filmas+i</td>
</tr>
<tr>
<td>cf.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>oll+a</td>
<td>ol+koon</td>
<td>oll+en</td>
<td>ol+i</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>

- So \( t \to s / __ i \). Can we modify the rule to deal with these cases?

| tila | ‘room’ |
| silti | ‘however’ |
| valtion | ‘public’ |
| aëtti | ‘mother’ |
| silti | ‘however’ |
| valettu | ‘public’ |
| lahtī | ‘Lahti’ |
| metti | ‘roe’ |
| limonaati | ‘lemonade’ |
| paasi | ‘boulder’ |
| kuusi | ‘six’ |
Another rule is needed to account for this vowel alternation:

- joke+na ‘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+na ‘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.
- kæte+næ ‘hand’ essive sg.  kæsi  ‘hand’ nom. sg.
- yhte+næ ‘one’ essive sg.  yksi  ‘one’ nom. sg.

What’s the problem in vesi?

**Sanskrit “ruki”**

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

- da+da:+si ‘you give’
- kram+sjä+ti ‘he will go’
- bi+bhar+ši ‘you carry’
- vak+šjä+ti ‘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 \([s]\), \([s^w]\), and \([f]\)) would cause the fricative noise of \(s\) to lower in frequency, because the resonant cavity in front of the constriction becomes bigger. It would therefore be difficult to maintain a contrast between \(s\) and \(\$\) in the post-\(ruki\) environment.

How is this like Finnish:

- bisa ‘lotus’
- busa ‘mist’
- barsa ‘tip’

**ablaut**  
\(sas\) ‘instruct’ /sas+ta/ → sista → [siš+[a]]  participle

**V-deletion**  
ghas ‘eat’ /ga+ghas+anti/ → dža+ks+anti → [dža+kš+anti] 3 pl.

Most other cases of NDEB I’ve seen require feeding by a morphological operation only (rather than morphological or phonological), so these classics may not be representative.

### 5. Aside on strict cyclicity: counterfeeding

Polish (originally from Rubach): \([+\text{cor}]
\rightarrow \mathcal{C} / \_\]  \([+\text{syl}]
\rightarrow \mathcal{C} / \_\]  \([+\text{back}]
\rightarrow \mathcal{C} / \_\]  \([+\text{high}]
\rightarrow \mathcal{C} / \_\]  (in nouns) “nominal strident palatalization”
kapelu[s] 'hat' kapelu[ç]+ik 'little hat' kapelu[ç]+ik+o 'big hat'
gro[s] (monetary unit) gro[ç]+ik 'little grosz' gro[ç]+iw+o 'big grosz'

\{k,g,x\} \rightarrow \begin{array}{c}
\begin{array}{c}
\text{−high} \\
\text{+cor} \\
\text{+strid}
\end{array} \\
\begin{array}{c}
\text{−cons} \\
\text{−back}
\end{array}
\end{array} \text{“first velar palatalization”}

krzy[k] ‘a shout’ krzy[ç]e+č ‘to shout’
stra[x] ‘fear’ stra[ç]+y+č ‘to frighten’
miaz[g]+a ‘squash’ miaż[ç3]+y+č ‘to squash’ miaż[ç3]+ę ‘I squash’

o What’s the order of the rules (assuming the rules are correct)?
gma[x] ‘building’ gma[ç]+ysk+o ‘big building’ kapelu[ç]+ik+o ‘big hat’

* gma[ç]+ysk+o

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

6. Another aside on strict cyclicity

Kiparsky has a nice alternative: assume that every lexical item is really a specific rule, such as Ø \rightarrow \text{tila}.

o What does the Elsewhere Condition say should happen to this sequence of adjacently ordered rules?

\[ \text{Ø} \rightarrow \text{tila} \]
\[ t \rightarrow s / \_ \_ i \]

7. Application to Icelandic (from Kiparsky 1984)

\textit{u}-epenthesis

dag+ur ‘day m.nom.sg.’ bæ+r ‘farm m.nom.sg.’
tek+ur ‘take 2/3sg.pres.ind.’ næ+r(ð) ‘reach 2/3sg.pres.ind.’

\textit{j}-deletion

bylj+ar ‘snowstorm gen.sg.’ krefj+i ‘request 2pl.’
bylj+ir ‘snowstorm nom.pl.’ krefj+a ‘request 3pl.’
bylj+i ‘snowstorm acc.pl.’ krefj+um ‘request 1pl.’
bylj+a ‘snowstorm dat.pl.’ kref ‘request 1sg.’
bylj+um ‘snowstorm dat.pl.’ kref+ur ‘request 2/3sg.’
byl ‘snowstorm acc.sg.’
byl+s ‘snowstorm gen.sg.’

o How should we order these two rules?
u-umlaut

/harð+um/ hörðum ‘hard dat.pl.’
/kalla+um/ köllum ‘call 1sg.’
/saga+ur/ sögur ‘sagas nom.pl.’
/dag+r/ dagur ‘day nom.sg.’

○ ordering?

syncope, roughly: certain unstressed Vs → Ø / __ {l,r,n,d,s}V
Additional fact: syncope applies before case and derivational endings, but not before the enclitic articles –inn and -ið.

<table>
<thead>
<tr>
<th>hamar</th>
<th>‘hammer nom.sg.’</th>
<th>akur</th>
<th>‘acne nom.sg.’</th>
<th>höfuð</th>
<th>‘head nom.sg.’</th>
</tr>
</thead>
<tbody>
<tr>
<td>hamr+i</td>
<td>‘hammer dat.sg.’</td>
<td>akr+i</td>
<td>‘acne dat.sg.’</td>
<td>höfð+i</td>
<td>‘head dat.sg.’</td>
</tr>
<tr>
<td>hamr+a</td>
<td>‘to hammer’</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>hamar#inn</td>
<td>‘the hammer nom.sg.’</td>
<td>akur#inn</td>
<td>‘the acne nom.sg.’</td>
<td>höfuð#ið</td>
<td>‘the head nom.sg.’</td>
</tr>
<tr>
<td>fóður</td>
<td>‘lining nom.sg.’</td>
<td>dag+ur</td>
<td>‘day nom.sg.’</td>
<td></td>
<td></td>
</tr>
<tr>
<td>fóðr+i</td>
<td>‘lining dat.sg.’</td>
<td>dag+r+i</td>
<td>‘day dat.sg.’</td>
<td></td>
<td></td>
</tr>
<tr>
<td>fóðr+a</td>
<td>‘to line’</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>fóður#ið</td>
<td>‘the lining nom.sg.’</td>
<td>dag+ur#inn</td>
<td>‘the day nom.sg.’</td>
<td>stað#num</td>
<td>‘the place dat.sg.’</td>
</tr>
</tbody>
</table>

Recall the problem from Anderson: we have to order u-umlaut before syncope (/bagg+ul+i/ → [bögg+l+i]—counterbleeding) but we also have to order syncope before u-umlaut (/alin+um/ → [öln+um]—feeding)

○ Shifting to Lexical Phonology, is syncope lexical or postlexical? u-umlaut? u-epenthesis?

○ Let’s try to resolve the ordering paradox using Lexical Phonology.

○ Some more data—are they consistent with our analysis?

/dag+r#inn/ dagurinn ‘the day nom.sg.’
/lifr#inn/ lifrin ‘the ? nom.sg.’
8. Brief exercise

Conservative European Spanish example (based on Harris)

Palatal and alveolar nasals and laterals contrast:

ka.na ‘grey hair’  po.lo ‘pole’
ka.na ‘cane’  po.λo ‘chicken’

But the contrast is neutralized in some environments

dez.ęe.p+ar ‘to disdain’  don.ęe.Ł+a ‘maiden’
dez.ęe.p+o.so ‘disdainful’  don.ęe.Ł+a+s ‘maidens’
dez.ęen ‘disdain (N)’  don.ęel ‘swain’
dez.ęe.nes ‘disdains (N)’  don.ęe.les ‘swains’

o 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 [ε] and [o]). Is it lexical or postlexical?

o The application of the rule in [dez.ęen] looks problematic for strict cyclicity—any way out?

Bare-bones lexical phonology bibliography


  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.

  Shows how Pesetsky’s proposal explains various differences between lexical and postlexical rules. Proposes levels, and uses identity rules to capture NDEB.

  Like Kiparsky, proposes levels, but argues that some rules have to apply in more than one level (as long as those levels are adjacent).

  Propose that an additional level of postcyclic lexical rules (word level) applies before syntax.