Turkish vowel harmony: Underspecification, iteration, multiple rules

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Data

- Turkish data on handout. [a] represents a low back unrounded vowel (more standardly [a]).
Morphological analysis and morpheme alternants

- Words in Turkish
  - root alone
  - root followed by one or two suffixes

- Suffixes
  - plural suffix, -[ler] ~ -[lar]
  - genitive suffix, -[in] ~ -[un] ~ -[ün] ~ -[în]

- Order of morphemes
  - root - plural - genitive
### Possible vowel features

<table>
<thead>
<tr>
<th></th>
<th>i</th>
<th>i</th>
<th>u</th>
<th>ü</th>
<th>e</th>
<th>a</th>
<th>o</th>
<th>ö</th>
</tr>
</thead>
<tbody>
<tr>
<td>high</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>low</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>+</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>back</td>
<td>-</td>
<td>+</td>
<td>+</td>
<td>-</td>
<td>-</td>
<td>+</td>
<td>+</td>
<td>-</td>
</tr>
<tr>
<td>front</td>
<td>+</td>
<td>-</td>
<td>-</td>
<td>+</td>
<td>+</td>
<td>-</td>
<td>-</td>
<td>+</td>
</tr>
<tr>
<td>round</td>
<td>-</td>
<td>-</td>
<td>+</td>
<td>+</td>
<td>-</td>
<td>-</td>
<td>+</td>
<td>+</td>
</tr>
</tbody>
</table>
## Distinctive features of vowels

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<thead>
<tr>
<th>i</th>
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<tbody>
<tr>
<td>high</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>back</td>
<td>-</td>
<td>+</td>
<td>+</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>+</td>
</tr>
<tr>
<td>round</td>
<td>-</td>
<td>-</td>
<td>+</td>
<td>+</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

([front] could be used instead of [back].)

Values of [low] are redundant:

\[
V \rightarrow [-\text{low}]
\]

- [high] \rightarrow [+] low
- [back] + [back]
- [round] - [round]

Otherwise:

\[
V \rightarrow [-\text{low}]
\]
Distribution of suffix alternants

• Plural suffix
  – -[ler] / front vowels C(C) ___
  – -[lar] / back vowels C(C) ___

• Genitive suffix
  – -[in] / front non-round vowels C(C) ___
  – -[ün] / front round vowels C(C) ___
  – -[în] / back non-round vowels C(C) ___
  – -[un] / back round vowels C(C) ___
Subscript and superscript convention

- $C_1 = \text{one or more consonants: } C, CC, CCC, \text{ etc.}$
- $C_0 = \text{zero or more consonants: } 0, C, CC, CCC, \text{ etc.}$
- $C^1 = \text{at most one consonant: } 0, C$
- $C_1^2 = \text{minimum one, maximum 2 C: } C(C)$
Analysis of alternating morphemes

• Symmetrical distribution of suffix alternants
• No non-alternating suffixes
  ➢ No single suffix alternant can be elevated to UR
URs

• UR = what all suffixes have in common
• genitive: -/ V n/
  [+high]
(values of [back] and [round] will be added to match preceding vowel)

an underspecified vowel, or “archiphoneme” (Odden p. 239)
• plural: \(/l V r/\) ([ler], [lar])

assimilates in backness (only) to a preceding vowel

([-round] in suffix UR, but possibly, all non-high suffixes are non-round---redundant [-round]?)
Backness Harmony

- Both high and non-high suffixes assimilate in backness to a preceding vowel

Backness Harmony:

\[
\begin{align*}
V & \rightarrow [+\text{back}] / V C_0 ____ \\
& \quad [+\text{back}] \\
V & \rightarrow [-\text{back}] / V C_0 ____ \\
& \quad [-\text{back}] \\
(\text{“collapsed”}) \ V & \rightarrow [\alpha \text{back}] / V C_0 ____ \\
& \quad [\alpha \text{back}]
\end{align*}
\]

(This is essentially the same as Hayes’ [feature_i]... [feature_i] notation.)
Rules for use of $\alpha$-notation in rules

- Minimum of two instances of $[\alpha F]$
  - one feature varies according to values of another

- $\alpha \ldots -\alpha$ is okay
  - e.g. for dissimilation

- Features don’t have to be the same.

Chamorro vowels:

\[
\begin{bmatrix}
+\text{syll} \\
-\text{low} \\
\alpha\text{back}
\end{bmatrix} \rightarrow [\alpha\text{round}]
\]
Nasal assimilation in Spanish

- If additional features independently co-vary, additional Greek letter variables are used ($\beta$, $\gamma$ etc.):

\[
[+\text{nasal}] \rightarrow \begin{bmatrix} \alpha_{\text{cor}} \\ \beta_{\text{ant}} \\ \gamma_{\text{back}} \\ \delta_{\text{distr}} \end{bmatrix} / \rightarrow \begin{bmatrix} +\text{obstr} \\ \alpha_{\text{cor}} \\ \beta_{\text{ant}} \\ \gamma_{\text{back}} \\ \delta_{\text{distr}} \end{bmatrix}
\]

Each feature assimilates independent of the other.

(Hayes' "[place]" (ch. 4) is essentially an abbreviation for sets of place features like these.)
Rule types

• Assimilation: Focus of rule takes on an element of the context

\[ V \rightarrow [\alpha \text{ back}] / V C_0 \]

[\alpha \text{ back}]
Harmony

• Type of assimilation rule (see Odden 8.2.1)
  – Phonetic origins of assimilation are coarticulation

• Focus of rule takes on an element of the context and (usually)
  – element of context need not be adjacent to the focus
  – the rule can apply more than once per word
Round Harmony does not apply to non-high vowels

\[
V \rightarrow [+\text{round}] / V C_0 \quad [+\text{round}]
\]

\[
V \rightarrow [-\text{round}] / V C_0 \quad [-\text{round}]
\]

collapsed:

\[
V \rightarrow [\alpha\text{round}] / V C_0 \quad [\alpha\text{round}]
\]
Derivations

• Illustrate the analysis, usually only included in more complex problems
• General schema

\[ /\text{UR}/ \ (\text{possibly morphologically complex}) \]

rule 1 \ (\text{result of applying rule 1})

rule 2 \ (\text{result of applying rule 2})

\ldots

\[ \text{[PR]} \ (\text{= phonetic representation}) \]

• Note: rule 2 applies to output of rule 1, not directly to the UR
Derivations

• A non-alternating root

\[
\begin{align*}
\text{UR} & \quad /ip - V/ & \quad /ip/ \\
\text{Final Devoicing} & \quad ^{-1} & \quad ^{2} \\
\text{Backness Harmony} & \quad [-\text{back}] \\
\text{Roundness Harmony} & \quad [-\text{round}] \\
\text{PR} & \quad [ipi] & \quad [ip]
\end{align*}
\]

1“-” can be included in a derivation to show that a rule does not apply to a form.

2Vacuous application—rule applies to form but no change occurs.
Derivations

• An alternating root

UR /sebeb - V/ /sebeb/

[+high]

Final Devoicing - p

Backness Harmony [-back]

Roundness Harmony [-round]

PR [sebebi] [sebep]
Caution: not a phonological derivation

/sebeb/

\[\text{[+high]}\]

‘reason’

‘reason’ (psd.)
Rule stages

• “/sebeb/ meets the structural description of Final Devoicing.”

• Final Devoicing

  C --> [-voiced] / ___ #

  structural description of rule: C #
  structural change of rule: C # [-voiced]

  form meets s.d. of rule: sebe b #

  (FD applies to word-final consonants. /sebeb/ contains a word-final consonant.)
Iterative rules

• Rules can apply more than once per word
  – Hayes 4.2.2: “If a rule matches up to more than one location in a form, it applies to all such locations…”

• A rule can apply to its own output

• A direction may be specified for rule application (L-R or R-L across word)

• In case of Turkish, L-R dictated by feature specification in UR < root/affix asymmetry

• (Another example: Choctaw, 6.1.4)
• ‘village’ (gen. pl.)
  
/kV̩y -lVr -Vn/
  -high -high +high
  -back -round
  +round

B.H.        -back           (1\textsuperscript{st} iteration)
             -back           (2\textsuperscript{nd} iteration)

R.H.        --
             -round

[köylerin]

• Note that 2\textsuperscript{nd} application of Backness Harmony applies to output of 1\textsuperscript{st} application of B.H., not directly to the UR
Summary of Turkish vowel harmony

- Turkish root vs. affix vowels
  - asymmetrical level of specification in UR
- Backness Harmony
- Roundness Harmony
  - interacts with [high]
- Both rules iterate
Practice

• Yakut vowel harmony
Typological perspective on Rounding Harmony

- **Turkish**
  - only high vowels undergo, all round vowels trigger

- **Kirghiz**
  - all vowels assimilate in rounding to preceding vowels except that [a] does not assimilate to [u]

- **Sakha (Yakut)**
  - high vowels undergo, round vowels trigger; nonhigh vowels are round if same height as trigger

- **Mongolian**
  - only nonhigh vowels undergo, only nonhigh vowels trigger

- **Yawelmani**
  - vowels undergo if same height as trigger
Harmony and assimilation

• Vowel assimilation
  – Vowels undergo, vowels or consonants may trigger
    ➢ Triggering vowels and undergoing vowels need not be adjacent

• Consonant assimilation
  – Consonants undergo, consonants or vowels may trigger
    ➢ Triggering segment typically adjacent to undergoing consonant