The direction of decay of Korean “vowel harmony” rule

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Korean “vowel harmony” rule

- Stem-final V decides the initial V of an adjacent suffix.
  - a-harmonic: stem-final /a,o/ ➔ a-initial suffix
    mak-a ‘block’, po-a ‘see’
  - ə-harmonic: other stem-final V ➔ ə-initial suffix
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Previous experimental and corpus studies

- It has been claimed as UNIDIRECTIONAL variation (Kang, H. 2012; Kang, Y&RYu 2015).
  
  - Existing stems
    Variations after /a/-final stems (ex) mal-a ~ mal-ə ‘roll’
    Conservative /o/-final stems (ex) mol-a *mol-ə ‘drive’
  
  - Nonce stems
    Variations after both stem-final /a, o/
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❖ Southern Chungcheong dialects  (Kwak 1999)

- Suffixes are /ə/-initial after all kinds of stem-final vowels.
  (ex) mək-əsə 'eat-reason',
    mak-əsə 'block-reason', cop-əsə 'narrow-reason'
Limitation of previous studies

• Since previous studies focused only on a-harmonic stem conditions, ə-harmonic stem-final vowels could not be compared under the same conditions as /a, o/. 
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• Bidirectional paradigm leveling across dialects

❖ Northern Kyeongsang dialects at the eastern coast (Kwak 1999)

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    (ex) mak-asə 'block-reason',
    
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\textbf{Every} stem-final vowel condition must be compared in order to figure out the direction of decay of Korean “vowel harmony” rule.
Alternation patterns of the initial vowels of verbal suffixes across various stem-final conditions
Research hypotheses

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1. **Unidirectional variations across speakers**
   - Every speaker allows disharmonic /ə/-initial suffixes only after **a-harmonic** stems (/a, o/-final).
Alternation patterns of the initial vowels of verbal suffixes across various stem-final conditions

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2. **Bidirectional variations across speakers**
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   - Other speakers allow disharmonic /a/-initial suffixes only after ə-harmonic stems.
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Alternation patterns of the initial vowels of verbal suffixes across various stem-final conditions

HYPOTHESES

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   • Other speakers allow disharmonic /a/-initial suffixes only after e-harmonic stems.

3. Bidirectional variations within speakers
   • Disharmonic suffixes are allowed after various stem-final conditions in responses from the same speaker.
Production experiment

- 17 Seoul Korean speakers (8♀, 9♂; average 26.7y)
  - 3 participants are excluded in the data analysis due to unnatural or non-canonical responses.
  - 1 participant is excluded in the analysis because of the random data distribution.

- **Stimuli**: 38 (C)VC(C) stems + 3 suffixation frames
  - Six stem-final vowel conditions: a, o, ə, u, i, ɨ
  - 14 existing stems
  - 24 nonce stems (pVp, pVph, pVm, pVlp)
  - Suffixation frames using ha- ‘do’
    - Sentence-final ~hæ
    - Non-final (serial verbs) ~hæ bat-ta [bat-t’a]
      ~hæ bəs-ta [bət-t’a]
밤다 + ~해
“ha-ta becomes hɛ, then what does pam-ta become?”

밝다 + ~해
“ha-ta becomes ʰɛ, then what does pam-ta become?”

밤다 + ～해

pam-a or pam-ə
Data analysis

- F1 and F2 of suffix-initial vowels and reference vowels (stem-final a and ə) in the same utterance
- Produced suffix-initial vowels are categorized based on relative Euclidean distance to reference vowels.
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Categorization of the log ratio measure using Gaussian Mixture Model (GMM)
Result 1: Fully bidirectional variations

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  - Blue bars: suffix-initial V after stem-final /a,o/
  - Red bars: suffix-initial V after other conditions
  - Left to the cross-point: classify as being a-like
  - Right to the cross-point: classify as being ə-like
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- **Red** bars: suffix-initial V after **other** conditions

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- Right to the cross-point: classify as being a-like
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Result 4: Unidirectional variations

- Ongoing unidirectional to $\emptyset$: 2 participants

- Blue bars: suffix-initial V after stem-final /a, o/
- Red bars: suffix-initial V after other conditions

- Left to the cross-point: classify as being a-like
- Right to the cross-point: classify as being $\emptyset$-like
Result 5: Unidirectional variations

- Almost completed unidirectional to ə: 3 participants
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- Almost completed unidirectional to \( \varepsilon \): 3 participants
Statistical analysis

Generalized Linear Mixed-Effects model (glmer in R) is fitted to the categorization results (a-like=1, ə-like=0).

Random effects:

Groups     Name        Variance Std.Dev.
participant (Intercept) 8.509    2.917
Number of obs: 4368, groups: participant, 13

Fixed effects:

(Intercept)         -2.97965    0.83569  -3.566 0.000363 ***
Stem exist vs nonce
result 0.84291    0.12102  -6.965 3.29e-12 ***
finalV a vs others
finalV av vs o     -0.67203    0.02272 -29.584  < 2e-16 ***
finalV i vs əu      -0.30385    0.06730 -4.515 6.33e-06 ***
finalV ə vs iu      -0.21154    0.05377 -3.934 8.34e-05 ***
finalV i vs u       0.25178    0.10277  2.450 0.014288 *
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1
Statistical analysis

The diagram shows a comparison of cluster values for different final vowels ('a', 'o', 'i', 'ə', 'ɪ', 'u') under two stem types: 'exist' (red line) and 'nonce' (blue line). The y-axis represents the cluster values, ranging from 0.0 to 0.6, while the x-axis represents the final vowels. Error bars indicate variability or uncertainty in the data.
Statistical analysis

The graph shows a comparison of cluster values for different stem types: exist and nonce. The x-axis represents final vowels (i, θ, i, u), and the y-axis represents cluster values. The graph indicates a-like pronunciation patterns for the specified vowels.
Fluctuations between two paradigms

- Across speakers, the direction and degree of decay of the “vowel harmony” rule vary.

- In the path of disappearance of naturalness of a rule, speakers try to find the new natural criteria to re-formalize the rule.

- There are many possible paths to re-generate an unnatural rule even in the same generation of speakers of the same dialect.
- **Bidirectional** inter-paradigm leveling
  
  - Small ratio of the size of the two target paradigms leads to bidirectional paradigm leveling (Zadok & Bat-El 2015).

The size ratio of the two harmonic paradigms of Korean calculated based on Sejong dictionary

<table>
<thead>
<tr>
<th>Paradigm</th>
<th>a-harmonic</th>
<th>ø-harmonic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stem-final V</td>
<td>a</td>
<td>o</td>
</tr>
<tr>
<td>Type freq</td>
<td>1046</td>
<td>386</td>
</tr>
<tr>
<td>Size ratio</td>
<td>1432</td>
<td>9236</td>
</tr>
</tbody>
</table>
Discussion

- Different degree of variation within same paradigm
  - Possible phonetic criteria: **frontness** of stem-final V

- The further **back** the vowel, the more likely it is to take **disharmonic** ə-initial suffixes: o > a
- The further **front** the vowel, the more likely it is to take **disharmonic** a-initial suffixes: i > i > ə, u
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Thank you

Kiitos 😊
References

- Kwak, Ch. 1999. moumcohwawa moumcheykyey [Vowel harmony and vowel system]. Saykwukesaynghwal, 9(4), 151-159.