Er-suffixation in Chinese monophthongs: phonological analysis and phonetic data

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Historically, the retroflex suffix /-ə-/ originated mainly from four morphemes (Chao 1968; Li 1986):

- (1) the diminutive /er/ 儿,
- (2) /ri/ 日 “day”,
- (3) the locative /li/ 里 “inside”, and
- (4) the perfective /le/ 了

Other, specific lexical items (see e.g. T. Lin 1982)
monophthong vowels in Beijing

- Phonetically, seven (not counting “er”, i.e.) single vowels: \([i, y, z̄, z̄, u, ɤ, a]\) (Cf. Chao, 1968)
  - \([z̄]\) only after dentialveolar /ts, tsʰ, s/
  - \([z̄]\) only after retroflex /tʂ, tʂʰ, ʂ, ʐ/
surface forms of /ə-/-suffixed single Vs

- **Pulleyblank (1984)**
  \[i, y, z, \dot{z}, u, y, a \] + /ə-
  \[> [jər, jwər, ər, ər, ur, ər/ər, ar]\]

- **Duanmu (2007)**
  \[> [jəə, həə, əə, əə, əə, uə, əə, əə, əə]\]

- **Li (1986)**
  \[ [iəɭ, əɭ, əɭ, ɣɭ, uɭ, əɭ, aɭ] \]
  \((ɭ, \text{Karlgren’s symbol} = \dot{z})\)


- **Y. Lin (1989)**
  \[ [iər, ər, ər, ɣər, ur, ər, ar]\]
Methodology (1) - recording

• Six (6) female and six (6) male speakers from the city of Beijing. Results from eight (4 male and 4 female) speakers will be reported here.

• The recording material: a randomized list of 350 x 2 disyllabic words, balanced for rhyme and tone, with the second syllable containing the target plain rhyme or er-suffixed rhyme.

• Equipment:
  – a sound-attenuated booth
  – a Shure® SM10A head-mounted microphone
  – a Marantz® solid state recorder.
Methodology (2) – data tagging

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Methodology (3) – taking measurements

• Formant measurements were taken with a Praat script (originally written by Mietta Lennes)

• Setting LPC parameters
  ◦ In general: 5 formants under 5000Hz for male and 5 formants under 5500Hz for female
  ◦ In an /ə/-suffixed form: 5/4500 for male and 5/5000 for female (esp. in non-front Vs)
Beijing monophthongs: “mid” F1 vs. F2 (female)

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Beijing monophthongs: “mid” F1 vs. F3 (female)
Beijing monophthongs + er: “early” F1 vs. F2 (female)

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Beijing monophthongs + er: “early” F1 vs. F3 (female)

F3

4000 3500 3000 2500 2000 1500 1000 500

F1

-200

-300

-400

-500

-600

-700

-800

-900

-1000

-1100

-1200

ir

uyr

e+tr

zhir

zir

er

ar

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Beijing monophthongs + er: “mid” F1 vs. F2 (female)

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Beijing monophthongs + er: “mid” F1 vs. F3 (female)
Beijing monophthongs + er: “late” F1 vs. F2 (female)
Beijing monophthongs + er: “late” F1 vs. F3 (female)
Changes in F1 ("mid") with er-suffixation

(Hz)
Changes in F2 ("mid") with er-suffixation
Changes in F3 with er-suffixation

(Hz)
Results – general patterns (2)

- F3 is lowered significantly \( (p < .05) \) across the board, except for \([ʐ̩]\).

- For the non-back Vs \([i, y, ʐ̩, z̩]\):
  - F1 is significantly \( (p < .05) \) raised \(↑\) in /ə/- suffixed forms
  - F2 is significantly \( (p < .05) \) lowered \(↓\).

- For \([ɤ]\): F1 and F2 are raised \(↑\) (marginally significant).

- For the low \([a]\): F1 and F2 are lowered \(↓\).

- For \([u]\): no significant changes in F1 and F2.
examples of [u] and [uː̃]
The formant structure of /u/ is mostly preserved, with the r-formant “super-imposed”. (Formant values were taken from mid vowel.)

<table>
<thead>
<tr>
<th></th>
<th>u</th>
<th>u + ζ</th>
</tr>
</thead>
<tbody>
<tr>
<td>F5</td>
<td>3635</td>
<td>3025</td>
</tr>
<tr>
<td>F4</td>
<td>2975</td>
<td>1760</td>
</tr>
<tr>
<td>F3</td>
<td>800</td>
<td>795</td>
</tr>
<tr>
<td>F1</td>
<td>390</td>
<td>445</td>
</tr>
</tbody>
</table>
Examples of plain and r-suffixed [ʐ̩]
Examples of plain and r-suffixed [z̩]
For /i, y/, the first 20% of the vowel is somewhat unaltered, followed by drastic downward movements in F2 and F3.

- Pulleyblank (1984: 53): /i; y/ + r-suffix > [ʃə, jwər]
- Duanmu (2007): [ʃəɭ, ɭəɭ]
- Y. Lin (1989): [ʃəɭ, ɭəɭ]
- Li (1986: 125-128): [ʃəɭ, ɭəɭ]
Examples of plain and er-suffixed /i/

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5000Hz

0Hz

jil-e  jil-m  jil-l

jirl-e  jirl-m  jirl-l
Examples of plain and r-suffixed /y/

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## Results for [i, y] (2)

<table>
<thead>
<tr>
<th></th>
<th>Female</th>
<th>i</th>
<th></th>
<th>ü</th>
<th></th>
<th>er</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>F1 (Hz)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>plain V</td>
<td>350</td>
<td>355</td>
<td>365</td>
<td>325</td>
<td>355</td>
<td>450</td>
</tr>
<tr>
<td>V+er</td>
<td>450(*)</td>
<td>655*</td>
<td>550(*)</td>
<td>445(*)</td>
<td>630*</td>
<td>560</td>
</tr>
<tr>
<td><strong>F2 (Hz)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>plain V</td>
<td>2765</td>
<td>2920</td>
<td>2880</td>
<td>2460</td>
<td>2320</td>
<td>2205</td>
</tr>
<tr>
<td>V+er</td>
<td>2465</td>
<td>1575*</td>
<td>1605*</td>
<td>1950(*)</td>
<td>1490*</td>
<td>1545*</td>
</tr>
<tr>
<td><strong>F3 (Hz)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>plain V</td>
<td>3670</td>
<td>3750</td>
<td>3620</td>
<td>2905</td>
<td>2795</td>
<td>2885</td>
</tr>
<tr>
<td>V+er</td>
<td>3230(*)</td>
<td>2175*</td>
<td>1990*</td>
<td>2635</td>
<td>2230(*)</td>
<td>2065</td>
</tr>
</tbody>
</table>
Examples of “ge1” and “ger1”
Examples of “ba1” and “bar1”
The formant values in the latter half of all /ə/-suffixed single vowels (except for /u/) are similar to the rhotic vowel /ɚ/.

The revised representations of the /ə/-suffixed single vowels: [jə, ʉə, ə, ɚ; u̯; ŋə, ə̯(ɚ)]

This is mostly consistent with Pulleyblank’s (1984) and Duanmu’s (2007) analysis, except that --

- Rhoticity is noted throughout the V
- The offglide in /u-er/ may not be perceptible.
Future research

◦ To compare all r-suffixed rhymes with their plain counterparts

◦ an articulatory study

◦ To compare Chinese with other languages with r-colored Vs
Selected References


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