A Preliminary Study on the Child Production of the Phonation Contrasts in Kunshan Wu

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INTRODUCTION

1. Tonal systems in modern Wu dialects consist of two registers that are associated with both pitch and voice quality [1, 2]
   (1) upper register tones – modal phonation
   (2) lower register tones – usually breathier phonation [3]
2. Our pilot study on adult speech in Kunshan Wu (a Northern Wu dialect) confirmed that the phonation type in the lower register tones is generally breathier [4].
3. Research on the child production of such phonation contrasts has become urgently needed because
   (1) the number of fluent Wu speakers is drastically decreasing in younger generations
   (2) the phonation contrasts tend to be lost among younger speakers in neighboring dialects such as Shanghainese and Suzhou Wu [5].

METHOD

1. Participants
   (1) Four native children (aged 7;2-8;6; 2M, 2F)
   (2) Mandarin-Wu bilinguals
2. Materials
   (1) 64 monosyllabic words in isolation
   (2) Onset types: stops /p, b, t, d, k, ɡ/, fricatives /f, v, s, z/
   (3) Vowel context: /a, ɛ, i/, /ɔ/
   (4) Five unchecked tones
3. Acoustic measures are extracted from VoiceSauce [6], averaged on normalized-time intervals (ninths of the vowel duration) and Z-normalized within each speaker
   (2) noise/apertureicticity: Cepstral peak prominence (CPP), the harmonics-to-noise ratios (HNR) in 0-500Hz, 0-1500Hz, 0-2500Hz and 0-3500Hz

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RESULTS

1. Across speakers
   - Measures
   - F0 (7;2)
   - F2 (8;4)
   - M1 (7;7)
   - M2 (8;6)

2. Within speakers
   - Measures
   - H1* - H2*
   - H2* - H4*
   - H4* - H2K*
   - H2K* - H5K

Table 1: Example words from the recording materials

<table>
<thead>
<tr>
<th>Tonal Category</th>
<th>Upper/Yin (a)</th>
<th>Lower/Yang (b)</th>
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<tbody>
<tr>
<td>Ping (1)</td>
<td>/kal/</td>
<td>/gal/</td>
</tr>
<tr>
<td>Shang (2)</td>
<td>青 ‘fake’</td>
<td>紅 ‘loosen’</td>
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</tbody>
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Figure 1: F0 contours of the citation tones in Kunshan Wu [4]

Figure 2: Results of SSANOVA on each measures across speakers

DISCUSSION

1. For at least one-third of the vowel duration, the lower register tones generally exhibit
   (1) higher spectral tilts
   (2) lower noise measures (i.e. noisier)
2. Most measures show diverse patterns among the children
3. Since the acoustic measures are believed to be related to various physiological aspects of producing breathiness, it is concluded that children aged at 7;2 or above can produce some type of breathier phonation as a phonetic feature of the lower register tones, while between-speaker variation may be explained by idiosyncratic factors or the characteristics of their primary caretaker’s speech.