Does Orthography Affect L2 Tone Production and Perception?

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Introduction
Chinese Orthography

- Chinese characters
  - Major writing system for different Chinese languages
  - Opaque (no consistent grapheme-to-phoneme correspondence)
  - No information about the tone
  - e.g., ‘horse’ 馬

- Mandarin Pinyin
  - Official Romanisation system of Mandarin
  - Transparent (good grapheme-to-phoneme correspondence)
  - Tone is indicated by a number
  - e.g., ‘horse’ ma³
Cantonese & Mandarin

- Shared orthography – Chinese characters
- Different phonologies, tones for example:

<table>
<thead>
<tr>
<th>Tones</th>
<th>Cantonese</th>
<th>Mandarin</th>
</tr>
</thead>
<tbody>
<tr>
<td>T1</td>
<td>55</td>
<td>55</td>
</tr>
<tr>
<td>T2</td>
<td>25</td>
<td>35</td>
</tr>
<tr>
<td>T3</td>
<td>33</td>
<td>214</td>
</tr>
<tr>
<td>T4</td>
<td>21</td>
<td>51</td>
</tr>
<tr>
<td>T5</td>
<td>23</td>
<td>–</td>
</tr>
<tr>
<td>T6</td>
<td>22</td>
<td>–</td>
</tr>
</tbody>
</table>
# C-M tone correspondence

**Tsang-Cheung (1988)**

<table>
<thead>
<tr>
<th>Cantonese Tone</th>
<th>Mandarin Tone</th>
<th>%Correspondence</th>
</tr>
</thead>
<tbody>
<tr>
<td>T1[55]</td>
<td>T1[55]</td>
<td>93%</td>
</tr>
<tr>
<td>T2[25]</td>
<td>T3[214]</td>
<td>89%</td>
</tr>
<tr>
<td>T3[33]</td>
<td>T4[51]</td>
<td>91%</td>
</tr>
<tr>
<td>T4[21]</td>
<td>T2[35]</td>
<td>93%</td>
</tr>
<tr>
<td>T5[23]</td>
<td>T3[214]</td>
<td>76%</td>
</tr>
<tr>
<td>T6[22]</td>
<td>T4[51]</td>
<td>94%</td>
</tr>
</tbody>
</table>
Production Model (Chu, 2011)
Research Question

• Whether activations of the L1 phonological system
  • Facilitates/hinders Mandarin tone production?
  • Facilitates/hinders Mandarin tone perception?
Method
Subjects

• 16 native speakers of Hong Kong Cantonese
  • 7 males, 9 females
  • 19-29 years old (mean = 23)
  • Students from the Chinese University of Hong Kong
  • Beginning learners of Mandarin (mean length of formal training = 2.6 years)
Materials - Production

- Pinyin task
  - mi [mi] and na [na] with all four tones
  - 2 syllables $\times$ 4 tones = 8 tokens
  - Written in Mandarin pinyin

- Chinese character task
  - ja [ja] and wu [wu] with all four tones (e.g., 壓 and 烏)
  - 2 syllables $\times$ 4 tones = 8 tokens
  - Written in Chinese characters
Materials - Perception

- **Pinyin task**
  - Disyllabic minimal pairs (e.g. can1 guan1 参觀 ‘visit’ vs. can1 guan3 餐館 ‘restaurant’)
  - 1 sets × 6 pairs = 6 minimal pairs
  - Written in Mandarin pinyin
  - Read by a Mandarin native speaker

- **Chinese character task**
  - Disyllabic minimal pairs (e.g., 字跡 zi4 ji4 ‘handwriting’ vs. 自己zi4 ji3 ‘oneself’)
  - 2 sets × 6 pairs = 12 minimal pairs
  - Written in Chinese characters
  - Read by a Mandarin native speaker
Procedures - Production

- Recording
  - All stimuli produced in isolation
  - 256 tokens collected
    - 128 Pinyin tokens
      (2 syllables × 4 tones × 16 speakers)
    - 128 Chinese character tokens
      (2 syllables × 4 tones × 16 speakers)
Procedures - Production

- Transcription

  - Transcriber: 3 native speakers of Mandarin
  - Agreed transcription of at least two transcribers accepted as the actual tone produced

<table>
<thead>
<tr>
<th></th>
<th>No. of tokens</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 transcribers agree</td>
<td>173</td>
<td>67.6%</td>
</tr>
<tr>
<td>2 transcribers agree</td>
<td>80</td>
<td>31.3%</td>
</tr>
<tr>
<td>No agreement</td>
<td>3</td>
<td>1%</td>
</tr>
</tbody>
</table>
Procedures - Perception

- Pinyin task
  - Write down the tones of the second syllables
  - Both words of each pair presented once
  - 192 responses (6 pairs \( \times \) 2 words \( \times \) 16 subjects)

- Chinese character task
  - Two-alternative forced choice task
  - Both words of each pair presented once
  - 384 responses (12 pairs \( \times \) 2 words \( \times \) 16 subjects)
Results
Production

- Pinyin task
  - %Err = 2.3% (only 3 errors out of 128 tokens)
- Character task
  - %Err = 43.4%
- $t(15) = -7.678$, $p < 0.001$
Production (cont.)

- Confusing T1 with T4, T2 with T3

<table>
<thead>
<tr>
<th>Confusable pairs</th>
<th>%Err</th>
</tr>
</thead>
<tbody>
<tr>
<td>T1-T2</td>
<td>0</td>
</tr>
<tr>
<td>T1-T3</td>
<td>0</td>
</tr>
<tr>
<td>T1-T4</td>
<td>0</td>
</tr>
<tr>
<td>T2-T3</td>
<td>0</td>
</tr>
<tr>
<td>T2-T4</td>
<td>0</td>
</tr>
<tr>
<td>T3-T4</td>
<td>0</td>
</tr>
</tbody>
</table>

- Confusability:
  - T1 with T4
  - T2 with T3

![Confusability Graph]
Perception

- Pinyin task
  - %Err = 47.9%

- Chinese character task
  - %Err = 11.7%

- $t(15) = 5.495, p < 0.001$
Perception (cont.)

- Confusing T1 with T4, T2 with T3
Discussion
Error Patterns

• T2-T3 pair
  • Also found in learners of other language background
• Possible accounts:
  • Acoustic similarity (Kirilloff, 1969)
  • Perceptual assimilation (Best, 1995)
  • T3 Sandhi
Error Patterns (cont.)

• T1-T4 pair
  • Not found in learners with some other backgrounds (cf. Kiriloff, 1969)
  • Possible account
    • Cantonese T1[55] has a falling allotone [53] (Mathews & Yip, 1994)
Pinyin vs. Character

- **Production**
  - %Err: Pinyin < character
  - Chinese character hinders L2 tone production

- **Perception**
  - %Err: Pinyin > character
  - Chinese character facilitates L2 tone perception
Production Model

(Chu, 2011)
Production

• Pinyin
  • Directly access L2 phonological representations
  • May not reach the concept level

• Chinese character
  • Sub-lexical route through the L1 phonological system
  • Corresponding rules may not have been correctly established
Perception

• Pinyin
  • Only need to reach L2 sub-lexical representation level

• Chinese character
  • Need to go through L1 phonological system

• However, pinyin %Err > character %Err
  • Possible account: top-down process in the Chinese character task
Conclusion
Conclusion

- Comparing with Pinyin, Chinese character
  - Hinders tone production
  - Facilitates tone perception

- Therefore, orthography plays an important role in L2 speech production and perception, especially when the learners’s L1 and L2 share the same orthography system.
References


Limitations

- Different task settings:
  - Pinyin perception (transcription) vs. Chinese character perception (2AFC)
  - Production (monosyllabic) vs. perception (disyllabic)

- Stimuli not well controlled
  - Word frequency
  - Segmental features
  - Character strokes
  - Cantonese-Mandarin correspondence