A Study on perceptual training of Japanese CSL Learner to Discriminate Mandarin Lexical Tones

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Outline

1. Introduction
2. Experiment
3. Results
4. Conclusion
1. Introduction—Mandarin Four Tones

Distinctive F0 patterns of Chinese four tones.

- Tone 1: high-level
- Tone 2: high-rising
- Tone 3: low-dipping
- Tone 4: high-falling
1. Introduction—Difficulties of Japanese Learner in Acquiring Mandarin Tones

- Problematic tone pairs: T2-T3
- T1-T4
- T1-T2
1. Introduction—Possible Main Reason

Poor performance

Perceptual difficulty

Japanese: Pitch-accented Language

Chinese: Tone Language

Perceptual Training!
1. Introduction—Perceptual Training

- Perceptual trainings for foreigners learning Mandarin tones.
    - Utilizing a wide range of highly variable natural syllables to make materials close to what happens in real-world speech processing.
  - Adaptive Training (Zou, 2012)
    - Synthesizing continua with the key acoustic cues continuously changing for training subjects to get native-like perception capability.
  - Hybrid Perceptual Training (Sun, 2013)
1. Introduction—Proposal

Problematic tone pairs

T1-T4

T1-T2

T2-T3 (most difficult)

Perceptual training Zou, 2012; Sun, 2013
2. Experiment - Procedure

1\textsuperscript{st} day  \rightarrow  2\textsuperscript{nd}-4\textsuperscript{th} days  \rightarrow  4\textsuperscript{th} day  \rightarrow  5\textsuperscript{th}-7\textsuperscript{th} days  \rightarrow  8\textsuperscript{th} day

- Pre-test
- Adaptive Training
- Mid-test
- High Variability phonetic training
- After-test

Acoustic continua + Chinese model

Chinese monosyllabic corpus
## 2. Experiment - Materials

<table>
<thead>
<tr>
<th>Test Type</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre/mid/after-test</td>
<td>132 continua stimuli</td>
</tr>
<tr>
<td></td>
<td>80 nature syllables</td>
</tr>
<tr>
<td>Adaptive training</td>
<td>132 Continua stimuli</td>
</tr>
<tr>
<td>High Variability phonetic</td>
<td>total 260 nature stimuli</td>
</tr>
<tr>
<td>Training</td>
<td></td>
</tr>
<tr>
<td>generalization test</td>
<td>new syllables</td>
</tr>
<tr>
<td>(60 nature stimuli respectively)</td>
<td>New speakers</td>
</tr>
</tbody>
</table>
T1-T2&T1-T4 Continua

- Unequal 10 steps, 11 stimuli of each pair
- 6 kind of syllabic structures
- 11 stimuli * 6 syllabic structures * 2 Tones

- da hua chuan
- di sui jian
# 2. Experiment - Japanese Subjects

<table>
<thead>
<tr>
<th></th>
<th>Experimental group</th>
<th>Control group</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Number</strong></td>
<td>8</td>
<td>8</td>
</tr>
<tr>
<td><strong>Gender</strong></td>
<td>5 female 3 male</td>
<td>8 male</td>
</tr>
<tr>
<td><strong>Average age</strong></td>
<td>24-year-old</td>
<td>29-year-old</td>
</tr>
<tr>
<td><strong>Length of Chinese learning</strong></td>
<td>1-month</td>
<td>3-month</td>
</tr>
</tbody>
</table>
3. Results - the Perceptual Model of Native Chinese Speaker

12 Native Chinese Speakers

Number

Accuracy

0%

100%

1 2 3 4 5 6 7 8 9 10 11

CH-T1

CH-T2

Number

Accuracy

0%

100%

1 2 3 4 5 6 7 8 9 10 11

CH-T1

CH-T4

2016/10/15
3. Results - Discrimination of continua

Results of perceiving T1-T2 continua before and after training,

Deviation scores of perceptual results of Chinese and Japanese in 3 tests: 0.25, 0.16, 0.12.

\[ Z_j = \sqrt{\frac{1}{11} \sum_{i=1}^{11} (S_{c,i} - S_{j,i})^2} \]
3. Results-Discrimination of continua

Results of perceiving T1-T4 continua before and after training,

![Graph showing results before and after training for Chinese and Japanese participants.](image)

Deviation scores of perceptual results of Chinese and Japanese in 3 tests: 0.15, 0.08, 0.07.

\[
Z_j = \sqrt{\frac{1}{11} \sum_{i=1}^{11} (S_{c,i} - S_{j,i})^2}
\]
3. Results - Identification of natural syllables

Accuracy of natural syllables identification in all tests.

<table>
<thead>
<tr>
<th></th>
<th>PRE</th>
<th>MID</th>
<th>POST</th>
<th>G1</th>
<th>G2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accuracy (%)</td>
<td>85</td>
<td>90</td>
<td>95</td>
<td>100</td>
<td>95</td>
</tr>
</tbody>
</table>

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3. Results - Identification of natural syllables

Two groups’ average relative rate of progress of natural syllables in 3 tests.

\[ R = \frac{E_1 - E_0}{E_0} \]
4. Conclusion

- Hybrid perceptual training could improve Japanese listeners’ perceptual ability of T1-T4 and T1-T2 in isolated Mandarin words.

- The ability could be generalized to new materials.

- Discrimination of T1-T4 pairs are much easier than T1-T2 pairs for Japanese subjects.
Thanks for your attention!

Q&A