Talker Differences in Speech Perception by Early English Learners in a Minimal Input Situation

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Handout available

- You can download a handout of this slide at the following site:

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Goal of this presentation

- To share with you research findings on effects of different talkers and background noise on the perception of English /l/ and /r/ by Japanese-speaking early and late learners;
- To discuss theoretical implications for early language learning in a minimal input situation:
  - The age of learning and the amount of input
  - The quality of input
  - Noise and talker variability
The earlier the better?

- Second language (L2) speech learning
  - Age of learning (AOL) (e.g., Flege 1999)
  - Amount of exposure (e.g., Flege & Liu 2001)
  - Quality and diversity of the input (Logan et al., 1991; Lively et al., 1993, 1994)

- To what extent is early language learning (ELL) in a foreign language setting (i.e., a minimal input situation) beneficial for L2 speech perception and production.

Significance of this study

- In ELL in EFL contexts, English lessons with a few hours’ classroom contact per week are given by nonnative speakers of English as well as native speakers.

- Early language learning in EFL contexts differs substantially in the amount of input and quality of input from early bilingual acquisition in naturalistic settings, which has been well documented in SLA studies (Flege, 1999; Flege, et al., 2006; Piske, et al., 2001).
Effects of ELL in EFL countries on L2 phonemic perception

- Perceivable age effects of English language learning in a minimal input situation on phonemic perception (Larson-Hall, 2008);
- No effects of early English learning in such a context on the perception of phonemes (Lin et al., 2004);
- However, only under background noise condition (i.e., white noise) did early L2 learning better affect L2 phonemic perception (Lin et al., 2004).

Non-native speech perception

- Adverse conditions
  - In background noise, early bilinguals are better than late L2 learners in the perception of speech (e.g., Mayo & Florentine, 1997).
- Talker differences
  - Non-native listeners are strongly affected by across-talker variability (e.g., Bent, Kewley-Port, Ferguson, 2010).
Research questions

1. Do early learners, who were minimally exposed to English in childhood for a few hours a week, outperform late learners, who started learning English in middle school, in the perception of L2 sounds?
2. Is the early learners’ perception more impervious to different levels of background noise than the late learners’?
3. Is the early learners’ perception more impervious to different talkers (i.e., gender) than the late learners’?

Method

Listeners
- 10 native speakers of American English;
- 18 Japanese university students who started studying English for a few hours a week between ages of three and eight (early learners (EL): equivalent to around 700 on the TOEIC);
- 20 Japanese university students who began to study English in junior high school at the age of twelve or thirteen (late learners (LL): equivalent to around 700 on the TOEIC).
### Method

#### Talkers
- Speech tokens were drawn from the vowel-consonant-vowel (VCV) corpus collected by Shannon et al. (1999).
- A total of 6 talkers, three of whom were men and the remaining three of whom were women.
- Talkers were chosen who had no noticeable regional accent (standard American Midwest dialect).

<table>
<thead>
<tr>
<th></th>
<th>AOL (year)</th>
<th>LOL (year)</th>
<th>K to Grade 6</th>
<th>Grades 7 to 12</th>
<th>Total Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Early Learners (EL)</td>
<td>5.4</td>
<td>11.2</td>
<td>209</td>
<td>875</td>
<td>1084</td>
</tr>
<tr>
<td>Late Learners (LL)</td>
<td>12</td>
<td>6</td>
<td>0</td>
<td>875</td>
<td>875</td>
</tr>
</tbody>
</table>
Method

Materials
- The selected target phonemes were word-medial approximants ([l, r]).
- Using MATLAB and COLEA, each of the tokens was combined with speech babble, the background sound of a group of people talking simultaneously.
- The signal-to-noise ratios (SNRs) were 8 dB (medium noise), and 0 dB (quite high noise for L2 listeners) (Cutler, 2008).
- For each noise condition, two tokens of each VCV (i.e., ala, ara) from the six talkers were used.

Method

Procedures
- A discrimination test was given in the ABX format (e.g., A: ala, B: ara, X: ala) using E-Prime 2.0.
- The listeners were asked whether the third word (X) was the same as the first (A) or second (B) in each trial.
Method

Procedures
- For each of the two conditions (i.e., medium noise and high noise), four trials (i.e., ABA, ABB, BAB, BAA) were presented with a repetition of each (4 trials x 2 conditions x 6 talkers x 2 repetitions = 96 trials for each participant).
- Examples
  - 8 dB (medium noise)
  - 0 dB (quite high noise for L2 listeners)

Data analysis
- The early and late learner groups did not significantly differ in an English language placement test at Waseda University (WeTEC), $F(1, 31) = .360, p = .553$.
- The data were submitted to a Group (2: EL vs. LL) x Condition (2) x Talker (6) three-way repeated analysis of variance (ANOVA).
**Results: Effects of ELL**

![Graph showing discrimination rates for early learners (EL), late learners (LL), and native speakers of English (NS) for /l/ and /r/. The error bars enclose ± one standard error.]

**Figure 1.** The mean discrimination rates of the early learners (EL), the late learners (LL), and the native speakers of English (NS) for /l/ and /r/. The error bars enclose ± one standard error.

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**Results**

**Effects of early language learning**

- A two-way ANOVA testing showed that the LL (M = 94.6, SE = 2.32) outperformed the EL (M = 87.4, SE = 2.45) in the discrimination test for /l/ and /r/ regardless of the noise condition and talker difference, $F(1, 36) = 4.566, p = .039$, partial eta squared = .113, power = .548).

- This may suggest that early language learning in a minimal input situation does not better affect L2 speech perception, and LL may be able to catch up with EL.
**Results: Effects of noise conditions**

**Figure 2.** The mean discrimination rates of the early learners (EL), the late learners (LL), and the native speakers of English (NS) for [l] and [r] in the different noise conditions. The error bars enclose ± one standard error.

**Results**

**Effects of noise conditions**

- The discrimination scores for the EL and LL groups varied significantly across the two conditions (condition: $F(1, 36) = 20.746, p < .001$, partial eta squared = .101, power = .856; condition x group: $F(1, 36) = 1.884, p = .178$).

- The noise affected both groups adversely, and the scores for the high noise condition for each group were significantly lower (EL, $p < .001$; LL, $p = .027$).
**Results**

**Effects of talker differences**

- Both the EL and LL had their L2 perception significantly affected by talker variability (talker: $F(3.27, 117.55) = 4.06, p = .007$, partial eta squared = .101, power = .856; talker x group: $F(3.27, 117.55) = 1.193, p = .314$).

- For the EL group, Talkers 1 ($p = .026$), 3 ($p = .010$), and 5’s ($p = .005$) speech was significantly negatively affected in the high noise condition, while for the LL group, Talker 1’s ($p = .034$) speech was.

*Figure 3.* The mean discrimination rates of the early learners (EL), the late learners (LL), and the native speakers of English (NS) for [l] and [r] in the different talkers. The error bars enclose ± one standard error.
Effects of talker differences (i.e., gender)

- The discrimination of the L2 groups was significantly affected by gender (gender: $F(1, 36) = 12.37, p = .001$, partial eta squared = .256, power = .928; no two- or three-way significant interactions).
- Pairwise comparisons show that only under the high noise condition were the female talkers more intelligible than the male talkers (EL, $p = .020$; LL, $p = .030$).

Figure 4. The mean discrimination rates of the early learners (EL), the late learners (LL), and the native speakers of English (NS) for [l] and [r] across the gender. The error bars enclose ± one standard error.
Summary of the findings

- The LL discriminated /l/ and /r/ better than the EL, which is consistent with García Lecumberri and Gallardos's (2003) findings.
- As opposed to Lin's (2004) hypothesis, the EL and LL's discrimination ability was more negatively affected in the high noise condition.
- Supporting Bent et al.'s (2010) findings, both the EL and LL underwent the significant impact of talker differences, specifically gender differences.

Discussion: Age of learning and amount of input

- These findings suggest that early language learning in a minimal input situation may not be beneficial to L2 speech perception.
- Larson-Hall (2008) found that the earlier learners usually outperform the later starters in the phonemic discrimination test “when the total hours (of instruction) were somewhere between 1500 and 2000.”
- The failure of the EL to outperform the LL in my study may be accounted for by the fact that the listeners’ total hours of instruction did not amount to at least 1500 hours.
Discussion: Quality of input

- Effects of L1 speakers’ input in childhood: Differences due to native-speaking English teachers (NESTs)
  - Out of the 18 early learners:
    - 4 learners received only L1 English input in childhood (i.e., taught by native speakers of English) (M = 91.3, SD = 6.02);
    - 3 learners received only L2 English input in childhood (i.e., taught by Japanese teachers of English) (M = 84.2, SD = 13.72);
    - 11 learners received both L1 and L2 English input in childhood (i.e., taught by both teachers) (M = 86.8, SD = 16.42).

Discussion: Quality of input, cont’d

- We cannot conclude whether or not a limited amount of L1 English input in childhood may work well later in life.
- There seems to be a tendency for the very early starters (ages 4–6) to do much better on the phonemic discrimination test if they had NESTs (Larson-Hall, 2008).
- However, her data also imply that after the ages of 4-6, the benefit of having NESTs may gradually decrease, and disappear around the age of 8.
The findings imply “the lack of robustness” of L2 listeners’ phonetic categories and their failure to use “multiple, redundant cues and appropriate cue weighting strategies” (García Lecumberri & Cooke, 2006).

The findings are consistent with Ferguson’s (2004) study showing that “the female talkers had significantly higher vowel intelligibility in clear speech than the male talkers.”

Discussion: Noise and talker variability
Conclusion and future work

- Because of the lower level of noise than I had expected and the easiness of the ABX format, the noise levels and the ABX format should be reconsidered;
- To investigate the quality of input in childhood, a subgroup should be made according to L1 or L2 English input;
- Due to the low power level (55%) for the groups, more participants should be recruited.

REFERENCES


REFERENCES


