# FACTORS AFFECTING SUCCESSFUL LATE LEARNERS' PHONEMIC DISCRIIMINATION BETWEEN /l/ AND /r/ IN ENGLISH

Tetsuo Harada

Waseda University
tharada@waseda.jp

## ABSTRACT

The view "the earlier the better" (e.g., [10]) may be a myth in a foreign language instructional setting (e.g., [1]). To identify successful late learners, this study compares early and late learners studying English as a foreign language in the situation of classroom minimal exposure to English, focusing on the perception of English consonants ([l, r]) produced by different talkers with and without noise. In addition, it clarifies what factors have influenced the success of late learners in perceiving the difficult phonemic contrast. The findings did not show any age effects of English input on the phonemic discrimination, regardless of the noise and talker variability. The successful late learners, who outperformed the early learners and did not differ from the native speaker group, were generally proficient in English and actively used English both in and outside of classroom.

**Keywords**: successful late learners, discrimination, age of learning, noise, talker variability

## 1. INTRODUCTION

Age of learning plays an important role in achieving target-like ability to both perceive and produce second language (L2) speech sounds (e.g., [4, 10]). However, the finding "the earlier the better" may be misleading and even a myth, depending on the context where L2 is learned. For example, Bongaerts [1] found that very advanced, highly successful late learners of English or French with a Dutch L1 background, who had learned the L2 in an instructional setting, had their pronunciation rated "native-like, or authentic" by native listeners. As Ushioda [13] suggests, context can be "conceptualized and operationalized as an independent background variable," and matters for two reasons. First, most studies on age of learning, including ones on the critical period hypothesis, have been done in L2 settings where immigrants living in English-speaking countries are much exposed to English on a daily basis. They do not necessarily give any implication about foreign language (FL) learning in an instructional, not naturalistic, setting. Among a very limited number of studies, some researchers (e.g., [8, 9]) worked on effects of minimal input in an FL setting on linguistic ability, and found that input has a stronger association with measures of oral performance than starting age. Second, why context matters is concerned about learners' linguistic competence being context-dependent in real language use. Language data should be collected in different situations and tasks. For example, Lin, Chang, and Cheung [5] showed that although they did not outperform late learners in the perception of English vowels and consonants in a quiet condition, early English learners in Taiwan performed better under a noise condition. Also, it is well known that variability among talkers affects speech perception. For instance, Ferguson [3] showed that female talkers' vowels were more intelligible than male talkers'. This suggests that we investigate learners' ability to perceive L2 speech sounds in an adverse context. Therefore, to identify successful late learners, this study compares early and late learners studying English as a foreign language (EFL) in the situation of minimal exposure, focusing on the perception of English consonants ([l, r]) produced by different talkers with and without noise. In addition, it clarifies what factors have influenced the success of late learners in perceiving the difficult phonemic contrast. Specifically, this study addresses the following research questions:

1. Do late EFL learners outperform early EFL learners in a discrimination task for /l/ and /r/ in English under adverse conditions (i.e., noise and talker variability)?
2. If so, what language learning experiences are beneficial for the successful late EFL learners' phonemic discrimination?

## 2. METHOD

### 2.1. Listeners

Two groups of Japanese learners of English participated in a phonemic discrimination test as paid subjects: 21 university students who started studying English for a few hours a week between the ages of three and eight (early learners), and 24 university students who began to study in junior high school at the age of twelve or thirteen (late

learners). In addition, the baseline data were collected from 10 native speakers of American English. Both L2 groups had a level of English proficiency equivalent to the average score of 700 on the Test of English for International Communication (TOEIC). The early and late learner groups did not significantly differ in an English language proficiency test at Waseda University, Japan (WeTEC) ($F(1, 42) = .136$, $p = .714$: one participant's test score was not available). The early learners' age of learning was around 5 and the length of learning in childhood was about 5 years up to Grade 6. They spent 1079 hours in total on average from kindergarten to grade 12. The late learners' age of learning was 12, their length of learning was 6 years, and they spent 875 hours in all from grades 7 to 12. This means that the early learners in this study spent an additional 200 hours between ages of 3 and 8.

### 2.2. Talkers

Speech tokens were drawn from the vowel-consonant-vowel (VCV) corpus collected by Shannon et al. [11], from which a total of 6 talkers (3 men and 3 women), who had no noticeable regional accent (standard American Midwest dialect), were selected.

### 2.3. Materials

The selected target phonemes were word-medial approximants ([l, r]). Each of the tokens was combined with speech babble (downloaded from [12]) at the signal-to-noise ratios (SNRs) of 8 dB (medium noise) and 0 dB (quite high noise for L2 listeners, [2]), using MATLAB and COLEA, a MATLAB software tool for speech analysis. For each condition, two tokens of each VCV (i.e., *ala*, *ara*) from the six talkers were used.

### 2.4. 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. For each of the two noise conditions, 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).

### 2.5. Questionnaire

To identify possible factors affecting late learners' L2 perception, a 6-point Likert scale questionnaire with 40 items was given on their language background including age of learning, length of learning, frequency of teacher's English use, students' comprehension of teacher's English, amount of oral practice in class, self-evaluation of pronunciation and listening, and amount of English use outside of classroom.

### 2.6. Data analysis

The data were submitted to a Group (3) x Condition (2) x Talker (6) three-way repeated measures analysis of variance (RM ANOVA). In addition, to identify significant factors affecting the late EFL learners' phonemic discrimination, a standard multiple regression was run.

## 3. RESULTS

### 3.1. Effects of background noise and talker differences

Figures 1 and 2 show the mean discrimination rates for [l] and [r] produced by the different talkers under the different noise conditions, obtained by the early learners (EL), the late learners (LL), and the native speakers of English (NS). Regardless of the noise and talker difference, the LL outperformed the EL (group: $F(1, 43) = 4.226$, $p = .046$; condition: $F(1, 43) = 24.932$, $p < .001$; talker: $F(3.57, 153.70) = 5.311$, $p = .001$; no interactions between them).

**Figure 1.** The mean discrimination rates of the early learners (Early), the late learners (Late), and the native speakers of English (NS) for [l] and [r] for the different talkers under the medium noise condition (8 dB).

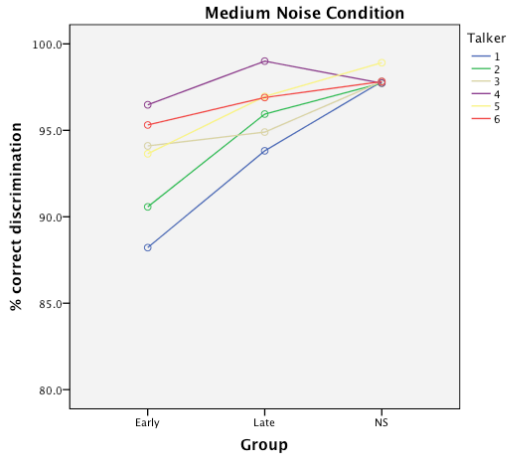
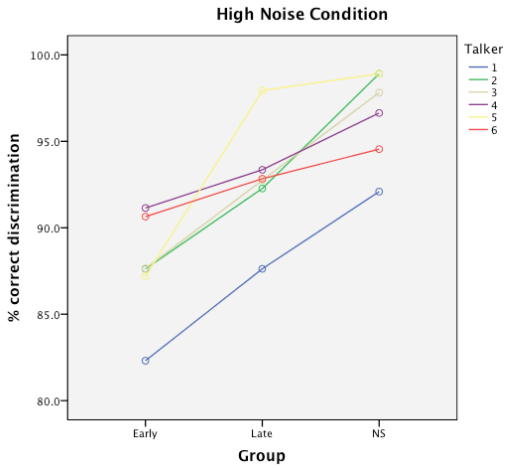


**Figure 2.** The mean discrimination rates of the early learners (Early), the late learners (Late), and the native speakers of English (NS) for [l] and [r] for the different talkers under the high noise condition (0 dB).




In addition, one-way ANOVA showed that the LL ($M$ = 94.0, $SE$ = 0.98) did not differ significantly from the NS group ($M$ = 97.6, $SE$ = 1.06) ($F(2, 55)$ = 4.726, $p$ = .013, partial eta squared = .147, power = .768).

### 3.2. Successful late learners and their language experiences

The Japanese-speaking LLs were more successful in discriminating the phonemic contrast between /l/ and /r/ in English than the ELs, and further, their performance was not significantly different from that of the NSs. To identify possible factors affecting these successful LL's perception, a separate standard regression was run for each of the dependent variables (i.e., the discrimination rates for 8 dB and 0 dB) with the following independent variables selected concerning their language learning experiences at the time of data collection:

- Teachers' English use (TEU)
- Students' comprehension of teacher's English (SCTE)
- Classroom interaction with teacher and peers (CITP)
- Use of spoken English outside of classroom (USE)
- Use of written English outside of classroom (UWE)
- Use of English at part-time job (UEPTJ)
- Self-evaluation of pronunciation (Self-EvP)
- Self-evaluation of listening (Self-EvL)
- English language proficiency test (WeTEC)

The model accounted for 86% of the variance in the successful LL's discrimination scores for 8 dB (the medium noise condition) ($R$ = .925, $R^2$ = .856, $df$ = 9, $F$ = 7.263, $p$ = .002), while it did not sufficiently account for the variance for 0 dB (the high noise condition) ($R$ = .817, $R^2$ = .667, $df$ = 9, $F$ = 2.448, $p$ = .082). Table 1 shows that the significant predictors were 1) the English language proficiency test, 2) classroom interaction with teacher and peers, and 3) use of spoken English outside of classroom.

**Table 1**: Results of a standard multiple regression analysis examining the relation between the total mean discrimination rate for 8 dB and learning experience factors obtained from the language background questionnaire.

| | B | t | Sig. | Zero-order | Partial | Part (unique) |
|---|---|---|---|---|---|---|
| Constant | 70.276 | 10.873 | .000 | | | |
| TEU | -.677 | -1.234 | .243 | .212 | -.349 | -.141 |
| SCTE | -1.585 | -2.135 | .056 | -.381 | -.541 | -.244 |
| **CITP** | 1.594 | 3.326 | .007 | .261 | .708 | .381 |
| **USE** | 4.169 | 3.737 | .003 | .063 | .748 | .428 |
| UWE | -.101 | -.104 | .919 | .078 | -.031 | -.012 |
| UEPTJ | -.277 | -.893 | .391 | .008 | -.260 | -.102 |
| Self-EvP | -3.063 | -3.432 | .006 | -.153 | -.719 | -.393 |
| Self-EvL | -1.857 | -2.225 | .048 | .236 | -.557 | -.255 |
| **WeTEC** | .053 | 6.419 | .000 | .575 | .888 | .735 |

These predictors indicate that the successful LLs may be learners who were generally proficient in English and likely to interact actively with their teacher and peers and use more spoken English outside of classroom.

## 4. DISCUSSION AND CONCLUSION

The findings did not show any age effects of English input in the EFL setting on the phonemic discrimination between /l/ and /r/, regardless of the noise and talker variability. The successful LLs, who outperformed the ELs and did not differ from the NS group in the phonemic discrimination skill, were generally proficient in English and actively used English both in and outside of classroom.

This suggests that age of learning may not account for the discrimination of similar L2 sounds by learners in FL settings, and it supports Bongaerts' [1] findings that highly successful learners reached the target-like norm of pronunciation. This implies that the idea "the earlier the better" may be misleading especially in the FL context where input is limited because factors other than age will interact differently with each other, and is comparable to Muñoz's [8, 9] view that input has a stronger

association with measures of oral performance than starting age.

What factors account for the success of the LLs in the phonemic discrimination? Frequent interaction with teacher and peers and use of spoken English outside of classroom may have led to more exposure to possible diversity of the input (e.g., [6]), which allowed them to develop a robust phonological category for /l/ and /r/. In addition, interaction in and outside of classroom (e.g., [7]) may play an important role in developing the perceptual accuracy of L2 sounds through the negotiation for meaning in real communicative situations, resulting in the learners' focus on phonetic form. Further, the requirement of a certain level of English proficiency assumes the minimum exposure to or input of English, whether in spoken or written form. It may be speculated that the more proficient learners are in English, the more aware they may be of the phonetic features or cues so that there will be more chance to fine-tune their phonological category.

Although this study will contribute to identifying the factors in affecting successful LLs' L2 speech perception, there are some limitations to note here. The overall discrimination scores ranged from 83% to 97%, which may lead us to consider the possibility that the ceiling effect happened. This possibly resulted from the lower level of noise than the researcher had expected and the easiness of the ABX format, where listeners could make a correct response only by listening to the last two tokens. The memory load for this format may be lower than other tasks. In addition, more participants may be required for the multiple regression analysis. Further research is called for to understand successful late learners' L2 speech perception in different and adverse conditions, contexts, and tasks.

## 5. ACKNOWLEDGEMENTS

This is a study supported by the Japan Society for the Promotion of Science (Grant-in-Aid for Scientific Research (C) 23520712). I thank Saya Kawase, Keiko Sato, and Toshinori Yasuda for helping me collect data, and I am grateful to the research participants for their time.

## 6. REFERENCES

[1] Bongaerts, T. 1999. Ultimate attainment in L2 pronunciation: The case of very advanced late L2 learners. In: Birdsong, D. (ed.), *Second language acquisition and the critical period hypothesis.* Mahwah, NJ: Lawrence Erlbaum Associates, 133-159.

[2] Cutler, A. 2008. Consonant identification in noise by native and non-native listeners: Effects of local context. *J. Acoust. Soc. Am. 124,* 1264-1268.

[3] Ferguson, S. H. 2004. Talker differences in clear and conversational speech: Vowel intelligibility for normal-hearing listeners. *J. Acoust. Soc. Am. 116*, 2365-2373.

[4] Flege, J. E. 1999. Age of learning and second-language speech. In: Birdsong, D. (ed.), *Second language acquisition and the critical period hypothesis.* Hillsdale, NJ: Lawrence Erlbaum, 101–132.

[5] Lin, H-L., Chang, H-W., Cheung, H. 2004. The effects of early English learning on auditory perception of English minimal pairs by Taiwan university students. *Journal of Psycholinguistic Research 33,* 25-49.

[6] Lively, S. E., Logan, J. S., Pisoni, D. B. 1993. Training Japanese listeners to identify English /r/ and /l/: The role of phonetic environment and talker variability in learning new perceptual categories. *J. Acoust. Soc. Am. 9*4, 1242–1255.

[7] Long, M. 1996. The role of the linguistic environment in second language acquisition. In: Ritchie, W., Bhatia, T. (eds.), *Handbook of second language acquisitio*n. New York: Academic Press, 413-468.

[8] Muñoz, C. 2011. Input and long-term effects of starting age in foreign language learning. *IRAL 49*, 113-133.

[9] Muñoz, C. 2014. Contrasting effects of starting age and input on the oral performance of foreign language learners. *Applied Linguistics 35*, 463-482.

[10] Piske, T., MacKay, I. R. A., Flege, J. E. 2001. Factors affecting degree of foreign accent in an L2: A review. *Journal of Phonetics 29*, 191-215.

[11] Shannon, R. 1999. Consonant recordings for speech testing. *J. Acoust. Soc. Am.* 106, L71.

[12] Signal Processing Information Base, The (SPIB). 2012. SPIB Infobases. http://spib.rice.edu/spib.html.

[13] Ushioda, E. 2011. Context matters: A brief commentary on the papers by Housen et al. and Muñoz. *IRAL 49*, 187-189.