

The Younger the Better: A Study under more Sensitive Conditions

周囲のノイズに対する影響とヒアリング能力の年齢差に関する研究

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ABSTRACT

Many aspects of linguistic competence may be used as criteria to evaluate the age factor on language learning. Among those aspects, phonological perception and production may be the most important, due to its essential role in verbal communication. The purpose of this study is to investigate the age factor in phonetic perception and production. The present study is focused on three important implementations:

- 1. to take a closer look at the relationship between age and phonological competence under sensitive conditions;*
- 2. to evaluate a wider range between age groups instead of age groups close together (e.g., pre-pubescent & post-pubescent students)*
- 3. to control for the influence of background knowledge by using a language unknown to the subjects.*

At the educational/practical level, in this study the researcher hopes to determine whether age affects auditory competence in distinguishing and producing minimal pairs at three age levels, under three different listening conditions. The age levels are 19-20 years old, the post-puberty period; 13-14 years old, the puberty period; and 4 years old, the pre-puberty period. The experiments were held (a) under normal conditions, (b) in a telephone situation, and (c) with background noise. To minimize the influence of background knowledge, the language used in materials was Turkish. All of the subjects heard Turkish for the first time. Results showed that even if no difference can be seen under normal conditions, the age groups' competence might differ under more sensitive conditions. In the telephone situation, age became a significantly effective predictor of phonological production.

KEYWORDS: Age-factor, Phonological perception, Language learning,
Phonological production

1. INTRODUCTION

An early start for language learning is believed to be better. However, is it really better? Many researchers have investigated the effects in second language learning (e.g., Burstall, 1985; Lenneberg, 1967; Snow & Hoefnagel-Hohle, 1978). Some studies suggested that late starters could catch up with earlier starters. If this is the case it might be wiser for policy makers in language education to postpone second language teaching up to the point when students' first language is more mature and stable enough to avoid the interference of the second language.

2. BACKGROUND

In 1967, Lenneberg suggested the Critical Period Hypothesis. He claimed that there is a critical period for language learning. He explains that the human brain loses its plasticity after puberty and loses its function of acquiring a new language (lateralization). Since then, however, a number of studies suggested that adults are better than children at learning a second language (L2); or older children are better than younger ones. For example, Snow and Hoefnagel-Hohle (1978) reported that older second language learners performed significantly better than younger learners.

Burstall's contrastive survey (1985) of English speakers who started learning French at the age of eight and eleven showed that older learners are consistently superior to younger learners. He found that the only exception was in the field of listening because the younger learners' scores for the listening test were higher. Cochrane (1980) evaluated the ability of Japanese children and adults to differentiate /r/ and /l/ sounds. He reported that, in terms of pronunciation, children have an advantage over adults. Higuchi et al. (1986, 1987, 1988, 1989) and Higuchi et al. (1990, 1991, 1992, 1993) found that Japanese students who started earlier were better in all four language skills: reading, writing, listening, and speaking.

Age also appears to be the most important predictor of degree of foreign accent (Flege, Yeni-Komshian & Liu, 1999; Piske, MacKay & Flege, 2001). Drawing conclusions from a comprehensive review of the literature, Long (1990) proposed that a native-like accent would be impossible unless first exposure was before six years of age, and that any individual who began learning a second language after the age of 12 would not be able to attain a native-like accent.

Some other researchers (Baker, Trofimovich, Mack & Flege, 2002; Munro, Flege & MacKay, 1996) have shown that early learners produce L2 vowels more accurately than most late learners. Thomas and S  n  chal (1998) investigated three-year-old children in their phoneme awareness of /r/ sound and its articulation. They suggested that the accuracy of the pronunciation is related to the quality of the phoneme awareness in young children. This shows that the accuracy of the L2 perception results in the accuracy of the L2 production.

Strange's study (1995) on phonological learning and development has shown that, without special training (in some cases even with special training), adults are often unable to discriminate differences in speech sounds that are not phonemic in

their native language.

Conversely, some researchers reported on the superiority of older children in the case of phonological perception. In these studies, subjects are all elementary school students and there is not much age difference. Nishio (1998) carried out a research on Japanese elementary school students' discrimination of English phonemes. As a result, 3rd/4th graders and 5th/6th graders scored significantly higher than 1st/2nd graders. Similarly, Nagai's review (2001) of Japanese elementary school students' ability to discriminate English phonemic contrasts reported that older students performed better.

In addition to the studies above, Mayo, Florentine and Buss (1997), and Lin, Cheng and Cheung (2004) tested the auditory perception of English minimal pairs with background noise. Both studies showed that age effects were salient under this condition. Without the interference of background noise, most subjects appeared to perform well enough to overcome any potential differences.

3. PURPOSE OF THIS STUDY

The purpose of this study is to investigate the age factor in phonetic perception and production. To be more specific, the present study has three important features: The researcher would like to take a closer look at the relationship between age and phonological competence under sensitive conditions; the researcher would like to include a wider range of age groups: a post-pubescent group, a pubescent group, and a group of prepubescent subjects; the researcher would like to control for background knowledge by using a language the subjects do not know at all.

A number of studies reported that there was no significant difference between the age groups and phonetic perception and production. If no difference can be seen under normal conditions, what if the conditions were more sensitive? As it is stated above, some research was carried out using background noise to make the conditions more sensitive. Also, there are some situations that are especially hard for foreign language learners. For example, it is very difficult for foreign language learners to hear and differentiate foreign words, especially in noisy situations and while listening on a telephone. To this end, this paper reports on the testing of subjects under normal conditions, in a telephone situation and with background noise. As was reported above, in many previous studies the age groups compared were very close to each other, and they did not compare young children with young adults. Moreover, very few studies have examined perception of non-native contrasts by young children.

4. SUBJECTS

There were three different age groups participating in this study - 20 preschoolers (4 years old), 37 junior high school students (13-14 years old), and 19 university students (19-20 years old). All subjects were Japanese and all reported never having studied or having listened to Turkish before.

5. MATERIALS

Turkish is the researcher's first language, and very few people in Japan know it. It was used instead of English to control for the previous language learning experience of subjects. Turkish has a variety of phonemes in its phonetic system, and the researcher has two years of experience teaching Turkish to Japanese learners and understands the phonetic characteristics of Turkish that Japanese learners generally have difficulty with (See the word pairs in Appendix A).

Questions were read by the researcher in the first and the third experiment. For the second test, questions were recorded with a high amplitude voice recorder and played with a tape player. For the third test, white noise was recorded with a high amplitude recorder and played with a tape player. All the tests were recorded with a video camera.

Listen and Differentiate test: As illustrated in Figure 1 below, the test's answer sheet for university students consisted of 10 questions with two choices,

1) 同じ (same) 2) 違う (different).

Q1	同じ	違う
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Figure 1. Example of the answer format for the Listen and Differentiate test

The subjects were supposed to circle 同じ (same), if the word pairs they heard were the same; 違う (different), if the pairs were different.

A special answer sheet was given to the preschoolers. As they cannot read, this kind of written test is inappropriate. Thus, the preschoolers answered the questions verbally, and they circled the cartoon characters (see Figure 2 below). Prior to the test, the researcher explained how to take the test, and the subjects completed a series of practice questions. The preschoolers were told that this is a game, and if they manage it, they would get stickers afterwards.

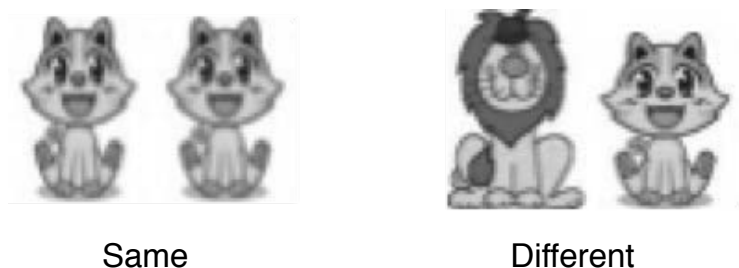


Figure 2. Example of the answer format for preschoolers taking the Listen and Differentiate test

6. PROCEDURES AND EVALUATION

6.1 Experiment I: Listening Under Normal Conditions

The researcher read each of the words and the subjects could see the researcher's mouth and tongue movement while completing the following two tasks:

(1) Listen and Differentiate test: Subjects listened to Turkish minimal pairs. The subjects were supposed to find out if the word pairs were the same or different. They were supposed to circle 同じ (same) if the pairs are the same, 違う (different) if the pairs are different. Preschoolers circled the cartoon characters as was mentioned above.

This test aimed to find out if age is an effective factor in differentiating foreign language phonological contrasts. Since none of the subjects had Turkish learning experience before, the previous learning experience was zero for all. One point was given when the subject could answer a question correctly. Full marks for Listen and Differentiate tests was 10 points.

(2) Listen and Repeat test: The subjects listened to word pairs and they were asked to repeat what they heard. Each Listen and Repeat test was staged independently between the subject and researcher.

All the Listen and Repeat tests were recorded with a video camera, which allowed the external evaluators both to hear the utterance and observe the subject's mouth and tongue movement.

The subjects were asked to repeat the utterances they heard. Each word was read twice and the subjects had to repeat the word twice. This format was decided to help the raters make a more informed assessment of speech skills. The recorded utterances were evaluated by the researcher and two external raters. All raters were Turkish teachers teaching Turkish to Japanese students at the Turkish Culture Center. Each rater's evaluation was conducted independently while watching the video recording of the test. The raters had a short practice evaluation session beforehand to conduct a more unified approach to evaluation. Each utterance was measured on a five-point scale: five points for native-like pronunciation, and one for poor pronunciation. Thus, the maximum score for a test item was five points. The average of the three raters' scores was then calculated to estimate the phonological abilities of each participant. This process of data analysis was repeated for each experiment separately.

6.2 Experiment II: In the Telephone Situation

This time, subjects performed the same tasks as Experiment I, but they listened to a tape player. Subjects listened without seeing the mouth and tongue movements of the speaker.

6.3 Experiment III: Background Noise Situation

For this test, artificial background noise, white noise was played with a tape player while the researcher read the words to the subjects. The same procedures were taken as in Experiment I and II for this third test.

7. DATA ANALYSIS AND RESULTS

7.1 Listen and Differentiate Test

First, the researcher examined whether there was a significant difference for the Listen and Differentiate test scores between the three groups under normal conditions, telephone situation and background voice situation one by one. All results were not significantly different among the three groups.

Then, the researcher compared Listen and Differentiate scores of the groups under all three conditions: normal conditions, on the telephone and under background noise.

Table 1

Descriptive statistics of the Listen and Differentiate test scores under all three conditions

	Level	Mean	Std. Deviation	N
Normal Condition	1	7.30	1.525	20
	2	7.46	1.145	37
	3	7.68	1.529	19
	Total	7.47	1.341	76
Telephone Situation	1	6.60	1.095	20
	2	6.92	1.479	37
	3	6.68	1.336	19
	Total	6.78	1.343	76
Noise Condition	1	7.10	1.334	20
	2	7.16	1.191	37
	3	7.21	1.475	19
	Total	7.16	1.286	76

Note: * Level 1: Preschool
Level 2: Junior High School
Level 3: University students

Since Mauchly's Test of Sphericity was suitable, the researcher conducted a Two-way ANOVA. The following table (Table 2) presents the results.

Table 2

Two-way ANOVA Listen and Repeat test scores under all three conditions

Source		Type III Sum of Squares	df	Mean Square	F	Sig.
Conditions	Sphericity Assumed	23.771	2	11.885	103.291	.000
	Greenhouse-Geisser	23.771	1.948	12.203	103.291	.000
	Huynh-Feldt	23.771	2.000	11.885	103.291	.000
	Lower-bound	23.771	1.000	23.771	103.291	.000
Conditions * level	Sphericity Assumed	3.920	4	.980	8.516	.000
	Greenhouse-Geisser	3.920	3.896	1.006	8.516	.000
	Huynh-Feldt	3.920	4.000	.980	8.516	.000
	Lower-bound	3.920	2.000	1.960	8.516	.000
Error (conditions)	Sphericity Assumed	16.800	146	.115		
	Greenhouse-Geisser	16.800	142.196	.118		
	Huynh-Feldt	16.800	146.000	.115		
	Lower-bound	16.800	73.000	.230		

The following are the results of the Two-way ANOVA:

1. A significant main effect of conditions was observed. The second condition (telephone situation) was much stronger than the other two conditions as all groups scored lowest in this section.
2. The Two-way ANOVA failed to produce a significant interaction between conditions and age level. ($p=.814$)

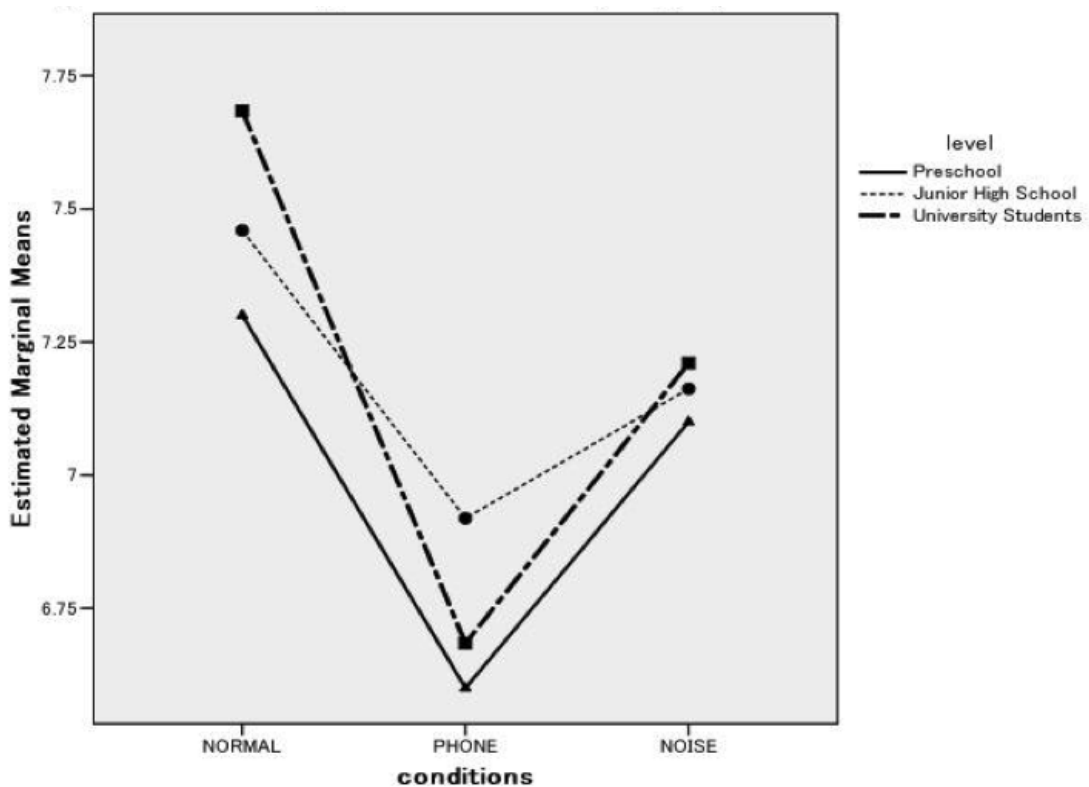


Figure 3. Listen and Differentiate test scores of the groups under all three conditions

7.2 Listen and Repeat Test

Next, the researcher examined the Listen and Repeat scores of the groups under all three conditions. Table 3 (below) reports on the descriptive statistics.

Table 3

Descriptive statistics of the Listen and Repeat test scores under all three conditions

	Level	Mean	Std. Deviation	N
Normal listen repeat	1	4.010	.4930	20
	2	3.703	.4687	37
	3	4.074	.1790	19
	Total	3.876	.4519	76
Telephone listen repeat	1	3.555	.4559	20
	2	2.976	.4816	37
	3	2.800	.2809	19
	Total	3.084	.5180	76
Background noise listen repeat	1	3.930	.8498	20
	2	3.314	.4768	37
	3	3.632	.1701	19
	Total	3.555	.6056	76

Note: * Level 1: Preschool
 Level 2: Junior High School
 Level 3: University students

Similar to the Listen and Differentiate analysis above, a Two-way ANOVA was used to test for a relationship between age-group and test scores. Table 4 (below) presents the results.

Table 4
Two-way ANOVA Listen and Repeat test scores under all three conditions

Source		Type III Sum of Squares	df	Mean Square	F	Sig.
Conditions	Sphericity Assumed	23.771	2	11.885	103.291	.000
	Greenhouse-Geisser	23.771	1.948	12.203	103.291	.000
	Huynh-Feldt	23.771	2.000	11.885	103.291	.000
	Lower-bound	23.771	1.000	23.771	103.291	.000
Conditions * level	Sphericity Assumed	3.920	4	.980	8.516	.000
	Greenhouse-Geisser	3.920	3.896	1.006	8.516	.000
	Huynh-Feldt	3.920	4.000	.980	8.516	.000
	Lower-bound	3.920	2.000	1.960	8.516	.000
Error (conditions)	Sphericity Assumed	16.800	146	.115		
	Greenhouse-Geisser	16.800	142.196	.118		
	Huynh-Feldt	16.800	146.000	.115		
	Lower-bound	16.800	73.000	.230		

The statistical analysis showed:

1. A significant main effect of conditions.
2. There was a significant interaction between conditions and age levels.

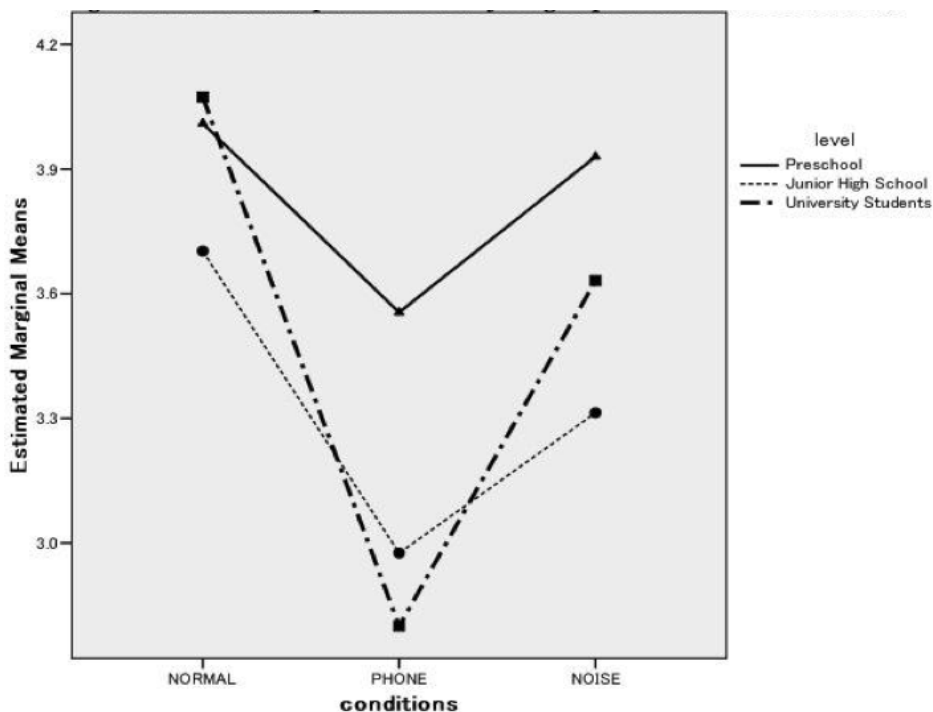


Figure 4. Listen and Repeat test scores of the groups under all three conditions

As observed in the Listen and Differentiate test above, all three groups scored their lowest scores in the second condition (telephone situation) for the the Listen and Repeat test. All three groups' performances can be ranked in the following order for both tests (from best to worst):

- (1) normal condition
- (2) background noise condition
- (3) telephone condition

This is the result of the significant main effect of conditions. The purpose of this study was to establish whether, under more sensitive conditions, a difference in performance among the three age groups could be observed. The results for pre-school students did not change much according to the three conditions, while the junior high and university students scored quite differently. The junior high students scored 1 point lower for telephone situation and 0.5 less in the background noise test. The university students scored 1.2 points lower in the telephone test and 0.8 points less in the background noise test.

8. CONCLUSION

The purpose of this study was to investigate whether the age factor is effective in phonetic perception and production. The study started with the assumption that "Even if any difference cannot be seen under normal conditions, age groups' competence may differ when the conditions become more sensitive." Listening experiments were held under normal conditions, a telephone situation and under background

noise. Another important feature of this present study was the age groups that were measured. The researcher carried out the study with three age groups: post-puberty group, puberty group and a pre-puberty group. The third important aspect of this study was the equality of the background knowledge about the language. All subjects heard Turkish for the first time. This way, the researcher avoided the effect of previous experience.

Based on the results observed, the thesis “Even if any difference cannot be seen under normal conditions, the age groups’ competence may differ when the conditions get more sensitive” has been confirmed. No statistically significant age effect was observed under normal conditions (both Listen and Differentiate and Listen and Repeat tests). Under telephone conditions, a drop off in overall performance for all three groups was observed in both tests. The poorer results are a reflection that such listening conditions were much harder than the first situation in which they were able to see the researcher’s mouth and tongue movements. Nevertheless, this study found that preschoolers were more likely to produce the correct sounds under these more challenging conditions.

In the telephone situation, starting age became a significantly effective predictor of phonological production in the test.

In this study, where white noise was superimposed upon the test setting without changing any material, background noise made a difference, but it did not have as much of an adverse influence on test performance as expected. Even if subjects could not perceive the sounds properly, they had a chance to imitate the researcher’s tongue and mouth movement. The results of the background noise situation for each group was between normal situation and telephone situation for all groups.

9. PEDAGOGICAL IMPLICATIONS & SUGGESTIONS FOR FURTHER RESEARCH

Some researchers stated that it is not simply age but other factors are important in language learning too. It is true that many factors affect foreign language pronunciation over a period of time such as the quality of experience, continuity over time, methods, environment and so on.

But still, we can claim that, if we talk about an ideal starting age for second language acquisition, the younger the better. As in this study all groups were exposed to Turkish language for the first time, and the preschoolers scored significantly higher than the junior high school and university students in the telephone situation and significantly better than the junior high school students in the background noise test.

It is hard to expect favorable results with a limited amount of experience and inadequate teaching supplies. Still, for the places and schools with adequate supplies and materials, we can suggest that younger students may have stronger phonological abilities. With appropriate teaching and a sufficient amount of time, second language teachers may be able to bring young learners’ intuitive phonological acquisition capacities into play.

As for the future study, several points can be suggested. The aim, at the

beginning of the study was to collect data from 40 university students, 40 junior high school students and 40 preschool students. However, the researcher was only able to collect data from 19 university students, 37 junior high school students and 20 preschool students. More conclusive results may have been observed if the same amount of subjects from each age group was measured. It is also reasonable to suggest that the reliability of the results would be enhanced if a larger sample was tested. Moreover, the research might be broadened if more age ranges participate.

In this study, clear differences between group performance were only seen in the telephone situation. The test of background noise situation suggested a difference among the groups but the difference was not as clear as expected. The researcher believes that this difference will be clearer if the study is conducted under different and more sensitive conditions.

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APPENDIX A

Same/different		
1	göz	güz
2	yem	yen
3	fasıl	fasıl
4	karın	kalın
5	sıfat	sıhhat
6	lambda	lambda
7	sıra	sıla
8	som	son
9	kızı	kuzu
10	kır	kir

Listen and repeat		
1	som	son
2	yer	yel
3	kızı	kuzu
4	sahur	savul
5	kış	kuş
6	şeh	şef
7	göz	güz
8	kalın	karın
9	itin	için
10	kır	kış