

**Reaction Time in Phoneme Recognition: A Comparative Study among Iranian Upper-Intermediate vs. Advanced EFL Learners at Institute Level**

**Mozhgan Fallah, Ramin Rahimy**

Department of English Language,  
Islamic Azad University, Tonekabon Branch,  
IRAN

[Mozhgan.Fallah@yahoo.com](mailto:Mozhgan.Fallah@yahoo.com), [Rahimy49@yahoo.com](mailto:Rahimy49@yahoo.com)

**ABSTRACT**

The present study aimed to investigate of reaction time in terms of phoneme recognition: A comparative study among Iranian Upper-Intermediate vs. Advanced EFL Learners at Institute level. The main question this study tried to answer was whether there is no difference in reaction time in terms of phoneme recognition in Iranian learners at Institute level. To answer the question, 5Upper-Intermediate EFL learners vs. 5 Advanced EFL learners participated in the experiment of the study. They were randomly selected from among a population of 50, both female and male, aged ranged 18-35 via an OPT test scores. They were then divided into groups of 5 and assigned to Upper-Intermediate group vs. Advanced group. A phoneme recognition test was administrated to both groups, then, they choose the correct pronunciation of each word at a definite time. The researcher preferred to use Independent-Samples T-test between the posttest of scores of the study. The researcher applied descriptive statistic to analyze data. The results indicated that Iranian Advanced EFL learners received higher scores vs. Upper-Intermediate EFL learners in terms of L2 phoneme recognition.

**Key words:** Reaction time, phoneme, recognition, phonology, Iranian EFL Learner.

**INTRODUCTION**

The growth of international relations of Iranian society with other nations highlighted the greater importance of English language as an international language compared to previous years. Pronunciation plays a central role in both our personal and our social lives. EFL Learners need to have some understanding of the role of phonology in language learning. For more than a century psychologists have used reaction time as a window into brain. Information is retrieved from memory when learning and essentially perfect. The researcher was intended to emphasize the investigation of reaction time in phoneme recognition which is supposed to lead to a communicative and interactive way of teaching phonemes.

**THEORETICAL FRAMEWORK**

Recognition and production of a word can be affected by how many other words are similar to it in pronunciation or spelling (Goldinger, Luce, & Pisoni1989; Grainger1992). Word production is

slower and more erratic when there are other words with a similar beginning; interference is not so pronounced when there are other words that have a similar ending (Sevold & Dell 1994). Additionally, recognition involves the access to the subject's long-term memory for the object being recognized. Access may be easier for more frequent words (Daniel D. Wheeler 1976). As Gerald Reicher (1968) pointed out when viewing time is very limited, people identify individual letters more accurately when the letters are presented in the context of a word than they do when letters are presented alone. In this excerpt from process in word recognition. According to Hick's law, choice reaction time increases in proportion to the logarithm of number of response alternative. There is a significant relationship between reaction time and reading ability (Hays (2009), Nicolson & Fawcett 1994).

More precisely, Wundt (1880) developed an application in which RTs were measured when a subject had to respond after he had identified a stimulus, and also when he had to respond after merely detecting its presence. Reaction time differs according to phoneme type (Van Ooijen, Cutler and Norris 1992; Cutler, Van Ooijen, Norris and Sanchez-Casas 1996). (e.g. Cutler et al. 1996) which have found differences between reaction times to vowels and consonants suggest that this is due to different processing strategies resulting from greater variability in vowels and consonants. As Cutler wrote, the choice of materials in a reaction time (RT) experiment is crucially important. Most previous work indicated that target phoneme duration was a significant factor in reaction time.

### **STATEMENT OF THE PROBLEM**

According to Posner (1969), when a single letter is presented aurally for memorization, the decision whether a visual test-letter is the same is facilitated by the internal generation of a visual representation of the memorized letter, which obviates the need to identify the test letter...

According to Morin (1967), a representation of the test stimulus is successively compared to representations of every item in a to-be-remembered set. One prediction from the theory is that reaction time to a stimulus probe should not be a function of the serial position of the probed item within the set to be remembered. This prediction was tested in a recognition memory task. The prediction was not confirmed in that RT was markedly influenced by the serial position of items to be recognized.

According to Johnson (1955), the reaction-time experiment suggests a method for the analysis of mental processes which turned out to be unworkable. According to Donders (1868), there is the subtraction method—a method for analyzing the RT into its components and thereby studying the corresponding stages of processing. To use the subtraction method one constructs two different tasks in which RT can be measured, where the second is thought to require all the mental operations of the first, plus an additional inserted operation. The difference between mean RTs in the two tasks is interpreted as an estimate of the duration of the inserted stage.

According to Sternberg (1966, 1967, 1969), people are able to apply to information in short-term memory; they decide whether some piece of information is being held in short-term memory. He develops a method for using reaction time—the time it takes to perform a very simple task under a particular set of conditions—to understand a particular cognitive process. Sternberg points out when people introspect about what they do when they search short-term memory, they usually report that they either check all the items at once or they check one item at a time and stop when they find the desired piece of information. Sternberg's discussion and evidence about the relationship between short-term and long-term memories, the effect of different kinds of information, the determination of where in a memorized list an item is found, and the difference between recall and recognition of context information have been excluded.

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According to Marinis (2011), Reaction Time (RT) is the time it takes for participants to react/respond to a stimulus. For example, in naming tasks, participants see a picture and have to name it. In naming tasks we can measure two types of information: accuracy and RTs. The accuracy rate shows how accurate participants are in naming the picture; the RTs measure how long it takes for the participants to name the picture. Children typically show longer RTs than adults and several studies have demonstrated that second language (L2) learners show longer

RTs than native speakers. RTs are measured in milliseconds (ms) and can be used in off-line and in on-line tasks.

### **Research Question of the study**

This study aims to explore answer to the following question:

**RQ:** Is there any difference among Iranian Upper-Intermediate vs. Advanced EFL Learners at Institute Level in terms of L2 phoneme recognition?

### **Hypotheses of the Study**

By making the following statement, the researcher is defining a tentative and suggested answer to question:

**HO:** There is no difference among Iranian Upper-Intermediate vs. Advanced EFL Learners at Institute Level in terms of L2 phoneme recognition.

## **REVIEW OF THE LITERATURE**

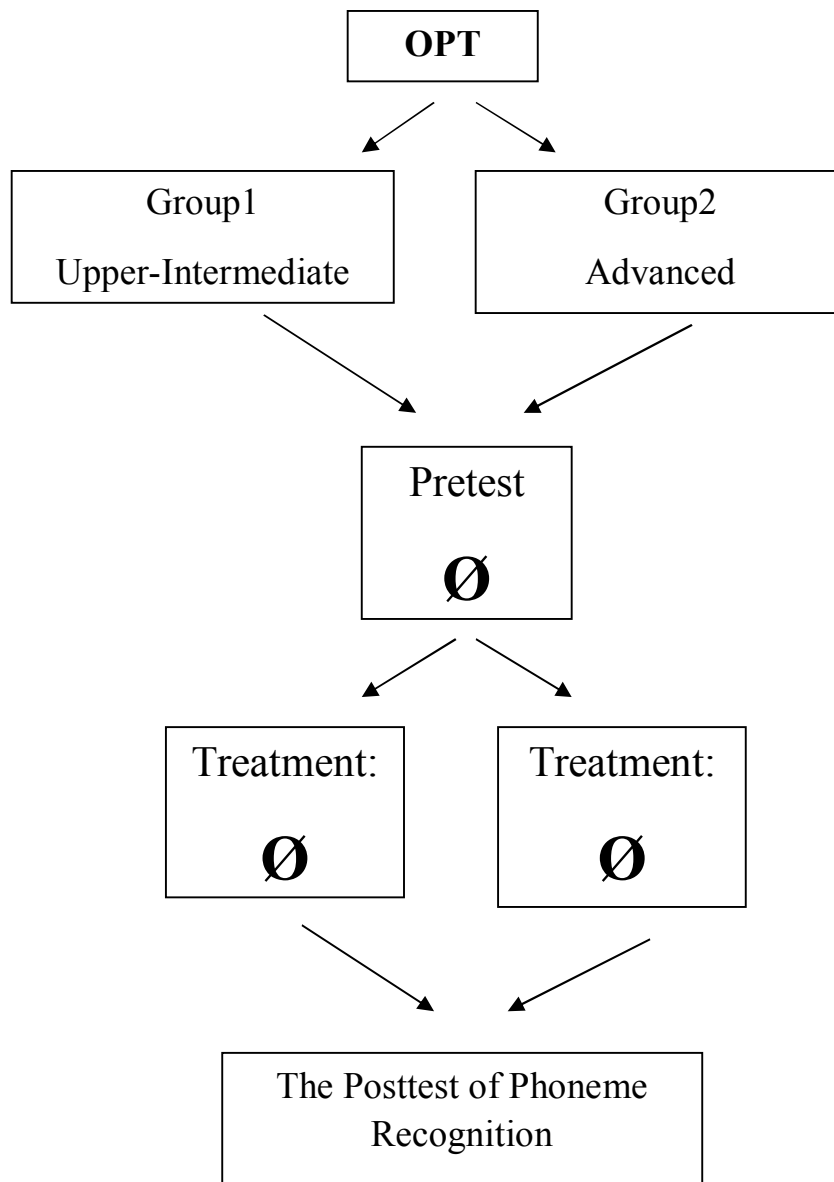
The central concept in phonology is the phoneme which is a classifiable category of sounds that all the native speakers of a language or dialect perceive as more or less the same. While phonemes are categories rather than literal sounds, they are not touchable things; instead, they are abstract theoretical types or groups that are just psychologically real. (In other words, we cannot hear phonemes, but we presume they exist for of how the sounds in languages patterns as they are used by speakers.)(T.E.Murray ,1995). Adam (1999); Lyon(1997); Stanovich (1986) pointed a strong correlation among children's ability to read and their ability to consciously analyze spoken words into phoneme. They stated phonemic awareness predicts reading ability. Children who have not even learned to read have difficulty consciously examining spoken words into their form phonemes. Rey et al (1998) investigated whether the presence of higher-order graphemes affected word processing times.( the possible role of subsyllabic components for the visual recognition of words in perceptual recognition task).The few studies that have investigated the effects of phonological neighbors on visual word recognition have reported null effects (Brown and Watson1994; Peerman and Content, 1997). Morton and Long (1976) found that phoneme targets on highly predictable words were responded to faster than targets on less predictable. Moreover Foss and Swinney (1973) pointed the basis of the finding that response

time to a word target was faster than response time to a phoneme target on that same word. Similarly, Rubin et al (1976) found that Phoneme-monitoring responses were faster when the target that targets beginning high-frequency words were detected faster than targets beginning low-frequency words. Cutler and Fodor(1979) believed that response time was shorter if the word beginning by the target was focused by context from preceding sentence. In several experiments, Foss and Gernbacher (1983) found evidence that monitoring responses were strongly determined by phonetic factors. Elenius and Blomberg(1992) pointed word recognition based on phoneme performs better than feature-based recognition for most speakers. Several measures of speed of processing were used to studied changes in the speed of information processing as a function of age. Kail (1991) pointed that speed of processing enhances exponentially from childhood to early adulthood. Ziyun Deng (2014) investigated that the role of phonological processing in reading comprehension among native and non-native English speakers. The researcher found native speaker's reaction time in phonological processing is positively associated with their passage reading time; On the other hand, non- native speaker' reaction time in phonological processing is negatively related with their passage reading time. The researcher established the negative English speakers might rely more heavily on meaning retrieving from the phonological information than non-native speakers. Research with non-native listener suggested that auditory word recognition is more harder in the second language than in the first language (e.g., Bradlow & Bent, 2002). As Cutler (1981) proposed, that choice the materials in a reaction time experiment is critically significant: Reaction time has shown to be greater when there is a mismatch among the phonological structure of foils and the target items (McNeil and Lindig1973). A mismatch among the target and stimulus context can lengthen reaction times (Mills1980), as can artificial shortening or lengthening of vowels preceding the stimulus (Martin1979). These results indicated that reaction time is majorly sensitive to small changes in stimulus, and that the design of reaction time stimuli should be undertaken with great care. Longer vowels are responded to more rapidly than shorter vowels (Cutler et al, 1996). Different types of segments have innately different duration, e.g. stops are normally shorter than fricatives. Therefore one may expect different reaction times for different segment types, and surely the effect of segment type on response time has been documented. West et al (2000) believed that duration has an important effect on reaction time in phoneme monitoring experiments, and found no consistent effect of the vowel-consonant distinction.

## METHODOLOGY

### The Design of the Study

The study followed a quasi-experimental design. The participants would be 10 Iranian Upper-Intermediate and advanced EFL learners selected via an OPT test from among a population of 50. The participants would be assigned into two groups. A test of phoneme recognition would be administered to both groups and the means would be compared using an Independent Samples T-test. The summary of the methodology was as follows:



Method

### **Participants**

The very first participants in this study included random language selected groups of 50 Iranian Upper-Intermediate and Advanced EFL learners, both male and female, aged ranged from 18-35. These groups were then classified into Upper-Intermediate and Advanced levels, 5 and 5 students, respectively in each. This classification was done by the Oxford Placement Test (OPT) as a general English proficiency test. The idea behind using the OPT was to make sure the homogeneity at the participants. The mean and standard deviation at the scores are calculated and participants whose scores, range within a one standard deviation above and below the mean in normal distribution curve are selected.

### **3.3. Materials used to run the research**

To run this study, the first material is the Oxford placement test (OPT), consisting 60 grammar and vocabulary items and to reading comprehension items and writing, which will be administered to the whole students of classes in order to homogenize the participants. and a test of words was adopted as the main data collecting instruments which involved 12 questions regarding terms of L2 phoneme recognition. However, all steps of developing a reliable and valid test taken prior to their actual administration.

Going into details, the OPT test used to determine the proficiency level of the participants. On the other hand, a test of words (i.e., 12 words for Upper-Intermediate students, and 12 words for Advanced students) was manipulated as the main data collecting instrument. The participants were asked to recognize phonemes when they watched words. The researcher then recorded the events to accurately analyze the data. The researcher utilized Stopwatch for recording reaction times of the participants.

### **Procedure**

The study aimed to seek whether there is no difference between Iranian Upper-Intermediate vs. Advanced EFL learners at Institute Level in terms of L2 phoneme recognition. To instigate, the researcher selected 25 Upper-Intermediate and 25 Advanced students, both male and female

aged 18-35, quit randomly, from different classes. Then, she gave the OPT and categorized them into two groups of 5 Upper-Intermediate and 5 Advanced participants based on their positions on normal distribution curve; + 1SD (Advanced), -1 SD(Upper-Intermediate), in order to have almost homogenous language learners in each group.

At this stage, the researcher attempted to determine whether there was any difference among Iranian Upper-Intermediate vs. Advanced EFL learners at institute level in terms of L2 phoneme recognition. At first, researcher prepared a multiple –choice test of words. These words that came from the Oxford Advanced learner’s Dictionary for recognizing of L2 phonemes. She gave a set of 12 words to the participants, for every word there were 4 different pronounces. Language learners saw words and were recognized the correct pronunciation in given time which checked them in 6 minutes. The given time for recognizing was 6 minutes. The researcher recorded their reaction times within a stopwatch. And so, she compared their reaction times of two groups with each other . for indicating which there was no difference between Iranian Upper-Intermediate vs. Advanced EFL learners.

### **Method of Analyzing Data**

The data collection was conducted in spring semester 2015 and involved the following instruments: OPT and multiple-choice test. OPT was applied to determined the level of the student's foreign language proficiency. The multiple-choice test was intended to recognize the correct pronunciation of each word used in test by the participants. In this study, the researcher utilized Independent Samples T-test between the posttest scores of the study, the independent t-test involves examination of the important differences on one factor or dimension among means of two independent groups or two experimental groups. For analyzing the researcher used SPSS 16.0 Statistical analysis.

## **DATA ANALYSIS AND FINDINGS**

### **The Descriptive Analysis of the Data**

This section focuses on the descriptive analysis of the obtained data in this study. Such analysis was done using the SPSS software. Table (1) shows the descriptive statistics for the posttest of phoneme recognition in the groups of the study:



Table 1 Descriptive statistics for the groups of the study

	Level	N	Mean	Std. Deviation	Std. Error Mean
Reaction Time	Upper-Intermediate	5	5.8000		1.92354
					.86023
	Advanced	5	8.2000		.83666
					.37417

As is indicated in table (1), the number of participants has been 5 in each experiment ( $N_{\text{Upper-Intermediate}}=5$ ;  $N_{\text{Adv}}=5$ ), and there have been standard error mean of Upper-Intermediate ( .86023) and standard error mean of Advanced(.37417). The mean for Upper-Intermediate scores was shown to be 5.8000 ( $\bar{X}=5.8000$ ) as compared to the mean for the Advanced scores which was 8.2000 ( $\bar{X}=8.2000$ ). As for the standard deviations obtained for the groups, there seems to be more variability among Upper-Intermediate scores than the scores in Advanced. Apparently, the means of the posttests of the two groups were significantly different; however, the significance of the difference between the means had to be determined when the t value could be calculated.

### The Inferential Analysis of the Data

This section focuses of the inferential analysis of the obtained data of this study. Such analysis was done using the SPSS (Statistical Package for Social Science) from which the 'Compare Means', 'Independent Sample Test' for calculating the t value.

Table2 the T-test results of the study

	T-test for Equality of means	Observed t	df	Sig.(2-tailed)
Reaction Time	Equal variances assumed		2.558	8
				.034
	Equal variances not assumed		2.558	5.461
				.047

As in indicated in table (2), the value of the study was calculated between the posttests of phoneme recognition the participants in the groups. The observed t value was calculated as to be 2.558( $t_{obs}=2.558$ ) and the degree of freedom was 5.461 ( $df=5.461$ ). Finally, the level of significance was calculated as to be .047( $P=.047$ ) which has been used in interpreting the data for the rejection or support of the hypothesis of the study in the next section.

### **Result of Hypothesis Testing**

In this section, the results of testing the hypothesis of the study have been presented and elaborated. In order to give a detailed analysis, attempts were made to take advantage of the results of the study as evidence to determine the rejection or support of the hypothesis. In addition, the rejection or support of the hypothesis was justified by explaining the consequences of such rejection or support, i.e. what would happen if the hypothesis of the current study was rejected or supported. Before analyzing the hypothesis, it will be repeated below:

**H<sub>0</sub>:** There is no difference among Iranian Upper-Intermediate vs. Advanced EFL Learners at Institute Level in terms of L<sub>2</sub> phoneme recognition.

The hypothesis of the study which targeted no difference among Iranian Upper- Intermediate vs. Advanced EFL Learners in terms of L<sub>2</sub> phoneme recognition was rejected. Evidence from various sources of data could help to verify the rejection. The results of the T-test of the study (see table 2) could be employed to confirm this analysis, accordingly, the observed t value calculated by SPSS was 2.558 ( $t_{obs}=2.558$ ) while the critical value of t determined on the basis of considering the 2-tailed significance level of 0.05( $P=0.05$ ) was 2.000( $t_{crit}= 2.000$ ). Thus, the observed t was higher than the critical t and high enough to reject the null hypothesis of the study.

The second evidence to verify the rejection of the hypothesis was the value of the level of significance calculated by the SPSS to be 0.047( $Significance_{2-tailed}= 0.047$ ). Since this value was lower than 0.05(based on the SPSS regulations), the difference between the means of the posttests of the study could not be by chance, and thus, the rejection of the hypothesis of the

study indicated that there is no difference among Iranian Upper-Intermediate vs. Advanced EFL Learners in terms of phoneme recognition in the groups of the study.

## **DISCUSSION**

### **General Discussion**

The research was to investigate whether there is no difference among Iranian Upper-Intermediate vs. Advanced EFL Learners in terms of L2 phoneme recognition, as well as, the probable significant difference between L2 phoneme recognition of two levels of language proficiency. To do so, the following question was raised:

1. Is there any difference among Iranian Upper-Intermediate vs. Advanced EFL Learners at Institute level in terms of L2 phoneme recognition.

However, the question was answered in the form of null-hypothesis.

In order to test the respective null-hypothesis, the two groups of Upper-Intermediate (5 EFL Learners), Advanced (5 EFL Learners) homogenized by an Oxford Placement Test (OPT), were asked to choose the correct pronunciation of each word in the test. To do so, the normal distribution assumption of the two groups of scores for OPT were met. Having selected the participants, the researcher-made multiple-choice test as the main data collecting instrument, in which a reliable and valid test, i.e. content validity, construct validity and reliability was taken prior to the actual assumption. The data captured through the word test was statistically analyzed to explore there is no difference among Iranian Upper-Intermediate vs. Advanced EFL Learners in terms of L2 phoneme recognition.

Concerning the research question, Independent-Samples t-test was run on the results of the test, which revealed that there was non-significant difference among Upper-Intermediate vs. Advanced EFL Learners in terms of L2 phoneme recognition. Therefore, it can be concluded that the null-hypothesis as there is any significant difference among Iranian Upper-Intermediate vs. Advanced EFL Learners in terms of L2 phoneme recognition, is rejected. To achieve the goal, an Independent-Samples t-test was run to compare the mean scores of reaction times in terms of L2 phoneme recognition for two groups. From table 4.1 it can be concluded that: there was a significant difference mean between Upper-Intermediate vs. Advanced EFL Learners.

That is to say Advanced learners showed a significantly higher mean in reaction time in terms of L2 phoneme recognition. As a general conclusion, the statistical analysis rejected the assumption among language proficiency levels and reaction times of them in terms of L2

phoneme recognition. Furthermore, qualitative findings are in line with the quantitative ones, as they revealed that learners in Advanced level had higher reaction time in terms of L2 phoneme recognition than learners in Upper-Intermediate level. The findings of this study are supported the findings of Van Ooijen et al (1992) believed that the reaction time differs fitting in phoneme type. Also, the findings of Cutler et al (1996) that have found differences among reaction times to vowel and consonant suggested that this is due to different processing strategies resulting from greater variability in vowel than consonants. The findings a of this study are supported the findings of West et al (2000) believed that duration has an important effect on reaction time in phoneme monitoring experiments, and found no consistent effect of the vowel-consonant distinction. The findings of this study are apposed the findings of Foss and Swinney (1973) pointed that the basis of the finding that response time to a word target was faster than response time to a phoneme target on that same word

### **Implications of the Study**

In this section, application of the findings will be discussed to shed light on objectives and significance of the study: theoretically the findings explore no difference among two levels of language proficiency in reaction time in terms of L2 phoneme recognition. In other word, the study of reaction time in terms of L2 phoneme recognition involve discovering how participants with different language proficiency levels recognize the terms of L2 phoneme in given time. So, the finding cast a shining light on the phonology, though there still remain rooms for further studies to suggest a strong and solid theory.

The main beneficiaries of this study are EFL teachers, in that they can get more insights into the reaction time of learners in terms of L2 phoneme recognition. Therefore, they would be one step forward in understanding learners' problems regarding their phoneme recognition ability. They would probably find a communication and attractive way of teaching phonemes.

Moreover, the implication of the study can help students in that they would be more aware of their difficulty and ambiguities while phoneme recognizing, so that they would develop their own phoneme recognition abilities.

### **Suggestions for further Research**

The main purpose of the study was to explore reaction time in term of L2 phoneme recognition among Iranian Upper-Intermediate vs. Advanced EFL Learners. Thus, the data were collected only to study reaction time in terms of L2 phoneme recognition. Therefore future studies may

have a comparative look towards to reaction time in terms of L1 and L2 phoneme recognition. On the other hand, unlike this research which studied reaction time in terms of L2 phoneme recognition among Upper-Intermediate vs. Advanced EFL Learners, another one might implement the research among Intermediate vs. Advanced EFL Learners. This study was to investigate reaction time in terms of L2 phoneme recognition among Iranian Upper-Intermediate vs. Advanced EFL learners at Institute level, another one examines reaction time in terms of L2 phoneme recognition among Iranian Upper-Intermediate vs. Advanced EFL learners at University level. In this study 10 EFL learners participated, another one, the researcher take parts more than 10 participants in the study.

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