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A STUDY OF THE EFFECT OF AGE IN THE PRONUNCIATION OF ENGLISH VOWELS BY SPANISH SPEAKERS

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ABSTRACT: This pilot study examines the role of age in the acquisition of English vowels by six native speakers of Spanish. The speech of three ESL adults and three ESL children were tape-recorded and analyzed by 7 judges and the software Multi-Speech. Their speech was analyzed phonologically by using a spectrogram and formant frequency of F1 and F2 (in Hz) of each vowel studied creating a basis for a comparison to the standard pronunciation of vowels in English produced by 76 native speakers reported by Peterson and Barney (1952). The final results of this experiment supported the findings by other researchers, which favor the "younger is better" hypothesis (Asher & Garcia, 1968; Fathman, 1975; Fathman & Precup, 1983).

Introduction:

The following pilot study examined whether children are better than adults in acquiring a native-like accent in pronouncing English vowels in certain words and short sentences. The main purpose was to investigate whether the age of exposure (immersion) of the six native speakers of Spanish had an effect on their pronunciation of vowel sounds in English. The subjects had had less than three years of immersion in the U.S. at the time of study. The adults were all professionals in their respective countries, obtaining their masters' or doctorate degrees in the U.S., and the three children were either in junior high or high school. The words and sentences were tape-recorded to be analyzed by 7 judges (students of Linguistics), and by the use of the (a) Multi-Speech computer program.

Age Factor in Second Language Acquisition:

One of the most widely studied factors in both first and second language acquisition is the role of age. The general belief has traditionally been that younger is better, but among researchers there are conflicting opinions about this issue, which is not surprising due to the many variables that are involved in the process. Biological and environmental factors change from person to person; therefore, there is always a great risk in the overgeneralization of findings, especially in second language acquisition, where the native language and learning

mode become additional variables. Thus, the notion of a critical period for second language acquisition has largely revolved around divergent positions. The question has been raised whether younger and older learners adopt different approaches to second language acquisition.

The evidence about age-related differences in acquiring a second language perfectly is very conflicting (Singleton, 1989; Bolotin, 1997). For example, Asher & Garcia (1969) conducted an experiment, which revealed an interaction between age of entry and length of residence. The study indicated that age of entry was the better predictor of successful acquisition of pronunciation. Although none of the 71 subjects were deemed to have a native pronunciation, a correlation was found to exist between the child's age at the entry to the U.S. and the probability of a native-like pronunciation. Of the 71 subjects none were to have native pronunciation however; the younger the child had been when entering the U.S., the higher the probability of native-like pronunciation. Oyama's (1976) study showed an even stronger similar correlation; generally the subjects who entered the U.S. before the age of 15 tended to do better. Various other studies (Fathman, 1975; Fathman & Precup, 1983) have indicated that children in both formal and informal situations score better than adults in English pronunciation while adults score better than children in syntax.

Evidence favoring the hypothesis that older second language learners are more successful than younger ones comes mostly from short-term experimental research (Singleton, 1989). Asher & Price (1967) conducted a study where 96 pupils from second, fourth and eighth grades and 37 undergraduate students were taught Russian in three short training sessions. The adults, on average and at every level of linguistic complexity, consistently outperformed the children and adolescents. Other studies (Olson & Samuels, 1973; Ervin-Tripp, 1974) have showed that adolescents and adults second language learners outperformed children in terms of pronunciation. Finally, the best evidence in favor of the short-term/long-term distinction (i.e. adults outperform children in the short term, but in the long run, children outperform adults) was found in the studies by Snow & Hoefnagel-Höhle (1977, 1978). The results of their study suggested that 'whether or not older learners have an initial advantage in respect of second language phonetics/phonology, any such advantage is short-lived, at least in a natural exposure situation' (Singleton, 1989, p.120).

Finally, including and controlling all possible variables in one study is very difficult or impossible to accomplish. However, as researchers, we should not give up on the quest for answers. More studies are needed in this area, and even though the results are not definitive, every piece of research based evidence will contribute to a better understanding of how the process of learning a second language works for both children and adults.

Linguistic Property:

The accent of the subjects were tested in producing orally the following English vowels sounds:

Front Vowels: /i:/ as in *Jean*; /ɪ/ as in *dish*; /e/ as in *get*; and /æ/ as in *fat*

Central vowels: /ɜ:/ as in *work*; /ʌ/ as in *lunch*; /ə/ as in *Bob*

Back vowels: /u:/ as in *blue*; /ʊ/ as in *book*; /o:/ as in *old*; /ɔ:/ as in *song*

Subjects:

Participating in the experiment were six native speakers of Spanish. They took part in this study voluntarily. All of them were studying at U.S. universities and/or high schools. Their names below are pseudonyms. The following is a description of the subjects in this pilot study:

First Group Teenagers: Three Spanish speaking teenagers, Anna: 11-year-old female, six months of immersion; Beatriz: 12-year-old female, fifteen months of immersion; and Carlos: 16-year-old male, fifteen months of immersion.

Second Group Adults: Three Spanish speaking adults, Enrique: 40-year-old male, one year and a half of immersion; Francisco: 32-year-old male, one year and a half of immersion; and Gerardo: 35-year-old male, two years of immersion.

Control Group 76 native speakers found in the study of Peterson & Barney (1952).

Variable	Children		Adults	
	Mean	Range	Mean	Range
Age at Testing	16	11-16	34.6	32-40
Age Arrival in U.S.	12	11-15	33	31-36
Years in U.S.	10 months	3-13 months	1.2	1-1.8
Years of Education	10	8-12	19	18-19

Chart 1 General information about the participating subject

Materials:

The materials in this experiment consisted of four short sentences and ten words similar to the ones shown in Chart 2 below.

Front Vowels	Central Vowels	Back Vowels
Sheep /iy/	Work /er/	Food /uw/
Ship /I/	Lunch /^/	Foot /U/
Fat /æ/	Drop /a/	Saw /o/

Chart 2 Words used in the study with their respective phonemes.

Procedure:

Individual recording sessions were held in the subjects' homes. The subjects were given five written statements to pronounce or read aloud into a tape recorder. Each participant was tape-recorded only once. That is, the participants could not go back and read the words or sentences again. Each stimulus was provided in written form on a sheet of paper. Each session lasted about 5 minutes. The following were the stimuli given:

1. She saw a sheep on a ship.
2. Her food was on his foot.
3. The big cat ate its lunch.
4. Bob took the yellow cap.

Each of the following words was shown to the subjects one by one for about 4 seconds. The purpose was to have the subjects produce the words (vowels) in isolation.

- | | |
|-----------|---------|
| 1. peak | 6. pick |
| 2. fat | 7. work |
| 3. lunch | 8. drop |
| 4. food | 9. foot |
| 5. yellow | 10. saw |

The recordings were transferred to a computer for further analysis (spectrogram). In addition, seven judges listened to the subject recordings in order to rate the level of accent using a pronunciation-rating guide.

Analysis:

Two procedures were employed in the data analysis. First, the recordings of each subject were examined by a group of phonetically trained judges to rate degree of accent by using the following pronunciation scoring guide: **1**=Very strong accent; **2**= Strong accent; **3**=Slight accent (near-native); **4** =Native

The raters were asked to judge how well each word was spoken. Each recording was played once and the raters did not know the subject were non-native speakers of English. Second, with a Multi-Speech software, each word and sentence was analyzed phonologically by using a spectrogram and formant frequency of F1 and F2 (Hz) of each vowel (see Figure 1). In this way, the produced vowels could be compared to the standard pronunciation of vowels in English produced by 76 native speakers including men, women and children reported by Peterson and Barney (1952).

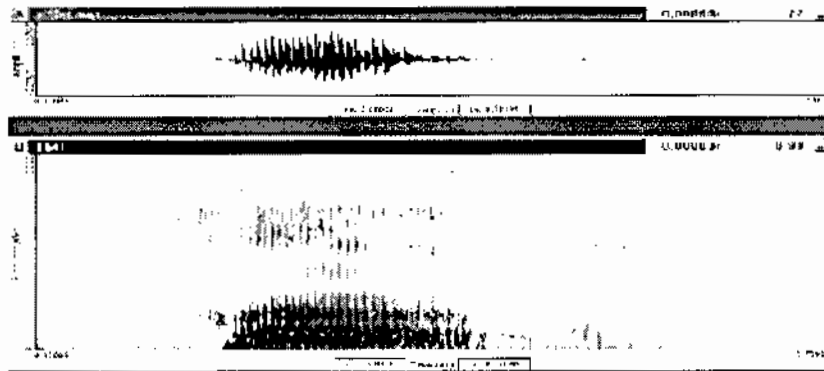


Figure 1 Oscillogram (wave form) and spectrogram of the word “fat” produced by an ESL adult, which has the vowel sound /æ/

Results of the Study:

Procedure 1 It is important to note that a relatively high correlation existed among the judges (80% agreement) who rated the subjects (interrater agreement). In other words, the judges’ ratings of the subjects were very similar. Chart 3 shows the average scores given by the judges to each subject:

Vowels	M40*	M32	M35	M16	F11	F12	Mean	SD
Fat	3	2.9	2	3.7	2.9	3.9	3.1	0.7
Peak	2.3	1.7	1.3	4	3.2	2.9	2.6	1.0
Foot	1.6	1.9	2	2.9	2.3	2.8	2.3	0.5
Saw	2.4	2.6	2	3.7	3.6	4	3.1	0.8
Lunch	3	2	2.1	3.3	2.8	3.7	2.8	0.7
Food	1.9	1	1.9	3.3	2.7	3.4	2.4	0.9
Yellow	2.7	1.6	1	3.4	3	3.9	2.6	1.1
Pick	2.3	2.6	2.3	3.3	3	3.7	2.9	0.6
Work	2.4	1.4	2.4	3.4	2.7	3.5	2.6	0.8
Drop	2.9	1.3	2.7	3.6	3.1	4	2.9	0.9

Chart 3 Average scores rated by judges. *M40: 40-year-old male, M32: 32-year-old male, M16: 16-year-old boy, F11: 11-year-old girl, F12: 12-year-old girl

The ratings of the judges show the children as outperforming the adults. Whereas most of the children were judged to have a slight accent (3 and above) the adults were found to have a strong accent to very strong accent (see Figure 2).

English Vowel pronunciation accent

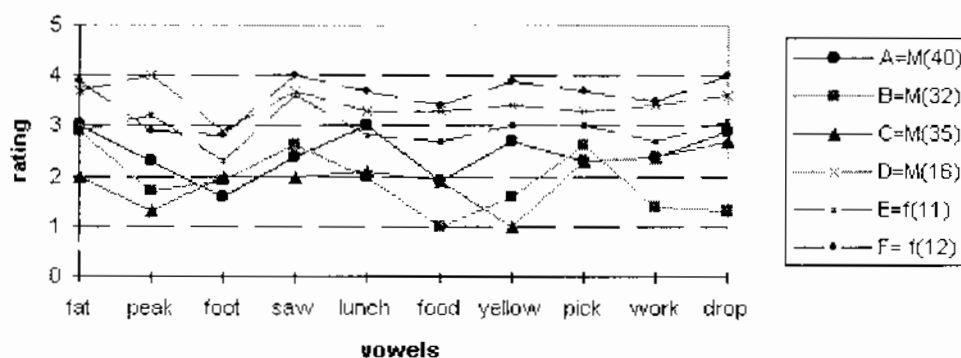


Figure 2 Graphical representation of the six subjects as they were rated by the judges

The difference in the ratings is evident in Figure 3, which depicts the averages of both groups. The only word the children were judged to pronounce with a strong accent was the word 'foot' /U/.

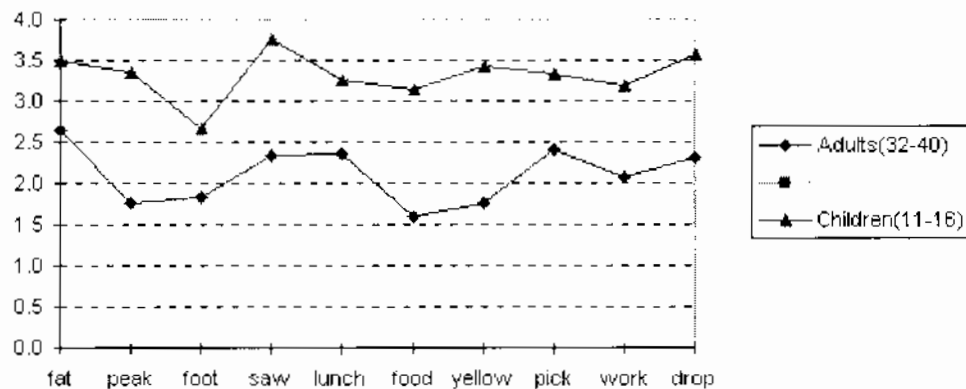


Figure 3 The average scores of both groups as rated by the judges

Procedure 2: To further analyze subject production of vowels, only vowels that are said to be the most difficult to produce for a Spanish native speaker were included. Based upon this criteria, the following words were chosen for subject pronunciation and analyzed using a spectrogram and a formant history (F2) in order that a comparison could be made with the control group (native speakers): peak /iy/, pick /I/, fat /æ/, foot /U/, and food /uw/ (see Figure 4).

Vowels	NS	NNS		
	76 subject	Children Female	Child Male	Adults
/æ/	1650*	1180	---	---
	1180 **	---	1204	1380
/I/	1640	1450	---	---
	1200	---	1187	1387
/iy/	1785	2000	---	---
	1285	---	1346	1446
/U/	980	820	---	---
	720	---	681	1358
/uw/	790	819	---	---
	775	---	700	1364

Figure 4 Results of the Formant history averages by native speakers (NS) and non-native speakers (NNS) subjects * First numbers refer to females **Second numbers refer to males

Even though both groups did not approximate the native speakers' speech sounds, the children appeared to be closer to a native-like pronunciation than the adults. In both groups we saw significant differences in the mean scores of the formants. These differences can be depicted graphically in Figures 5 through 7.

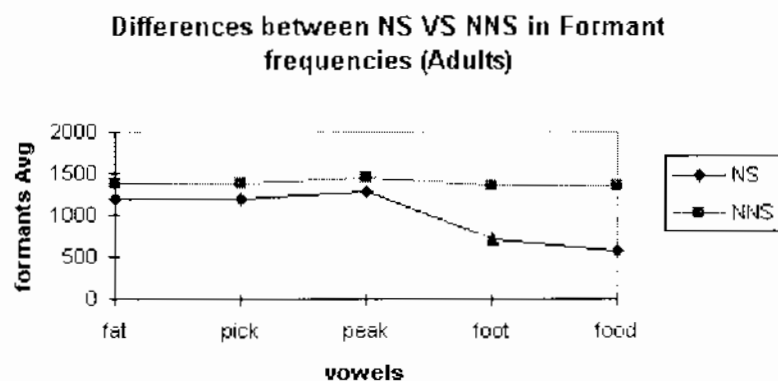


Figure 5 Formant averages of both NS and NNS adults

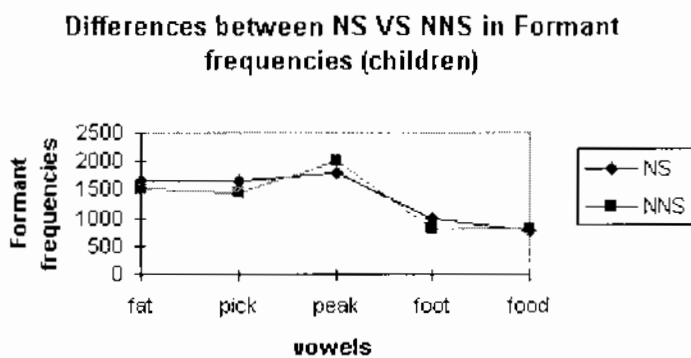


Figure 6 Formant averages of both NS and NNS children

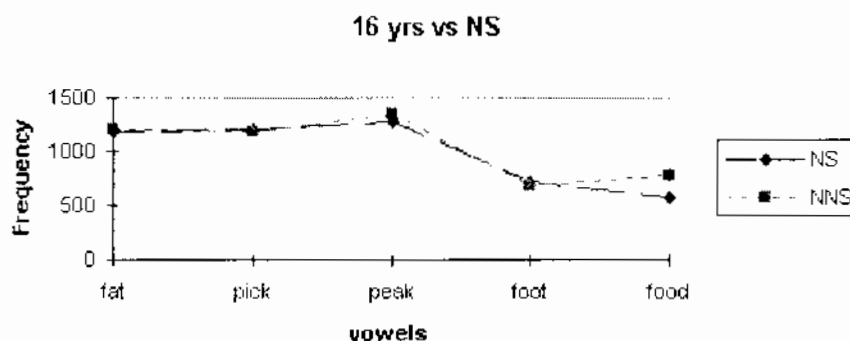


Figure 7 Formant averages between NS and the 16-year-old boy

As is evident in Figures 5 through 7, the 16 year-old subject did better than the other children as well as the adults. In general, the younger group had a more native-like pronunciation than the adult group. Both analyses (judges and Multi Speech) pointed to the younger learners as outperforming the adult learners.

Interpretations and Discussion:

The age of arrival in the U.S. of the six native Spanish speakers correlated with the degree of perceived accent in all of the English vowels studied. Throughout the analysis of the results, it was evident that the younger group proved to be significantly better in terms of accent than the older group. This was despite the fact that the younger group had been immersed for an average of ten months while the adults had been in the U.S. for about two years. Even though none of the subjects pronounced any of the vowels like a native speaker as shown in the Multi-Speech analysis, some vowels were significantly closer to that of a native speaker of English. The main reason behind the subjects' failure to produce an entirely native-like pronunciation was the constant L1 interference.

The most plausible explanation for the marked differences between the children and the adults in this study stemmed from the fact that the younger group had a higher quality and quantity of exposure to English than the older learners. The children were in school, most of the day, in constant contact with native speakers. In contrast, the adult group spent most of their time with other non-native speakers of English and their exposure to English at the university appeared to be insufficient. Three times a week for two or three hours cannot be compared to the seven hours a day that the children experienced. These results support the hypothesis that the younger you start to learn a second language the better, and reject the critical period hypothesis (CPH) premise that once you go past twelve or thirteen years old, you cannot learn a second language with native-like proficiency.

Conclusions:

The data in this study show a strong effect of biological maturation on the ability to pronounce certain English vowels without a transfer of accent from L1. The final results of this mini-experiment supported the findings by researchers such as Asher & Garcia (1968), Fathman (1975), Fathman & Precup (1983), and Tahata & Wood (1981) which favor the "younger is better" hypothesis. By the same token, the results of this study contradict the findings by Snow & Hoefnagel-Hohle (1977, 1978) which suggest that older learners have an initial advantage with respect to second language phonetics/phonology in the short-term. With only six subjects, it is difficult to generalize the findings of the study. A future study in which the spontaneous conversation of a larger number of subjects is recorded could yield more reliable as well as generalizable results.

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