WHAT FACTORS PREDICT AGE EFFECTS IN L2 PERCEPTION: A COMPARISON OF SOCIAL, COGNITIVE, AND EXPERIENTIAL FACTORS

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ABSTRACT

Previous research has demonstrated that age of acquisition (AOA) plays an important role in L2 phonological acquisition. However, it is not clear why such AOA effects occur. Researchers have hypothesized that these effects may be explained by social (such as identification with L1/L2 culture), cognitive (ability to imitate, working and phonological memory capacity), and experiential (length of residence and amount of L2 use) factors. However, little research has compared all three types of factors in the same study, nor has it determined whether these factors affect early and late learners differently. The current study seeks to fill this gap by asking seventy-six Spanish learners of English with different AOAs (0-69) to participate. Their accuracy on an L2 perception task was compared to their scores on the cognitive tasks, social factors and experiential factors noted above. Results demonstrate different factors were important for different AOAs and that all three types of factors played important roles.

Keywords: L2 acquisition, Spanish, English, cognitive, social, experiential factors

1. INTRODUCTION

Several factors influence whether or not second language (L2) learners are able to perceive and produce the L2 accurately. Of these factors, the learners' age of acquisition (AOA) has been found repeatedly to determine how and how well L2 perception and production are acquired. Indeed, most researchers agree that "age effects" are one of the most prominent factors to determine all aspects of L2 learning, although they disagree on what causes these age effects.

Some research has suggested that age effects are really related to the experience of the learner. For example, some researchers have argued that early learners have spent more time in the target country (length of residence or LOR) [1] and/or use the L2 more on a daily basis [2]—and that it is these factors that explain why age effects occur.

Other researchers argue that cognitive factors, such as the capacity of the learners' working [3] and phonological memory (i.e., the ability to recall nonsense syllables) [4] decline over the lifespan and may be the reason for declining L2 acquisition abilities in late learners. Indeed, a prominent line of research has found that only late learners with a degree of L2 learning aptitude (which includes among other things working memory capacity) will be successful in learning an L2 [5,6]. This research has mostly focused on aspects of the L2 other than speech perception and production; thus it is still unknown what encompasses aptitude for learning L2 speech perception and production. One other possible cognitive factor that may be related to age is the ability to imitate [7].

A third line of research has focused on how social factors, such as the learner's motivation or other social and affective factors are related to a person's age [8]. These studies suggest that early learners are more motivated to learn the L2 or identify more with the L2 culture and that this is the cause for age effects. Social factors may also include the learners' attitudes towards the L1 culture [9] or who is in learners' social networks (those that they interact with) [10] .

While this past research has demonstrated that age effects may be related to experiential, cognitive, and social factors, the relative importance of these three factors on L2 acquisition is not known, especially as they relate to age effects. Indeed, it often appears that researchers fall into one of two camps: either cognitive factors influence L2 phonological learning or social factors do, with little research examining both types of factors. Thus, in this study, we examine both cognitive, social and experiential factors in the same study.

In addition, previous research suggests that factors may affect late and young learners differently [5,6]. However, no known previous studies have examined whether this is true when examining L2 speech perception and production learning.

Thus, the purpose of this study is to examine to what degree experiential, cognitive, and social factors affect L2 speech perception and whether these factors

affect early and late L2 learners differently. To this end, the following research questions were examined:

1. What is the relative importance of experiential, social and cognitive factors on L2 speech perception?
2. Do the same factors influence L2 speech perception for early and late bilinguals?

To answer these questions, we examined the L2 speech perception of native Spanish learners who are acquiring English in the United States. In this study we focused on L2 perception since many studies examining age effects across the lifespan have focused more on production [11].

2. METHODOLOGY

Participants filled out a language background questionnaire asking their age, length of residence in the United States, and amount of L2 use. These responses were used to as measurements for the experiential factors examined in this study. Next participants filled out three social surveys described below to determine scores on social factors. Finally, the participants performed cognitive and perception tasks. Results of the responses on the experiential and social surveys and the cognitive tasks were compared to their results on the perception task to answer the research questions outlined in the introduction. A brief explanation of each of these surveys and tasks is given below.

2.1. Participants

Seventy-six native Spanish speakers participated. In order to examine experiential factors, the learners differed in terms of their age of acquisition (from 0 to 69) and their length of residence (from 1 year to 25 years) and amount of L2 use. However, when the participants were divided into an "early" (acquisition of English by age 15) and "late" (acquisition of English after age 15) groups, their average length of residence and amount of L2 use were approximately the same.

Table 1: Demographics of participants

Group	N	AOA	LOR	CA	ENG Rating	L2 Use
Early (>15)	38	6.2	9.92	21	8.6	56%
Late (<15)	38	28.2	11.19	40	6.7	60%

In addition to asking participants about their age and amount of time living in the United States, we also asked them to determine their amount of L2 use. This was done by asking a series of questions about when and where they used both English and Spanish. The results of these questions determined the percentage of time they used both languages**.**

2.2. Perception task

Participants heard words spoken by three male native English speakers and were asked to identify the vowel in the word by matching the word they heard with 7 possible words that they thought the word rhymed with. These words were displayed on the computer as buttons that they were asked to click. Perception was determined as the number of correct vowels identified.

2.3. Cognitive tasks

Participants were also asked to complete three cognitive tasks described below.

2.3.1. Working memory task

Participants performed a backwards digit span test in order to determine general working memory capacity. In this task, participants heard a list of numbers and were asked to repeat them in the opposite order. The number of numbers they were asked to repeat increased by one for each trial. For example, if the participants heard "1, 3, 7" they were supposed to say "7, 3, 1." Participants were given a score of "1" for each correct repetition and "0" if there were any mistakes.

2.3.2. Phonological memory task

In the phonological memory task, participants heard two lists of one-syllable nonsense words and were asked to determine whether they were given in the same or a different order. These syllables followed both Spanish and English phonotactics and were composed of 7 syllables. As with the working memory task, participants were given a score of "1" for each correct repetition and "0" if there were any mistakes.

2.3.3. Imitation task

As in Hummel [12], for an imitation task, participants listened to Arabic words and phrases and were asked to repeat them exactly as they heard them. Participants were given a score for the accuracy of their renditions as well as the number of syllables they were able to imitate.

2.4. Social surveys

To determine the extent that social factors affect second language phonological learning, three surveys were conducted.

2.4.1. Social network survey

Participants filled out a survey determining how many native English and Spanish speakers were in their social networks, how many they were related to, and what languages they spoke with each of their social network members. This created a score to determine how much their social networks were composed more of English- or Spanish-speaking members.

2.4.2. L1 identity survey

Next, participants were asked to rate 22 statements on a 9 point scale (based on the Ethnic Group Affiliation (EGA) proposed in [13]. The answers to these questions were combined into a single score. Some of the questions included the following:

1. I am Latino
2. People who don't speak Spanish do not deserve to call themselves Latino.
3. I am proud to display the flag and other symbols of my home country.
4. Speaking Spanish is an important part of my identity.

2.4.3. L2 identity

Similar questions to those asked in the L1 identity portion of the survey were asked about the participants' association with the L2 culture. These included statements like the following listed here.

1. I am American.
2. I feel like I belong in America.
3. The people in this area are really friendly.

3. RESULTS

The first research question of this study focused on the relative importance of experiential, social, and cognitive factors on L2 speech perception. This was done by running a multiple regression analysis (MRA) with the speech perception scores for each participant as the dependent variable and the 9 factors (3 experiential, 3 social and 3 cognitive factors) as independent variables. The results of this analysis are given in Table 2 below.

Table 2: Results of MRA for all participants

Factor	R^2	P value
AOA	.47	$p < .0001$
Working Memory Capacity	.11	$p < .0001$
Native Spanish in SN	.06	$p < .0001$
L2 identity	.04	$p < .0001$
Total	.68	

These results suggest, as previous research has also suggested, that AOA is a major factor contributing to acquiring L2 speech perception. In addition, these results suggest that both social (number of native Spanish speakers in a social network and scores on how strongly a learner identifies with the L2 culture) and cognitive (working memory capacity) factors affect L2 speech perception scores.

Do these factors correlate with age? If so, then this would suggest that these factors may in fact explain why age effects occur. A correlation analysis of the 9 factors examined in this study, however, seem to suggest that few of them do in fact correlate, as is shown in Table 3.

Table 2: Correlations of factors with AOA

Factor	Correlation with AOA	P value
Experiential		
Amount of L2 Use	.116	$p = .37$
Length of Residence	.004	$p = .97$
Cognitive		
Ability to imitate	.283*	$p = .02$
Working Memory Capacity	.287*	$p = .01$
Phonological Memory Capacity	.317*	$p = .01$
Social		
Native Spanish in SN	.106	$p = .43$
L2 identity	.224	$p = .07$
L1 identity	.128	$p = .318$

The results of the correlation analysis suggest that cognitive factors may be the most related to age, although even these correlations are weak.

The second research question was to examine whether these factors play a different role in late and early L2 learners' acquisition of L2 speech perception. To answer this research question, two similar multiple regression analyses were run: one on the early learners' scores and one on the late learners'

scores. The results of these analyses are given in Table 4:

Table 4: Separate MRAs for early and later L2 learners' speech perception abilities

Factor	R^2	P value
For Early Learners		
AOA	.49	$p < .0001$
Working Memory Capacity	.09	$p < .0001$
Native Spanish in social network	.07	$p < .0001$
Total	.65	
For Late Learners		
L2 identity	.38	$p < .001$
Phonological memory	.13	$p < .0001$
Total	.52	

These results suggest that, although AOA is a strong predictor of L2 perception abilities in early learners, this is not the case for late learners. Moreover, these results also indicate that a social factor, identification with the L2 culture, is the strongest predictor of L2 speech perception abilities in late learners.

These results also indicate that both cognitive and social factors play a role in predicting L2 perception abilities of both late and early learners.

4. DISCUSSION AND CONCLUSION

The main purposes of this study were to identify the relative importance of cognitive, social, and experiential factors on the acquisition of L2 perception and to determine whether this importance differs when examining early versus late L2 learners.

The results of this study verified that AOA was the strongest predictor of L2 perception abilities of native Spanish speakers acquiring English in the United States. These results also demonstrated that AOA was correlated more with cognitive factors (such as working memory capacity, ability to imitate, and phonological working memory) than with social or other experiential factors. In fact, AOA correlated with *all* the cognitive factors examined in this study. These results suggest that the *cause* of age effects may be related more to cognitive than social factors. Without research such as this, it would be difficult to answer the question of what causes age effects. With that said, it is interesting that both cognitive and social factors did play a role in predicting L2 speech perception abilities. These results also suggest that, of the factors examined, working memory capacity, social networks, and identity with the L2 culture play the most important roles.

The second goal of this study was to examine whether the relative importance of these factors changes depending on whether one is examining early or late learners. For early learners, age of acquisition was the strongest predictor of L2 perception accuracy, while for late learners, identification with the L2 culture was the strongest predictor. For both groups, both cognitive and social factors played some role in predicting L2 perception accuracy.

These results are in some ways similar to those found in previous research [5, 6]. Both Dekeyser et al [5] and Abrahamsson & Hyltenstam [6] demonstrated that aptitude (defined in part as some of the cognitive factors examined in this study) plays a very different role for early versus late learners. The current study, however, is the first to demonstrate these findings for L2 perception learning, instead of for grammatical learning. Moreover, this study is the first to demonstrate that it is not just aptitude, or cognitive factors, that differentiate early from late learners, but that other factors, such as identification with the L2 culture, and number of native language speakers in your social networks, can also affect L2 perception learning.

Why would different factors affect early and late learners differently? One possibility is that cognitive factors decline across the lifespan—so that younger learners benefit from these to a greater extent than do older learners. By contrast, for older learners both their desire to integrate into L2 society and these cognitive factors provide the motivation and aptitude needed to more accurately use and acquire the L2.

These results merely scratch the surface of the complicated nature of L2 phonological acquisition, but they also demonstrate the need for examining several types of factors when attempting to predict and explain why some learners are more accurate at L2 perception than are others.

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