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Listen carefully y presta atención: Selective attention in late L2 learners

Jennifer Anderson

College of Saint Benedict | Saint John’s University
Abstract
The current study sought to understand the effects of two languages on selective attention in a complex listening environment. Adult second language learners of Spanish of high or low proficiency attended to one spoken message in one ear while ignoring another from their other ear in a dichotic listening task. The language of each message was either English or Spanish. While both proficiency level groups performed worse on the dichotic listening task when attending to their second language, the high proficiency group was significantly better than the low proficiency group at attending to their second language and ignoring their native language. These results imply that late second language learners can develop some of the same cognitive abilities, such as improved selective attention, as are associated with early proficient bilinguals.
Listen Carefully y Presta Atención: Selective Attention in Late L2 Learners

In today’s increasingly global world, there is more and more emphasis on fostering bilingualism and second language acquisition as skills to compete effectively. Just in the U.S. alone 26% of people can hold a conversation in a second language (McComb, 2001). Aside from the actual language skills of bilinguals and second language learners, psychologists have examined the related cognitive effects of speaking two or more languages. The majority of the body of research on this topic has used early proficient bilingual subjects who have acquired both languages very early in life, often learning at least one in the home setting (i.e. Goodman, Haith, Gutentag, & Rao, 1985; Bialystok & Martin, 2004; Prior & MacWhinney, 2009). There is another situation that deserves exploration: individuals who acquire their second language (L2) later in life.

The critical period hypothesis or a more moderately labeled sensitive period has been hotly contested as to onset and offset maturational times (See Singleton, 2005 for a review), but that will not be discussed here as none of the myriad of proposed ages for an offset period is later than 16 years of age. Today, a large number of high school and college students are learning a second language in a classroom setting sometime after that age, so regardless of the true offset of the sensitive period, it is likely to have passed before these students began learning their second language. In 2003, the U.S. Education Department released that the most recent survey which had been conducted in 2000 found 42% of high school student enrolled in foreign language education classes (Snyder & Hoffman, 2003). The linguistic skills of these multilingual speakers are beyond the scope of this project, but an important line of research explores the possibility that these late L2 learners will experience similar cognitive effects not directly related to
language use. In the present study, I further investigate the effects by focusing on selective attention in late second language learners.

Individuals are often required to focus on just a few things in their environment, such as listening to the person to whom one is talking while surrounded by other conversations or music. This is complex enough if all these auditory inputs are in an individual’s native language, but some listening situations include several languages. Do adult second language learners deal with this problem successfully, or does the addition of their second language make it too difficult? The basic question includes a necessary understanding of several cognitive processes. These foundations include selective attention, the dichotic listening methodology, cognitive load, and the abilities of proficient bilinguals.

**Selective Attention**

Selective attention is integrally related to this problem. Selective attention involves filtering out some of the flood of perceptual information in order to focus on a limited number of inputs. According to Broadbent’s (1958) theory of Filter model, one initial way this is aided is through the early stage of attention in which the individual sorts the sounds in their auditory scene by surface characteristics. This allows one to separate out the sound of a friend’s voice from the radio, another person’s voice, the hum of the air conditioner or any number of other sounds present in the environment. The individual would be biased towards the characteristics of the target signal.

However, several other researchers have contested Broadbent’s Filter model. Deutsch and Deutsch (1963) disagree that Broadbent’s Filter could be sufficient because individuals can separate two speech streams with the same surface characteristics, but different content. The homunculus feel of this filter carries with it the same complications which always arise, those of
how complex information about content could be determined preattentively. Instead, Deutsch and Deutsch posit that signal height on some important factor that draws attention determines what is attended to. In a simple way, each signal does not have to be compared to each other one, only the most important, automatic, or perceptually loud will capture attention.

Thus, selective attention is more difficult in most tasks if the ignored stimuli are ones which are usually automatically processed, such as familiar language processing (Bialystok & Martin, 2004). One type of task that has measured visual language related selective attention is the Stroop (1935) task in which participants are asked to name the color in which the name of a color is printed. The participants are directed to selectively attend to the ink color and ignore the written color name. For example, the word GREEN might be printed in red ink and the participant is directed to answer the ink color, in this case red. Participants show slower reaction times and higher error rates when the color name was different than the color in which it was printed. This task was used bilingually in a study conducted by Goodman et al. (1985). In this study French-English bilingual subjects examined lingual interference from distractor words in either the same or opposite language as they were being asked to name the color. They found that with minimum second language proficiency that participants showed just as much interference in interlingual conditions as intralingual. This means that the use of L1 and L2 in roles of distractor and target language show similar levels of interference, rather than amplified interference in the L2 target and L1 distractor condition.

Several previous studies have examined the effects of interlingual and intralingual interference in bilinguals (Goodman et al., 1985). A number of these have used bilingual versions of the Stroop (1935) task or similar picture naming tasks using objects instead of colors. These studies have found conflicting information about whether there is increased interference
from the dominant language in non-balanced bilinguals. In simpler tasks like the bilingual Stroop task used by Goodman et al., there were no effects found for language dominance as long as there were minimal proficiency levels in the second language. However, in more complicated tasks like the dichotic listening task used by Mägiste (1984), interlingual and intralingual interference varied with the students’ proficiency in the two languages used in the task (German and Swedish). The students experienced increasing interlingual interference with increased proficiency likely because they were able to process the non-target language more automatically. I will explain the methodology and then return to the theories behind this pattern.

**Dichotic Listening Methodology**

In my present study, I focus intentionally on real world stimuli as opposed to any more tightly controlled single word stimuli like that used in a Stroop task. The participants in this study listened to full sentences in the auditory modality through a dichotic listening task. The methodology used in this study was originated in a seminal study conducted by Cherry (1953). Cherry developed a “dichotic listening” task which used headphones to deliver two different spoken messages to either ear. The participant was asked to “shadow” the message in one ear, that is, repeat it as the message was being played. The study then measured several effects of interference from the message in the unattended ear, such as slowing of reaction time, post-tests of surface characteristics such as gender of speaker and language being spoken, and comprehension tests of the unattended message. This methodology is particularly suited to answer the research questions in the current study because of its natural stimuli.

Much of my study is based off a similar one carried out by Edith Mägiste (1984), but there are important differences that are worth noting. Her participants were German-native immersion school students of Swedish. The first issue is of immersion as compared to classroom
learning. Linck, Kroll, and Sunderman (2009), support that immersion learners can perform better than traditional classroom learners. In the U. S., many foreign language students do not attend immersion schools, so it is important to establish this task with the regional population of late second language learners. The next concern is that the age of Mägiste’s participants ranged from 14-16 years of age and all of the participants had been in Sweden from one year to 16 years (Hence some of the participants had been immersed in Swedish since infancy, some since childhood, and some had just arrive). The previously mentioned critical period hypothesis is asserted by some to intersect this wide range of beginning age of second language acquisition. If true, this would make these participants still in the tail end of the sensitive period, whereas the undergraduate students used in my study were well past this point, making them different populations that should be studied separately. A related factor is that there was a very wide range in age of initial language acquisition in these participants and my own participants provide a closer snapshot of the second language development process from a smaller difference in developmental points. Finally, she used a translation task to measure how well the participants were able to avoid interference from the ignored ear, but I chose a comprehension test to determine this interference.

The underlying difficulty of the present dichotic listening task is grounded on previous work done on interference in bilinguals from their non-target language (the “other” language, the one they are not presently using) on a task that requires them to produce a response in just one of their languages. Cognitive interference appears to take place even without immediate presentation of the non-target language. Kaushanskaya and Marian (2007) studied this effect in Russian-English bilinguals using a picture naming task in which participants named pictures of common objects in Russian with printed distractor words in a congruent (Russian) or
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incongruent (English) language and found slowed reaction time when the distractor words were presented in English. Theories behind the reason that bilinguals experience interference from their non-target language while they have no problem speaking in just one of their two languages lies in the difference between activation of that language and production of that language. The effect is such that the non-target language is activated while the bilingual individual is using the target language, rather than a case of actual errors being committed i.e. producing the non-target language (Albert & Obler, 1978).

Kaushanskaya and Marian (2007) assert that this is due to the proficiency of fluent bilinguals at producing words only in the target language for that situation. If we return to Broadbent’s (1958) Filter model, in listening comprehension situations like a dichotic listening task, the participants were able to identify some shared surface characteristics of the two auditory messages, such as that they were spoken by the same person, she was female etc. The specific language that the sentence is spoken in should be the difference between the two streams that helped them sort the two from each other because the message in English should have been easily recognized as familiar and their native language, while Spanish was less familiar.

However, the task is still very difficult if we take into account Albert and Obler’s (1997) work positing that we cannot help but process input in any minimally understood language. Their work contradicts Macnamara’s (Macnamara, Krauthammer, & Bolgar, 1968) “two-switch” model in which there is both an input switch and an output switch that operate independently. Albert and Obler generally assert that there is only a voluntarily controlled output switch, but no input switch because in tasks with distractors in more than one language, a familiar language causes more interference (Treisman, 1964; Van Engen & Bradlow, 2007). When individuals are tested in a task using two languages that they can understand, such as the bilingual Stroop tasks
previously discussed (Goodman et al., 1985; Mägiste, 1984), the bilingual participants could not “turn off” their ability to process the non-target language. The simpler and more parsimonious Albert and Obler one-switch model is assumed during this study.

Cognitive Load Theory

Cognitive load is another significant cognitive effect present in dichotic listening tasks. Cognitive load theory suggests that individuals only have a certain amount of cognitive resources, or cognitive energy, at any given time. It must be distributed among the cognitive processes that the individual is attempting to engage in. Once the cognitive resources are all being used, there is maximum cognitive load and nothing else can be processed. There are two important types of cognitive load: germane load or the load put on the cognitive resources from the target processes and extraneous load, which is the cognitive load which stems from present, but unrelated and undesired processes (Plass, Moreno, and Brunken, 2010). In dichotic listening tasks, the complexity of the attended and ignored speech signals increases the cognitive load stemming from parsing the messages into two streams and selectively attending to just one.

This concept is correlated to working memory. Similar to chunking in memory, Plass et al. (2010) maintain that learner expertise about the task or content helps learners that are more expert can organize input into organize knowledge structures. In tasks requiring the use of two languages, more proficient bilinguals may be able to cut down on cognitive load when attending to stimuli and responding to them because they can chunk some of the incoming information as it is collected. Mägiste assumes this quite casually when she said, “Obviously, with very good command of a language it is possible to ignore irrelevant stimuli, whereas this is hardly possibly at earlier stages of development” (p. 314). Lavie, Hirst, deFockert, and Viding (2004) suggest that in the case of particularly high load demands on cognitive control, more interference occurs
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from distracting input, such as the unattended message in a dichotic listening task. I seek to establish whether the load demands of a dichotic listening task with sentences used as stimuli shows these proficiency advantages or not.

Bilingual Advantages

Past research on bilingual individuals has found that bilinguals have better selective attention and inhibitory control (repressing non-target, sometimes automatic, responses) abilities than monolinguals (Bialystok, 2001; Bialystok & Senman, 2004). This is theorized to be true because bilinguals are constantly selecting one language to use at a given time and inhibiting the other, which improves their general skill to control their attention. Bialystok and Codd (1997) report evidence of this skill in nonlinguistic realms as well relating to number cardinality. Bialystok and Martin (2004) specifically found support that bilingual children have increased inhibitory control in comparison to monolinguals for perceptual information in their study using a dimensional change card sort task. This task requires that children sort cards based on a certain dimension (say color) and so they ignore the other dimensions. The researchers then ask the children to sort the cards by a different dimension (shape), which means that they need to ignore the previously adaptive dimension and attend to a different dimension. Bilingual children were able to handle this change in directions with less difficulty than monolingual children. In more recent studies, Bialystok questions if this is true in all situations, or if this advantage is limited to situations that involve high cognitive load (Bialystok, 2006).

Other studies on bilinguals highlight the rarer difficulties, such as the increased deficit for second-language learners in classrooms with loud background noise as opposed to native speaker students working in their native language (Nelson, Kohnert, Sabur, & Shaw, 2006). Although popular opinion airs concerns that bilingual children have a developmental language delay (King...
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& Fogle, 2006), empirical studies do not support this effect in either of these bilingual children’s languages (Petitto & Holowka, 2002; De Houwer, 1999).

**Research Questions**

These cognitive elements involved in dichotic listening may be affected in several different ways by the use of interlingual conditions. The present study seeks to answer several questions. The first is how adult second language learners’ comprehension and attention of spoken language is affected by presentation of a competing message. The second more direct question is if it is harder for an individual to attend to their second language while ignoring their first language. A hypothesis based on cognitive load theory would anticipate less interference from the distractor message when the target message is spoken in the participant’s second language and the distractor was spoken in the participant’s native language, as the cognitive load would reach maximum capacity and leave no cognitive energy to process the unattended message at all. However, a hypothesis based on selective attention and automaticity of activation in proficient L2 learners would anticipate more interference from conditions where the distractor message was spoken in the first language, when the target message was spoken in the L2.

A secondary hypothesis of this effect is that the group of participants with higher second language proficiency would be less prone to this effect based on increased experience in selecting their L2 as a target language. Essentially, I expect more proficient late L2 learners to perform similarly to fluent bilinguals in previous studies, and the low proficiency L2 learner group to have more difficulty selecting for their less experienced and fluent second language. Bialystok (2006) supports that the longer that an individual has been bilingual, the more practiced they should be at ignoring distraction. Although previous research has examined this question in written language and visual interference studies of individuals who have been
bilingual from a young age (i.e. Goodman, Haith, Guttentag, & Rao, 1985), the present study fills in a gap concerning adult second language learners’ listening abilities. In summary, the hypotheses are as follows:

**Native Language Priority Hypothesis:** Both the low and high proficiency groups of participants will have a greater deficit in selective attention in conditions when attending to their second language and hearing a distraction in their first language as measured by their incorrect answers to comprehension questions about the text in the bilingual dichotic listening task. I predict a significant main effect of language on participants’ dichotic listening performance.

**Proficiency Hypothesis:** In addition, the low proficiency group will show more difficulty than the high proficiency group and hence more errors on the comprehension questions. I expect to find a main effect of proficiency.

**Method**

**Participants**

The participants (N = 29) were 8 male and 21 female native English speaking students with ages ranging from 20-22 (M = 21.1) chosen by convenience sampling at a central Minnesota small, private, liberal arts university. The 14 students in the low proficiency group had taken the equivalent of three semesters of college Spanish classes and no more than five semesters (M=3.71). The 15 students in the high proficiency group had taken at least six semesters. Due to the system course requirements and numbering system in the Hispanic Studies department at this college it was only possible to collect data about the exact number of semesters up to six semesters, however 12 of 15 participants in the high proficiency group had taken more than six
semesters and most were Hispanic Studies majors or minors and as such had taken 8 or more courses. None of the participants had ever experienced any significant hearing loss.

Materials

The text used as auditory information was taken from published bilingual versions of children’s stories to ensure consistency and comprehensibility. I chose these previously translated books as more valid than creating her own stimuli as a non-native Spanish speaker. Sixteen sentences with length ranging from 10 to 26 words were selected from three different books (Beauty and the Beast, The Jungle Book, and The Little Mermaid). Proper names of the characters were replaced with pronouns to prevent previous knowledge of the stories’ plots to bias participants’ answers. Also, the comprehension question that followed never directly had to do with the plot of the story. For example, one of the English sentences was, “Pairs of yellow eyes glowed in the dark forest as a pack of wolves surrounded the girl and her horse.” The question asked was, “What color were the wolves’ eyes?,” and the answer was “yellow.” An example of one of the Spanish sentences was, “El barco fue lanzado contra las grandes olas y todos los que estaban a bordo cayeron al mar,” and the comprehension question here was, “Who was thrown into the sea?,” and the answer was “everyone on board”. The final selection of sentences were normalized to lengths to between 6 and 8.5 seconds and to volumes of the same decibel level. See Appendix A for the sentences.

The participants reported demographic information including their second language proficiency, frequency of second language use, hearing loss, gender, and age. McArdle, Wilson, and Burks (2005) showed that hearing loss had an additional deficit in hearing in complex listening environment, so this self-report was used as a screening question to ensure a normal population. They also reported information about how many hours of sleep they had had the
night before and how alert they felt because sleep deprivation and drowsiness have been found to affect selective attention (Johnsen, Laberg, Eid, & Hugdahl, 2002; Deutsch & Deutsch, 1963).

See Appendix C.

Procedure

The preliminary part of the study consisted of a Spanish language listening proficiency test. The participants listened to four audio selections from a published language education website lasting several minutes each and answered three multiple-choice comprehension questions about the content of the selection. This test was created specifically for this study due to a lack of viable professional alternatives. The proficiency test administered by the American Council on the Teaching of Foreign Languages (ACTFL) does not include a speaking section and both it and the others like it costs significant funds per student. I also deemed it necessary to use an auditory listening comprehension task to assess the participants’ proficiency instead of a more traditional written text reading comprehension so I could control for differences in participants’ abilities in reading and listening, and between auditory and visual modalities. This is relevant because Martens, Johnson, Bolle, and Borst (2009) have previously shown that there are individual differences in selective visual and auditory selective attention and that cross-modally these do not remain completely stable. Some individuals are more skilled at visual selective attention, but do not retain those advantages in tasks involving auditory selective attention. In this case it was logical to test their proficiency auditorily as well so that I could control for this possible confound, so I chose to keep the entire experiment in the auditory modality. See Appendix B for the text of the selections and the actual questions.

The main portion of this study was a dual-language dichotic listening task. The participants used headphones to listen to different sentences being spoken into either ear. In test
trials, they heard two simultaneous sentences, one in each ear, in different languages. Written words presented on the computer screen directed participants to attend to just one of the sentences in an indicated ear. Each participant completed sixteen trials in two varying language conditions (eight trials in each): attending to Spanish and ignoring English, or attending to English and ignoring Spanish. The number of trials was limited due to time constraints associated with recruiting a very specific group of participants. I counterbalanced the ear in which the target message was presented across ears to avoid the influence of a right ear advantage (Persinger, Chellew-Belanger, & Tiller, 2002). The sentences were counterbalanced and randomized so the participants never attended to the same sentence in both languages, and the distractor sentence for a trial was never a translation of the target sentence. Directly after listening to each pair of sentences, the participants were asked a fill-in-the-blank short answer comprehension question about the target message presented in the ear they were instructed to attend to during that trial. The questions were all asked in English (the participants’ L1) to avoid an issue of the participants knowing the answer to a question, but answering incorrectly due to not understanding the question. Answers were accepted in either language as long as the meaning was correct.

Finally, participants answered several demographic questions assessing frequency of second language use and individual characteristics (age, gender, alertness etc). See Appendix B.

Results

The present study examined the role that language proficiency plays in the performance of late L2 learners in selectively attending to their non-native language. There were two main hypotheses: first, in the Native Language Priority Hypothesis both the high proficiency and low proficiency groups would perform better on the condition in which they attended to their first
language and ignored their second language. Second, in the Proficiency Hypothesis the low
proficiency group would show more difficulty (incorrect answers to comprehension questions)
than the high proficiency group when selectively attending to their second language and ignoring
their first language. Both the Native Language Priority Hypothesis and the Proficiency
Hypothesis were supported.

First, I collected various measure of proficiency as part of the demographic information:
the recency of their last Spanish class, the frequency of their current Spanish use, the number of
hours of Spanish used per week, and the highest level of Spanish that the students had taken, in
addition to a scalar variable collected from the listening proficiency test completed in the present
study. These factors were reduced to a simple categorical variable of high and low proficiency
because all of these variables were significantly correlated and loaded onto two mutually
exclusive groups. See Appendix D.

As predicted by the Native Language Priority Hypothesis, all participants from both low
and high proficiency groups were better at attending to their native language and ignoring their
second language than at attending to their second language and ignoring their native language.
All participants performed worse on the dichotic listening task when attending to Spanish and
ignoring English. The effect of language (English or Spanish) on performance is highly
significant, $F(1,27) = 149.286, p = .000$. However, the interaction between language and
proficiency was not significant, $F(1,27) = 2.193, p = .150$. See Figure A.
More importantly, however, the Proficiency Hypothesis was also supported. Both the scalar and categorical variables of proficiency were significantly related to performance on the dichotic listening task condition in which they attended to Spanish and ignored English. In an independent samples t-test, there was a significant different between the low and high proficiency group’s performance on the dichotic task when attending to Spanish and ignoring English, $t(27) = -2.674$, $p = 0.013$. See Figure B for a regression using the scalar proficiency variable obtained in the listening comprehension test completed by all participants.
Figure B  Scatter plot of participants’ performance on the dichotic listening task and the listening proficiency test, separated by proficiency group of the participants. The two proficiency groups are significantly different in their performance on the listening proficiency task, supporting the validity of the group distinction. There was a significant difference between the two proficiency groups on the performance on the Spanish dichotic listening task.

There was no statistically significant difference between the low and high proficiency groups on their performance when attending to English and ignoring Spanish, $t(27) = .660, p = .515.$, however, there was more variability in the low proficiency group and high scores overall which might indicate a ceiling effect. See Figure C for a box plot representation and Figures D and E for histograms of performance on each language sorted by proficiency.
Figure C Box plot of participants’ performance on the dichotic listening task, separated by language condition and proficiency group of the participants. There was a significant difference between the two proficiency groups on the performance on the Spanish dichotic listening task. There is no significant difference between the two groups’ performance on the English dichotic listening; however there is less variability in the high proficiency group in their extremely high scores on the English dichotic listening, suggesting a possible ceiling effect.
Figure D  Histogram of participants’ performance on the Spanish dichotic listening task, separated by proficiency group of the participants.

Figure E  Histogram of English dichotic listening

Figure E  Histogram of participants’ performance on the English dichotic listening task, separated by proficiency group of the participants. There are outliers in the low proficiency group causing increased variability in the low proficiency group. There is less variability and more perfect or near perfect scores in the high proficiency group, which suggests a ceiling effect.

Discussion

In this study, I sought to investigate the role that language proficiency plays in the competency of late L2 learners in selectively attending to their non-native language. I hypothesized that while both the high proficiency and low proficiency groups would perform better on the condition in which they attended to their first language, the low proficiency group would show more difficulty (incorrect answers to comprehension questions) than the high proficiency group when selectively attending to their second language. Both parts of the hypotheses were supported.
The results of this study hold promising implications for the ability of late second language learners to develop at least some of the improved cognitive abilities present in early proficient bilinguals. Here, there is a possible example of increased proficiency in late L2 learners resulting in increased selective attention ability in their second language and possibly their first. The stimuli used were real world sentences that should have been easily comprehensible by both proficiency groups in non-dichotic presentation. So, we can attribute the difference in performance between these two groups to their selective attention abilities. The direction of the difference with relation to the snapshots of low to high proficiency in the development of second language learners implies that as late L2 learners become more proficient, these abilities, like selective attention, improve with increasing proficiency. Finding a significant difference between groups that vary in amount of language instruction by about six semesters of instruction at the college level may indicate that this progression increases somewhat rapidly. The next logical step would be to test even more highly proficient late L2 learners, possibly students at the graduate level, or who have experienced long periods of immersion in a place where the primary language spoken is their second language.

Additionally, while there was no statistical difference between the high and low proficiency participants in their performance on the dichotic listening task when attending to their native language and ignoring their second language, there was a possibly meaningful change in the variability between the two groups. From the low proficiency group to the high proficiency group, one can see a tightening of the distribution towards the top scores of the scale where even more of the high proficiency participants are earning perfect scores. At this point, it seems likely that there is a ceiling effect caused by the dichotic listening task being too easy to complete in one’s native language. If there is a ceiling effect, this brings with it the requisite
question of what the true distribution would look like. While the definite answer lies with future research, there is some reason to believe that with increased proficiency in late L2 learners’ second language, that they actually may improve their selective attention across the board including back in their native language. Since several other cognitive effects observed in early proficient bilinguals are found even in nonlinguistic tasks, such as sorting tasks, this further emphasizes the similarities between early proficient bilinguals and late L2 learners as the L2 learners’ proficiency increases. Other nonlinguistic tasks that could be tested on bilinguals would continue previous studies of selective attention tasks where the auditory stimuli are musical selections instead of speech excerpts (Bigand, McAdams, & Forêt, 2000).

If we examine this development in a broader light, we find that there is an important implication here related to plasticity in adult individuals. If these young adult participants have changed their abilities in selective attention in only a few years, this could be the beginning of important brain development that has been spurred by acquisition of a second language. Imaging studies should longitudinally track the changes in brain areas not directly related to language throughout the progress of individuals as they learn a second language in adulthood. If there are visible changes which accompany the behavioral changes we have already noted, we can begin to discuss real evidence of multilingual catalyzed plasticity into adulthood.

It is indeed hopeful that indications of the cognitive effects of bilingualism can be found in late second language learners. Many nations spend significant education funds providing second language education for their students, and it is crucial to understand both the linguistic development of these late L2 learners and the peripheral cognitive development that occurs as a byproduct of second language acquisition. Selective attention is just one of these, so further research should also address other cognitive abilities that tend to be higher in early proficient
bilinguals, such as inhibitory control (Bialystok, 2001) and task switching (Prior and Macwhinney, 2010).

Possible limitations of the present study could include small sample size of participants and a limited number of test trials of the dichotic listening task. While significant results were obtained, a larger sample size would ensure greater generalizability. In addition, there was a gender imbalance in the number of female and male participants. Future research should strive for equal representation of gender. Thirdly, time limitations prevented collecting a measure of working memory. This should be done because working memory has been found to be related to selective attention and second language acquisition (Dalton, Santangelo, & Spence, 2009; Okuniewska, 2007). It could show a mediating effect. A final participant characteristic was that the participants were assumed to have similar second language learning environments (i.e. the classroom), but it would be important to obtain more specific information from each participant such as participation in an immersion situation. These results were obtained using two very specific groups of participants using a limited collection of stimuli for testing, so future research should broaden these parameters in order to broaden the generalizability of the current results.

The sentences from the children’s books selected may have brought several limitations. The most important is that while the content of children’s books was assumed to be simple enough for the low proficiency group to easily understand when presented in isolation. However, the vocabulary may have been too specific. This could have caused a false difference between the two groups if the low proficiency group incorrectly answered comprehension questions not because they experienced more interference from their native language than the high proficiency group, but because they could not understand the Spanish language sentences even if they had been presented in a non-dichotic setting. Additionally, while the sentences were edited to avoid
revealing the answer based on the participants’ previous knowledge of the stories, this still may have been an issue. Future studies should pilot test the stimuli more vigorously for the dichotic listening task to avoid this possible confound.

Most importantly however, there should have been intralingual conditions (English/English, Spanish/Spanish) in order to obtain baseline scores on dichotic listening. Then the Spanish/English and Spanish/Spanish conditions could have been compared to make sure that the difficulty of the task for low proficiency individuals was not just based on the difficulty of a dichotic listening task. I also would have used interference measures if there had been time during the study to have them complete online tasks to check for interference. These could have included pressing a key when hearing a target word and checking for reaction times and false alarms, push button every time you hear “dog” in the left ear, how often is there a false alarm when “perro” is in the right ear or simply the latencies of shadowing the target message. Another brief task could be a word recognition task where after the test trials participants would be asked, “was this word presented in the shadowed ear?” to see if they confirm any words which were in the ignored ear, indicating interference.

Despite these limitations, there is an important main finding to be gathered based on the results obtained in this study if the findings hold up when baselines are applied. When complex stimuli such as full sentences are used in a difficult auditory selective attention task like dichotic listening, low proficiency late L2 learners who have learned their L2 in a classroom setting cannot perform well when attending to their non-native language, while higher proficiency L2 learners have more success.

Therefore, I suggest repetition of the present study, taking into account and mending the limitations previously discussed. Future research with a slightly different focus may be beneficial
in examining the validity of the current hypothesis or perhaps modified versions. One focus might be to investigate how proficiency affects performance in selective attention tasks with stimuli of increasing complexity from a Stroop type task up to full paragraph of text in either the visual or the auditory modality. Previous findings disagree over the level of proficiency needed to show bilingual-like performance on selective attention tasks (Goodman, Haith, Guttentag, & Rao, 1985; Goodman et al., 1985), but these differences may be due to the nature of the task. Single words may be simple enough to show results in low proficiency speakers, while complex stimuli like the full, natural sentences used here show a strong effect for variation based on language proficiency in the second language.

Another important direction for future research would be to compare individuals with more varying degrees of second language proficiency. The participants used in the current study varied little within each group. Based on these results, there is likely a point at which late L2 learners increase their ability to selectively attend to that second language despite the presence of their L1 in the auditory environment. It may be important to find the proverbial tipping point in order for L2 learners to successfully use their second language even in a complex auditory environment that includes their second language, such as a classroom with other L2 learners.

If future research supports my general hypothesis, this would add to a body of research comparing the linguistic and general cognitive abilities of late L2 learners, especially as compared with early proficient bilinguals. Thus far, the present findings support that as second language proficiency increases, L2 learners approach similar performance in selective attention tasks as balanced bilinguals. At a point when they achieve fluent proficiency similar to early proficient bilinguals or other native-like speakers, they should perform similarly in tests of selective attention in either of their competent languages. More general future research should
continue to investigate ways in which late L2 learners approach the same cognitive effects as early bilinguals in a variety of other cognitive capacities, such as working memory, inhibition, and social cognition.
References


Persinger, M. A., Chellew-Belanger, G. G., & Tiller, S. G. (2002). Bilingual men, but not women display less left ear but not right ear accuracy during dichotic listening compared to monolinguals. *International Journal of Neuroscience, 112*(1), 55-63.


Appendix A  Text from dichotic listening trials

-Just as the last enchanted rose petal was about to fall, she whispered, “I love you.”
-En el instante en que el último pétalo de la rosa iba a caer, ella susurró: “Yo te amo.”

-Pairs of yellow eyes glowed in the dark forest as a pack of wolves surrounded the girl and her horse.
-En el bosque tenebroso, la chica y su caballo vieron que numerosos ojos amarillos de una manada de lobos los acechaban desde la oscuridad.

-Before they could explain, the Beast grabbed the man and threw him into the dungeon of the castle.
-Antes de que ellos pudieran explicarlo, la Bestia agarró al hombre y lo arrojó al calabozo del castillo.

-As she explored the castle later that evening, she crept up the stairs to the forbidden West Wing.
-Cuando ella explore el castillo aquella tarde, se deslizó escaleras arriba hasta el Ala Oeste prohibida.

-Joyfully, all the enchanted objects in the castle returned to their human forms.
-Llenos de dicha, todos los objetos encantados del castillo recobraron su forma humana.

-One day the panther was hunting deep in the jungle when he found a basket in the river.
-Un día la pantera, encontró una cesta flotando en el río en plena jungla.

-As the boy floated by, the monkeys grabbed him and took him to their king.
-Cuando el chico pasó flotando, los monos lo atraparon y lo llevaron con su jefe, el rey.

-The ship was tossed into the air and everyone on board was thrown into the sea.
-El barco fue lanzado contra las grandes olas y todos los que estaban a bordo cayeron al mar.

-She offered the prince who lived there a rose in return for shelter.
-Ella le ofreció al Príncipe que habitaba allí una rosa a cambio de que la dejara refugiarse durante la noche.

-If the prince could learn to love and be loved in return before the last enchanted rose petal fell, then the terrible spell would be broken.
-Si el Príncipe podía aprender a amar y era amado antes de que cayera el último pétalo de la rosa encantada, el terrible hechizo quedaría roto.

-There she found an enchanted rose. She was about to touch it when the Beast suddenly appeared!
-Allí encontró la rosa encantada. ¡Estaba a punto de tocarla cuando la Bestia apareció repentinamente!

-The inventor was barely able to escape the wolves! He hid behind a castle gate.
-El inventor a duras penas pudo escaparse de los lobos, escondiéndose tras el portón de un extraño castillo.

-He threw the man out of the castle and then showed her to her room.
-Él arrojó el hombre fuera del castillo y le asignó a ella una habitación.

-Terrified, she fled the castle and rode away on her horse.
-Aterrada, ella huyó del castillo y se alejó cabalgando sobre su caballo.

-He and a group of villagers soon learned about the Beast and set off for the castle to attack him.
-Él y un grupo de gente del pueblo pronto supieron de la existencia de la Bestia y se dirigieron al castillo para atacarlo.

-Singing and dancing, the two friends made their way back to the jungle.
-Cantando y bailando, los dos amigos regresaron a la jungla.
Levantarse (Spain dialect)

Quizás la peor parte del día es cuando hay que levantarse. Despertarse es fácil, pero levantarse es otra cosa. Hay que hacer un esfuerzo para ponerse en pie. Lo mejor es no pensarlo y saltar de la cama.

Para facilitar las cosas suelo utilizar dos despertadores, uno cerca de la cama y otro un poco más lejos. El primero suena 5 minutos antes que el segundo, así empiezo a despertarme poco a poco. Para el segundo tengo que ponerme en pie, andar dos metros y apagarlo.

De lunes a viernes, la hora de levantarse para mí es a las 7:15, pero muchos días me despierto antes por los ruidos de la calle, en especial de los vehículos, o porque mis hijos hacen algún ruido si salen al baño por la noche.

En ocasiones, sí me despierto en mitad de la noche, por el motivo que sea, ya no puedo dormir otra vez, así que intento relajarme y, si no lo consigo, me levanto y me pongo a leer, a ver la televisión, a escuchar mi MP3 o a usar mi ordenador.

Me gusta madrugar y no tengo muchos problemas para levantarme, pero a veces tengo que hacer un gran esfuerzo si durante la noche no he dormido al menos 5 horas.

COMPREHENSION QUESTIONS:

What is the topic of the audio selection?
Going to bed
Eating lunch
Getting up
Driving

What time does he usually wake up?
6:15
7:15
8:15
9:15

How does he make it easier to wake up?
He leaves the window open all night
He sleeps on the floor
His wife shakes him awake
He uses two alarm clocks
Aseo Personal (Spain dialect)

Otra rutina diaria es la del aseo personal. No siempre solíamos hacer lo mismo por las mañanas, pero sin duda es habitual asearse. Eso incluye ir al baño a hacer nuestras necesidades, lavarse los dientes, tomar una ducha rápida, afeitarse, peinarse (si tienes pelo suficiente claro está).

Personalmente, yo prefiero tomar un café con leche nada más levantarme, eso me ayuda a terminar de despertarme. A la vez conecot mi ordenador, reviso mi correo electrónico, miro algún artículo de la prensa electrónica y sobre las 8:00 de la mañana hago un poco de ejercicio en una bicicleta estática, alrededor de media hora.

Mientras estoy en la bicicleta me gusta escuchar mi mp3 con algunas grabaciones en inglés para aprovechar el tiempo. Después, alrededor de las 8:30 tomo una ducha, me afeito y lavo los dientes, pero no tengo que peinarme porque soy bastante calvo.

COMPREHENSION QUESTIONS:

What is the topic of the audio selection?

Daily morning routine
Benefits of exercise
Getting ready for bed
Being at work

What does he eat for breakfast?
Tea and a bun

Just coffee with milk
Juice and waffles
Mocha coffee and toast

What does he do for exercise in the morning?
Running outside
Elliptical machine
Yoga
Stationary bike

Eating Out (neutral Americas accent)

¿Con qué frecuencia vas a restaurantes?
Voy muy seguido, quizás una vez a la semana.
Yo también. Pero es muy costoso.
Sí. Es muy caro comer fuera todo el tiempo.
Yo generalmente cocino en casa. ¿Qué tipo de comida te gusta cocinar?
Si estoy solo solamente pongo a hervir algo de sopa y me hago un emparedado. Eso no se ve muy interesante.
Lo sé. Pero no me atrae cocinar una gran comida para mi solo. ¿Qué tal si invitas a unos amigos?
Si invito a un amigo, generalmente intento hacer algo especial. ¿Qué tipo de cosas haces si llega un amigo?
Depende. Podría ser solamente una ensalada y un filete. Algunas veces intento cocinar una comida gourmet.
Los filetes son sencillos y siempre saben bien. Generalmente abro una botella de vino para la comida. ¿Y cuando sales? ¿A qué tipo de restaurantes te gusta ir?
Me gustan todo tipo de restaurantes. Me gusta la comida china, la comida italiana, el sushi, los filetes, todo tipo de comida. A mi también. Me gusta comer diferentes tipos de comida.
Sí, pero a mi me gustan más unos tipos de comida que otros. Creo que la comida italiana es la que más me gusta de todas. A mi me gusta la comida de mi madre más que nada. Por supuesto. A mí también.

COMPREHENSION QUESTIONS:

What is the topic of the audio selection?
Going to parties
Going to school
Going to restaurants
Going to carnivals

What is the favorite cuisine of the man being interviewed?
Spanish food
Italian food
Vietnamese food
Greek food

What is one food that the man cooks at home?
Steak filets
Potatoes
Corn
Shrimp

http://www.lingq.com/learn/es/workdesk/item/2468481/reader/

Pasatiempos (Mexican dialect)
En mi tiempo libre, me gusta ir al cine y leer, me encantan las películas y los libros de misterio. Me gusta mucho viajar y estar en contacto con la naturaleza. Adoro la playa, especialmente las playas del Caribe, aunque cualquier playa es muy bonita y relajante. Me gusta también ir a alguna cabaña donde haya muchos árboles, pinos y ardillas. Disfruto estar con mi familia, así que organizo muchas reuniones familiares.

COMPREHENSION QUESTIONS:

What is the topic of the audio selection?
Careers
Foods
Homework
Pastimes

What is one activity that the woman likes to do?
Ski
Go to the movies
Go to museums
Knit

What does the woman organize?
Work parties
Picnics with friends
Family get-togethers
Children’s carnivals
Appendix C Demographic questions

Survey Questions (will be presented on computer after other tasks in the experiment have been completed:

How old are you? ______

What is your gender? MALE or FEMALE

How frequently do you use the Spanish language? (extremely infrequently) 1 2 3 4 5 6 7 (extremely frequently)

About how many hours per week do you use the Spanish language? ______

What was the most recent semester in which you took a Spanish class? Fall 2008, Spring 2009, Fall 2009, Spring 2010, Fall 2010, Spring 2011, Fall 2011 (I am currently taking a Spanish class)

What is the highest level Spanish class you have finished? 111, 112, 211, 212, 311, 312, 320+

How alert do you feel today? (extremely not alert) 1 2 3 4 5 6 7 (extremely alert)

How many hours did you sleep last night? ______

How many caffeinated beverages have you consumed today? ______
### Appendix D
Correlation amongst the variables checked for unity and collapsed into one categorical variable of language proficiency

**Correlations**

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**. Correlation is significant at the 0.01 level (2-tailed).**