STUDENT **PAPER** 3

Controlling Two Languages: Cost-Benefit Analysis of Immersion in Second-Language Learning

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ABSTRACT

One of the most efficient methods to learn a second language (L2) is through immersion in a country where that language is spoken. What aspects of language immersion enable adult learners to acquire an L2 more efficiently? An obvious consequence of immersion is more frequent and varied exposure to the L2, but another possibility is that immersion makes it easier to inhibit the first language (L1). If so, learning an L2 would involve cognitive mechanisms that lead to some benefits but also produce some cost to the learner, and if so, it would be of interest to know exactly how and to what extent does immersion negatively impact the learner? In this study, we tested a group of eleven English-speaking college students learning Italian through a study abroad program in Rome, Italy for a period of eight weeks. We predicted that language immersion would reduce fluency in the L1, in order to obtain the benefit of acquiring greater gains in fluency in the L2. To test this, participants completed a language history questionnaire and a verbal fluency task in both English and Italian on the first and last days of the term. On average, participants' levels of Italian fluency increased and to a greater extent than any losses to their L1, which trended in the direction of an inhibitory effect, but not significantly so. These findings consider the possibility that foreign language acquisition is influenced primarily by frequency effects in the L2, and therefore not entirely due to an inhibitory mechanism on the L1.

Keywords: second-language acquisition, inhibition, immersion learning

Introduction

On the topic of the acquisition of a foreign language in adults, the following question arises: to what extent does language immersion trigger inhibition of a speaker's first language (L1)? Research has asserted that inhibition is a cognitive mechanism meant to facilitate the acquisition of a second language (L2) that can be observed in contexts where the

speaker is exposed to a target language and less opportunities to use their L1 (Baus, Costa, & Carreiras, 2013). However, it is still unclear if the effects brought on by immersion are due to an increased exposure to the L2 or whether this type of environment makes it easier for the speaker to inhibit their L1. In either case, it is important to consider the extent to which immersion effects benefit speakers and impose costs to their L1 abilities.

A study by Linck et al. (2009) investigated immersion effects by administering a fluency test to a group of students studying abroad in Spain for a semester and a second group of students studying Spanish at an American institution. Their findings supported the presence of an inhibition effect as represented through an increase in their L2 abilities after the immersion period, and a simultaneous decrease in their L1 abilities. To establish the compatibility of the inhibition account with the observed effects, Linck et al. administered the same language-processing tasks 6 months after the immersed group of students had returned to the US. They observed that the speaker's L1 abilities had rebounded to no longer show the differences seen at the re-test phase, supporting the account that inhibition imposed temporary processing costs on the L1 in order to facilitate the acquisition of the L2.

To further investigate how immersion reduces accessibility of the L1, Baus, Costa, & Carreiras (2013) administered a picture naming and a category fluency task on a group of German students studying abroad in Spain. They sought to determine the extent to which lexical retrieval is influenced by word frequency and cognate status. Interestingly, they observed a reduction in the accessibility of lexical representations in the L1, but only in the results of the picture naming task which were also found to be modulated by cognate status and level of frequency. They explain that these findings are consistent with the "weaker links" hypothesis (Gollan et al., 2008), also known as the frequency-lag account (Gollan et al., 2011), which specifies that words in the lexicon of a bilingual individual will be more accessible when they are used more frequently (have higher frequency values) or are cognates (words that are similar across languages). The latter "benefit from the addition of frequencies in both languages" (Baus, Costa, & Carreiras, 2013, p. 407). Therefore, according to this account, the words within the lexicon that are the least protected when a bilingual speaker experiences cognitive decline, are those that are non-cognates and of low frequency. In the context of immersion, processing costs imposed on the L1 would primarily affect words of these two qualities, and an increase in L2 might simply reflect increased use of words in the L2 during immersion.

As proficiency continues to increase through the process of language acquisition, one would expect that words with "weaker links" in the lexicon (non-cognates and low frequency words) develop stronger links over time. After sufficient language use takes place, these words would require less activation and experience smaller frequency effects (Gollan et al., 2011). To address whether their findings were due to inhibition or simply a reduction in the use of the L1, Linck et al. (2009) administered a re-test six months after his participants had returned to their L1-dominant contexts. If the effects in their data were to be attributed to a reduction in the use of the L1, which corresponded to the logic in the "weaker links" hypothesis, any attenuation tothe L1 should be undone when L1 dominance is restored. The results from the re-test did show a rebound effect, that could not be accounted for by the "weaker links" hypothesis but was instead more congruent with the inhibitory account he proposed. However, more interestingly, they also showed a sustained effect on the L2 even though inhibition on L1 had dissipated. This suggests that the increase in L2 is entirely independent of the ability to inhibit L1, and could instead reflect increased frequency of use of the L2.

In the present study, we directed our attention to the fluency task to observe Linck et al.'s (2009) inhibition effect more closely. We predicted that language immersion would reduce fluency in the L1, in order to obtain the benefit of acquiring greater gains in fluency in the L2. Through this study, one should expect to see differences in the number of category members that participants listed in the first fluency test (before immersion) and in the second fluency test (e.g., after being eight weeks in the Italian context). After taking an Italian-language course, participants will have listed more category members in the second fluency test, to represent an increase in their proficiency in Italian. For the English portion of the task, we expect to see a decrease in the average number of category members listed. These results would agree with previous findings that have shown the benefits of acquiring an L2 through an immersive environment.

METHOD

Participants

Eleven participants from the different UC campuses participated in this study.[1] Participants were recruited and tested during an eight-week study abroad program in Italy. All students were enrolled in a beginner or intermediate-level Italian language course at the UC Center. One participant was a native English speaker, and the remaining participants were bilingual in Spanish and English. Details of participants' language history can be seen in Table 1.

[1] Prior to the outbreak of COVID-19, we were able to collect data for the first testing period from 81 American students studying abroad in Italy and 18 students studying at the University of California, San Diego. Due to the pandemic, students studying abroad were asked to return to the United States and we were unable to administer the test to those whose contact information we had not previously recorded. After suspending our initial method, we were only able to collect data from 11 students through an online survey platform that included all of the questions from the language history questionnaire and timed sections to administer the fluency test. Our data analyses include the results from the 11 students' first and second testing periods. All other participant data was excluded from analysis.

TABLE 1:
Characteristics of the Participant Groups

Number of Participants	11
Age (years)	21.1
Self-rated proficiency in English	
Speaking	7
Reading	7
Writing	7
Understanding	6.9
Self-rated proficiency in Italian	
Speaking	1.5
Reading	2
Writing	1.6
Understanding	1.9

Materials and Procedures

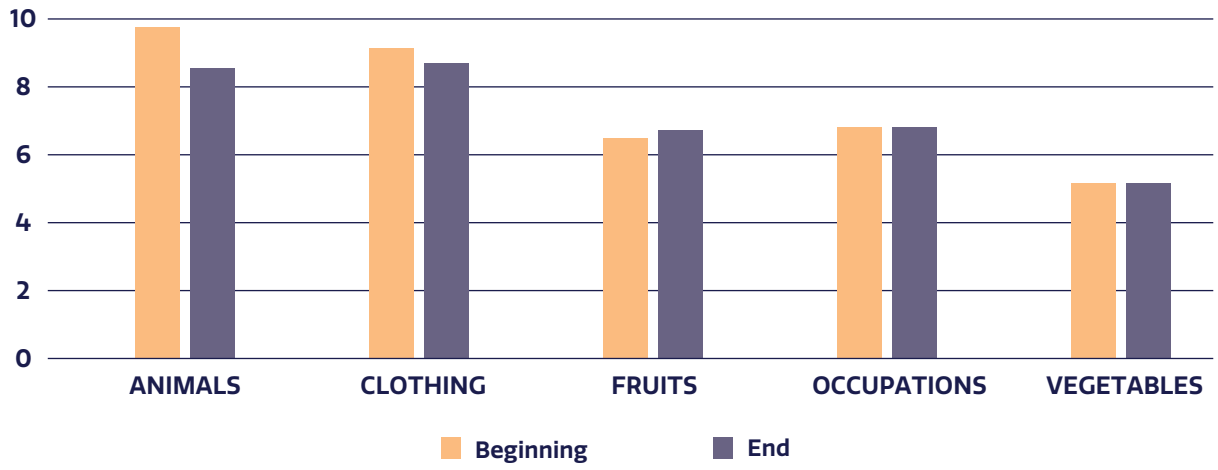
All participants provided informed consent and then performed a linguistic assessment (verbal-fluency test) and a language history questionnaire. Both tasks were completed on the first and last days of class. In the verbal-fluency task, participants were presented with a series of categories (i.e., animals, fruits, vegetables, clothing, occupations) and then instructed to write down as many category members as they could within 30 seconds. The task was completed first in English and then in Italian. Fluency scores were calculated by summing the total number of category members that were produced by each participant in each language. Afterwards, participants completed the language history questionnaire that asked them to list any previous exposure to Italian and other foreign languages, and to rate their levels of proficiency (on a scale of 1 to 7, where 7 represents native-like proficiency) in speaking, reading, writing, and understanding for each.

RESULTS

The average scores for production in English are presented in Fig. 1. A paired samples t-test was conducted to compare changes in fluency scores from the first (before immersion) to the second (after immersion) testing periods. Although participants tended to produce more category members in the first test compared to the second test, these differences were not significant overall ($t(10)= 2.23$, $p= .33$), and also not significant for each category on its own (all $ps \geq 0.09$). The only exception to this is in the fluency scores for the category 'Animals' which was marginally significant in the predicted direction ($p= 0.09$), significant with a one-tailed t-test ($t(10)= 1.8$, $p= 0.04$), supporting the presence of an inhibitory effect. The only category that showed an effect in the opposite direction (increased English fluency after immersion) was 'Fruits,' and in this case the before-after difference was very small, just 0.2 exemplars. The remaining 4/5 fluency categories all show a trend in the predicted direction.

With a higher sample size, the difference between these means could prove statistically significant, a finding that would have replicated the effect found in Linck et. al (2009). In their study, 25 participants were tested in the immersion condition and completed a verbal fluency task with three categories: 'Animals', 'Clothing', and 'Fruits'. Their findings reported an overall average of about 48 exemplars in the English verbal-fluency task, which would mean that participants produced about 16 exemplars per category. The verbal fluency task used in our study tested participants on two additional categories (i.e., 'Animals', 'Clothing', 'Fruits', 'Occupations'), and measured an average of 7.09 exemplars produced per category. Linck et al.'s level of proficiency is higher than the one observed in our studies, but our semantic categories might have been more difficult than those in Linck et al, and most of our participants were bilingual in Spanish-English, which previously have shown to have lower semantic fluency scores even in their dominant language (Gollan, Montoya, & Werner, 2002). If we assume that Linck et al.'s re-test findings for English proficiency rebounded to or very close to pre-immersion levels, we can calculate an average loss of about 2.33 exemplars per category. On average, differences in our study ranged from no change to losses of 1.4 exemplars per category. This analysis implies that Linck et al.'s subjects may have had larger losses to their L1 than the participants tested in our study, but actual pre-immersion test results would be needed to produce a more accurate comparison of L1

FIGURE 1: English Fluency Scores Before vs. After Immersion



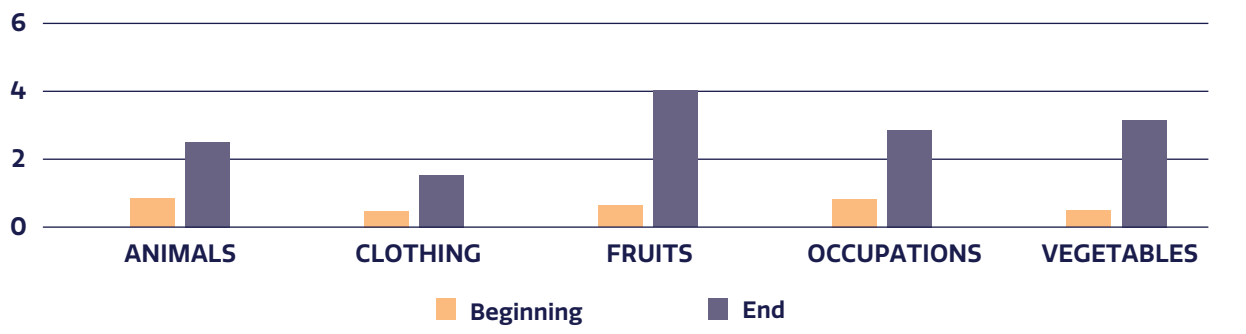
Average of English fluency scores produced for each category in each of the testing periods (before and after immersion period).

losses. In Spanish fluency scores, Linck et al. reported that immersed participants produced an average of 2.33 exemplars (per category) more than their classroom counterparts. After 2 months of immersion, our participants produced an average of 2.78 exemplars (per category) more compared to their pre-immersion scores. This analysis implies that our participants may have had slightly larger gains than Linck et al.'s participants. However, it is important to note that the subjects in Linck et al.'s study had an average of 3.9 university semesters of Spanish (L2) study previous to their studies abroad. Most of our subjects had little to no exposure previous to their time abroad and had less formal instruction in the L2 language.

The average scores for production in Italian are presented in Fig. 2. Contrasting the patterns shown in Fig. 1, scores in the second testing period were significantly higher than those initially recorded at the first testing period, this was true overall ($t(10)= 2.22$, $p < .01$). Increases in the means of 4/5 categories proved to be significant (all $ps \leq .07$) and the remaining category was found to be not significant ($p= .15$). When comparing overall scores, the decrease in English fluency scores is smaller than the increase in Italian fluency scores – even after considering the marginally significant decrease in one of the English categories. The smallest increase in L2 fluency can be observed in the category 'Clothing', which increased by an average of 1.2 exemplars (compared to an average decrease of 0.5 exemplars in the L1 category). L2 categories increase consecutively in the following order: 'Clothing', 'Animals', 'Occupations', 'Vegetables', 'Fruits'. The biggest change in the L2 category 'Fruits' has an average increase of 3.4 exemplars, compared to an average change of 0.2 in the L1 category in the same direction (instead of the expected decrease, this category shows a slight increase). The biggest decrease in L1 fluency is seen in the category 'Animals' with an average decrease of 1.4 exemplars. This category in L2 fluency scores increases by the same average of 1.4 exemplars. These comparisons suggest that the increase in L2 is not dependent on the decrease in L1.

We next examined changes in individual cases to investigate whether individuals who believed they had acquired more Italian were actually learning more. To observe the changes to Italian proficiency resulting from a period of prolonged exposure to the target language, we measured gains in verbal fluency across all five categories of the verbal fluency task. As shown in Fig. 3, the majority of subjects increased their level of proficiency in Italian. Namely, they were able to produce many more category exemplars at the second testing period compared to the first.

FIGURE 2: Italian Fluency Score Gaines

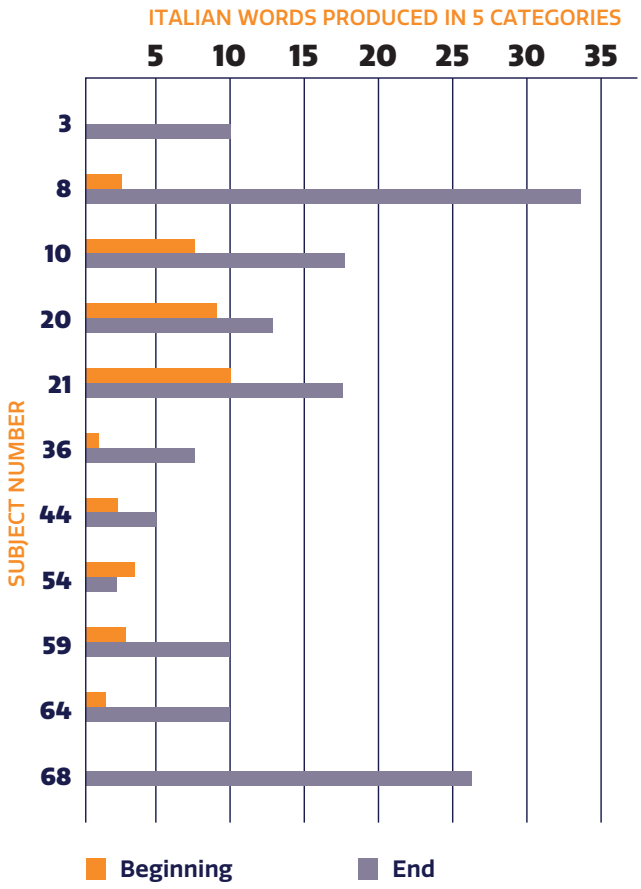


Average of Italian fluency scores produced for each category in each of the testing periods (before and after immersion period).

Past research has revealed that the accuracy of self-ratings as a measure of language proficiency and dominance, although correlated, are not nearly as good as objective measures and are often influenced by the participant's subjectivity and language background (Tomoschuck, Ferreira, Gollan, 2019). In an effort to understand whether speakers could accurately rate a change to their language proficiency, we analyzed the self-rating scores from both testing periods to measure the gains in self-rated fluency gains (Fig. 4). To better assess actual gains in Italian fluency, we compared each participants' verbal fluency scores (see Fig. 3) and the self-ratings recorded through the language history questionnaire, which consisted of a scale of 1-7 to rate speaker proficiency in reading, writing, speaking, and comprehension.

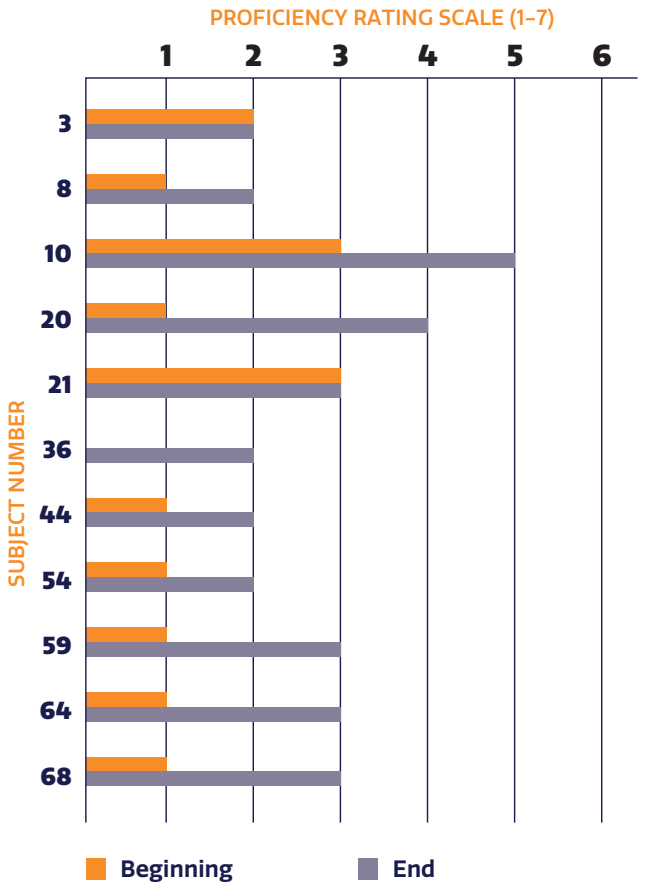
With just one exception, all participants increased their proficiency in Italian after the period of immersion. Self-ratings, however, varied greatly when considering changes to Italian proficiency. For example, the participant whose self-rating reflected a gain of 3, the highest self-rated increase in proficiency observed in our data, actually increased only slightly better in fluency scores compared to other participants. Alternatively, participants who stated that they had not increased at all actually increased their scores quite a bit. Fig. 5 compares differences in self-ratings and actual gains in fluency to further support the variability in participants' ability to judge their increase in Italian proficiency.

FIGURE 3:
Italian Verbal Fluency Gains



Italian verbal fluency gains measured by comparing beginning versus end scores across all five categories, for each subject.

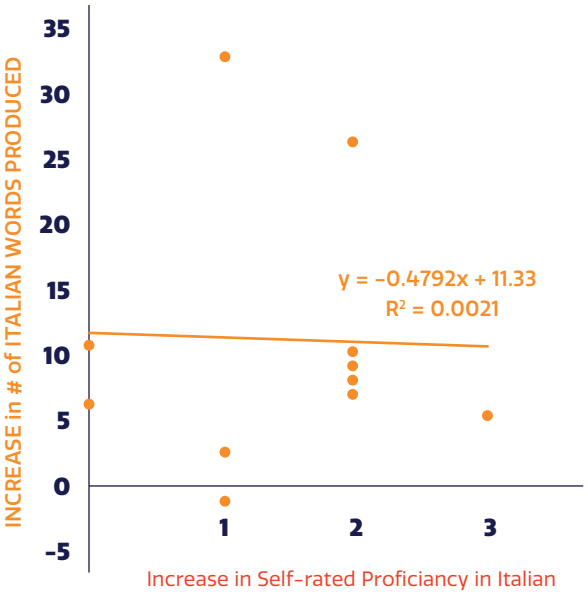
FIGURE 4:
Self-rated Italian Fluency Gains



Gains in Italian fluency, for each participant, measured by comparing their self- ratings (on a scale of 1-7 for reading, writing, speaking, and understanding abilities) from both testing periods

FIGURE 5:

Self Rating vs. Actual Fluency Gains



Differences in self-ratings versus actual fluency gains, measured by comparing the increase in self-ratings and the increase in Italian proficiency as shown through the verbal fluency test scores.

DISCUSSION

We tested 11 American students studying abroad in Italy at two different testing periods (prior to immersion and after the program had ended) through a verbal fluency task. Our data analyses compared the costs imposed upon production in the L1, resulting from language immersion, to any benefits in L2 proficiency. With the exception of one of the English categories, which showed a marginal effect in the predicted direction, our results do not show a significant difference in overall English fluency scores. Our results indicated that there was a significant increase in Italian fluency scores, namely, proficiency in Italian increased during the period of immersion. When comparing the overall difference between the decrease in L1 abilities to the increase in L2 abilities, our findings indicated that the latter was more robust than the former. Finally, our comparisons between self-ratings and actual gains in L2 fluency support previous research on the accuracy of individual ratings of their linguistic abilities (e.g. Tomoschuck, Ferreira, Gollan, 2019). Our findings showed that participant self-ratings were not representative of their actual gains in fluency. Although the majority of our participants experienced increases to their proficiencies in Italian, many claimed that they had not improved or that they slightly improved.

It is difficult to interpret the null result in our findings, but with more power, we might have been able to replicate Linck et al.'s (2009) findings which supported the presence of L1 inhibition effects. We speculate that some of these differences could arise from the fact that we tested fewer participants and in only one condition, compared to those tested in Linck et al.'s study (25 students in an immersed condition and another 20 in a classroom condition). Additional differences could have resulted from the fact that most of our participants were bilingual in English and Spanish. Although all students had little to no exposure to Italian, the fact that they had knowledge and previous experience in juggling two languages could have exerted an effect on their regulatory abilities while acquiring a third language. This effect might not be present in all individuals acquiring a foreign language, but it could be specific to bilingual speakers attempting to learn a third language.

In this respect, a temporary inhibitory mechanism which imposes a 'hit' to L1 accessibility, was observed to be smaller in our findings than a separate sustained effect on L2 proficiency. It could be that a prolonged immersion in an L2-dominant context triggers an inhibitory mechanism in the L1, as its use and frequency are greatly reduced in this environment. This weakens the levels of activation for the L1 and imposes processing costs when the speaker attempts to access it

(e.g. to complete the fluency task at the second testing period). Once the speaker returns to their L1-dominant context, frequency and use of the L1 strengthens links to access the language and allows proficiency to return to its original levels. A "persistent insensitivity to lexical interference in translation recognition" as reported by Linck et al. (2009) could be due to other consequences of inhibition that have not been visible through previous research. It might be helpful to note that the biggest increase in L2 that our data records is in the category of 'Fruits'. This increase is not reflected in any way nor does it impose changes to the results for the L1, and so it might be due to the fact that participants produced more fruit names that are only unique to Italy (and are therefore used less frequently in English). This reasoning could also imply that a mechanism other than inhibition is acting on the L1. Regardless, our findings suggest that the inhibition process is not related to the observed increase in Italian proficiency. We speculate that the increase in Italian can be better explained by more frequent use of the L2 during immersion, which has also been considered in previous immersion studies (e.g., Baus, Costa, & Carreiras, 2013).

While our findings were not able to prove a significant decrease in L1 fluency, they did show large and significant increases in L2 fluency. Such an evident increase in Italian fluency, compared to a much smaller decrease in English production, could imply that the decrease in English (which is a consequence of inhibition of the L1) is not responsible for the more evident increase in Italian fluency. Gains in the L2 could be better explained by an increased and more frequent use of it during the immersion period. Assuming L2 gains in proficiency are sustained even after participants have been back in their L1-dominant context for 6 months, in which case L1 production would have rebounded to its pre-immersion levels (Linck et al., 2009), an increased level of proficiency would not have necessarily been dependent on inhibitory effects, but rather be exhibiting frequency effects. Therefore, frequency of use during immersion would have been enough to effect a lasting increase in proficiency.

This logic agrees with the proposed mechanism by Kreiner & Degani (2015), which combines the frequency lag and dual-language activation accounts, and postulates that a bilingual cannot 'turn off' any of their languages, therefore they all remain simultaneously activated at all times. The activation of any one language can be enhanced through passive exposure to that language (Kreiner & Degani, 2015). This view also supports the presence of a cross-language interaction that accounts for global exposure effects, so that a change in activation affects all of the languages through competition between languages and/or inhibition. Under this account, we could claim that a lack of exposure and a decreased use of the L1 is attenuating production abilities causing them to fall behind. Meanwhile, the L2 is benefitting from more opportunities to use the language, to hear it, and to study it. Considering the low levels of L2 exposure that most of our participants had at the first testing period, it is likely that inhibition of the L1 was triggered by immersion in the L2-dominant context and not through competition, which has been the case in studies where participants have had significant prior exposure in the L2 (e.g. Kreiner & Degani, 2015). Therefore, we speculate that the opposite directions in which the L1 and L2 fluency scores change could be due to initial inhibition during the language acquisition process. While inhibition is being induced, a separate cognitive mechanism takes advantage of the benefits of immersion learning to effect increases to L2 proficiency.

Related to this idea, a study by Mårtensson et al. (2012) analyzed that structural changes to

brain regions that are brought on when learning a foreign language. The participants in their study received intense instruction in a foreign language as a part of their training at the interpreter academy of the Swedish military. Their findings revealed hippocampal changes, which they explained to have resulted from the participants' efforts on learning large amounts of novel words within a short period of time. They also indicated that "more stable lexical representations in neocortical areas... may be derived gradually from repeated encounters with new words". These findings could help connect structural changes in the brain during language acquisition with the cognitive mechanisms studied in this paper. Congruent to the frequency lag account, the process of language acquisition requires the speaker to develop stronger links to their lexicon through use and practice. Once this has been achieved, and reflected in the actual structure of the brain, namely in the neocortical areas, the speaker will have achieved a level of proficiency that is more stable and can be accessed with less cognitive effort.

Through this study, we aimed at investigating the benefits and consequences of immersive effects to better understand aspects that are critical for adult language learners. Although our findings lack power and are inconclusive, the numbers in our data trended in the right direction. With more power, we would have been able to sustain the notion that L2 acquisition during immersion is not dependent on the inhibition of a speaker's L1. Although these can be observed to be acting simultaneously during the process of language acquisition, our findings suggest that decreases in L1 production are far outweighed by increases in L2 proficiency. Future studies should investigate a more thorough cost-benefit analysis and consider the effects of foreign-language acquisition in different learning environments (such as immersion periods of varying lengths of time). It is important to continue investigating inhibition in language acquisition to improve foreign language teaching methods and potentially aid immigrant populations throughout the world in which any means of accelerating language acquisition would be invaluable.

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