

Examining the Effect of Structural Priming on Three Different Populations: Spanish Native Speakers, Spanish L2 Learners, and Spanish Heritage Speakers

Irati Hurtado and Silvina Montrul

1. Introduction

The importance of input in language acquisition processes has been widely discussed in the literature (e.g., Bybee, 2008; Genesee & Nicoladis, 2006). However, how that input is processed by different types of speakers (e.g., native speakers or L2 speakers) and how it influences subsequent linguistic production is not yet clear (e.g., Byalistok, 1991; Clahsen & Felser, 2006; Hartsuiker & Bernolet, 2017). A phenomenon that could shed some light on this issue is structural priming (also known as syntactic priming). Structural priming refers to the tendency of speakers to use a structure that was previously heard or read (Bock, 1986). Different models have been proposed to explain the nature of structural priming. On the one hand, activation models suggest that when speakers process a sentence they hear or read, a lemma is activated and it is later reused in production (Pickering & Branigan, 1998; Kaschak & Glenberg, 2004). The activation of the syntactic structure is thus what drives priming, according to this account. On the other hand, implicit learning models suggest that when speakers hear or read a sentence, they implicitly extract probabilistic information and create structural associations, which lead to the production of similar syntactic structures. (Chang, Dell, Bock & Griffin, 2000; Chang, Dell & Bock, 2006). More recent proposals have suggested that activation and learning go hand in hand in the priming process. Reitter, Keller, and Moore (2011) claim that short-term priming could be activation-based and long-term priming could be learning-based.

Structural priming was first accounted for in monolingual native speakers, although further studies have examined this phenomenon in different types of speakers, contexts, modalities, and also in the long-term. More recently, there has been an interest in this phenomenon in Second Language Acquisition and Bilingualism (see Jackson, 2018 for a review). If structural priming operates in L2 acquisition, it has the potential to be exploited as a valuable pedagogical tool to help L2 learners advance in their acquisition and production of the L2. On the other hand, examining how heritage speakers respond to structural priming both immediately and in the long-term could shed some light on how these speakers process language. This latter is a fundamental question in language processing

* Irati Hurtado, University of Illinois at Urbana-Champaign, ihurta3@illinois.edu. Silvina Montrul, University of Illinois at Urbana-Champaign, montrul@illinois.edu.

research, as some studies have found that heritage speakers are influenced by their heritage language in some aspects of sentence processing (e.g., Jegerski, Keating, & VanPatten, 2016), whereas the opposite has been found in other studies (e.g., Keating, VanPatten, & Jegerski, 2011; Moreno & Kutas, 2005). Thus, testing and drawing comparisons between native speakers, heritage speakers and L2 speakers will help broaden our understanding of how different speakers process and use language.

The few available L2 and heritage priming studies have focused on English as the target language (e.g., Kim & McDonough, 2008; Kim & McDonough, 2016) and not many have explored whether structural priming could be effective in the long-term (e.g., Shin & Christianson, 2012). Thus, investigating how structural priming behaves in other languages, with other structures, and in the long-term is needed to understand the phenomenon of structural priming, the extent to which it is an implicit learning mechanism, and how it may vary depending on language, structures and speakers. The present study is innovative in contributing to increase our understanding of structural priming in three different groups of speakers (namely, native speakers, heritage speakers, and L2 learners) and in using a task designed to elicit Spanish clitic doubling constructions (e.g., *Juan le da un libro a Maria* -Juan gives Maria a book-) in cases where the clitic is optional but much preferred in native varieties instead of prepositional constructions (e.g., *Juan da un libro a Maria* -Juan gives a book to Maria-), which L2 learners tend to use (especially when their L1 has no clitics). This alternation was chosen because it resembles the English dative alternation, which has already been the subject of several studies. Most studies of structural priming have examined the immediate effects of priming. The present study also examines the potential long-term effects of structural priming.

2. Clitic doubling constructions in Spanish

Ditransitive sentences in Spanish (i.e., sentences with a direct object and an indirect object), are characterized by the presence of a dative clitic (*le/les*¹) and a case marker (*a*), as in (1). The dative clitic agrees with the full NP that works as the indirect object, and the case marker *a* licenses that full NP. These ditransitive sentences with dative clitics are usually known as clitic doubling constructions.

¹ The clitic “le” refers to the 3rd person singular form, meaning that the option “les” (in plural) could also be found in these constructions when having a plural indirect object. However, this plural form will not be considered for this study because it is subject to a great deal of dialectal variation and, in many cases, “le” is taking the place of “les”. Given that this is not a study on sociolinguistics, but on acquisition, the simple form “le” will be the only one employed in order to control for this factor. For more on “le” and “les” from a variationist perspective, see Company (2006) and Huerta (2005), among others.

According to Fernández-Alcalde (2014), the indirect object of such ditransitive sentences can have different thematic roles: recipient (1), possessor (2), beneficiary (3), and locative (4).

- (1) Juan le_i regaló un libro a mi padre $_i$.
 Juan 3pIO gave.he a book to my father
 ‘Juan gave a book to my father.’
- (2) El peluquero le_i cortó el pelo a Julia $_i$.
 the hairdresser 3pIO cut.he the hair to Julia
 ‘The hairdresser cut Julia’s hair.’
- (3) Ana le_i preparó un bocadillo a Soraya $_i$.
 Ana 3pIO prepared.she a sandwich to Soraya
 ‘Ana prepared a sandwich for Soraya.’
- (4) Daniel le_i instaló un antivirus al ordenador $_i$.
 Daniel 3pIO installed.he an antivirus to the computer
 ‘Daniel installed an antivirus program on the computer.’

These four ditransitive constructions can also be expressed as prepositional constructions² (Table 1). In all cases, the alternation between the ditransitive construction and the prepositional construction involves the dropping of the dative clitic and a change in the case marker *a*, which now takes the form of a preposition (i.e., *a*, *de*, *para*, *en*). This latter change implies that the indirect object is no longer an internal argument of the verb (Cuervo, 2003; Fernández-Alcalde, 2013; Gutiérrez-Ordóñez, 1999).

Table 1: Alternation between ditransitive and prepositional constructions in Spanish.

Thematic role	Ditransitive construction	Prepositional construction
Recipient	Juan <i>le</i> regaló un libro <i>a</i> mi padre	Juan regaló un libro <i>a</i> mi padre
Possessor/Source	El peluquero <i>le</i> cortó el pelo <i>a</i> Julia	El peluquero cortó el pelo <i>de</i> Julia
Beneficiary	Ana <i>le</i> preparó un bocadillo <i>a</i> Soraya	Ana preparó un bocadillo <i>para</i> Soraya
Locative	Daniel <i>le</i> instaló un antivirus <i>al</i> ordenador	Daniel instaló un antivirus <i>en</i> el ordenador

Native speakers of Spanish produce and understand clitics at a very young age. By the age of 3, monolingual children already master the morphosyntactic properties of Spanish clitics and they hardly ever make any errors (López Ornat, Fernández, Gallo, & Mariscal, 1994; Eisenchlas, 2003; Montrul, 2004a). As for

² If the indirect object is a pronoun instead of a full NP, the alternation is not possible. This paper will only deal with those ditransitive sentences that allow for the alternation.

clitic doubling constructions in particular, children already use them before the age of 2 (Torrens & Wexler, 2000). Concerning the use of clitic doubling constructions in adult native speakers of Spanish, a great deal of variation has been attested. Company (2006) found that doubling is less common in Peninsular Spanish, where speakers use clitic doubling 64% of the time. Speakers of Latin American Spanish were found to use clitic doubling constructions much more frequently, with Mexico being the country where dative clitics are doubled the most (89% of the time).

Despite how easy it is for native speakers of Spanish to acquire clitic doubling constructions, this is hardly the case of L2 learners of Spanish, especially when their L1 does not have clitics. Previous studies have examined how speakers of other languages (mainly English and French) produce and interpret Spanish clitics. Overall, it seems that L2 learners of Spanish go through different phases throughout their process of clitic doubling acquisition. They seem to acquire the morphosyntax of the construction by the intermediate level of proficiency, but its semantics is not acquired until later on (Bruhn de Garavito, 2006; Cuervo, 2007; Montrul, 1999; Perpiñán & Montrul, 2006).

Clitic doubling constructions have also been investigated in some heritage language situations. More specifically, in cases where Spanish is in contact with a Germanic language. In these studies, heritage speakers showed levels of clitic production similar to those of native speakers, though still lower (Irizarri, 2014; Silva-Corvalán, 1994, Montrul, 2004b).

3. Research questions

The present study uses structural priming to understand the acquisition and knowledge of Spanish clitic doubling constructions in native speakers, heritage speakers and L2 speakers. It answers three research questions.

- 1) Do Spanish native speakers, Spanish L2 learners, and Spanish heritage speakers use clitic constructions in optional contexts?

This first question intends to show whether the rate of clitics produced by these three groups of speakers is consistent with what previous studies have found. In other words, this question looks at speakers' average rates of clitic production. Following Company (2006), it is expected that Spanish native speakers will produce more clitic constructions than prepositional constructions. Likewise, based on previous research, heritage speakers are expected to produce clitics closer to the rate of native speakers and more often than L2 learners (Irizarri, 2014; Montrul, 2010; Silva-Corvalán, 1994). The L2 learners are expected to produce fewer clitic constructions than native speakers and heritage speakers overall (Montrul, 2004b).

- 2) Can structural priming make the three groups of speakers produce more clitic constructions? Does lexical repetition have an effect on the degree of priming?

Since the Spanish ditransitive-prepositional alternation has never been used in a priming study, there are no specific predictions for this question. However, following priming studies with other constructions, if L2 learners produce fewer clitics in general, they are expected to be more sensitive to priming than native speakers and heritage speakers.

Lexical repetition between the prime and the target might also have an effect on the degree of priming, as it has been found in other studies (e.g., Jackson & Ruf, 2017; Kim & McDonough, 2008) where lexical repetition enhanced priming. If this is true, higher rates of priming are expected when the prime and the target contain the same lexical item.

3) Do priming effects hold one week after the treatment?

Some studies have shown that structural priming effects persist in the long-term (e.g., Jiang & Huang, 2015; Shin & Christianson, 2012). That is, speakers show priming effects when they are tested again some days after they completed the main priming task. If such long-term priming effects are found in the study, we will have evidence that structural priming might have important pedagogical implications for L2 teaching.

4. Participants

A total of 75 participants were recruited: 23 Spanish native speakers, 28 Spanish L2 speakers, and 24 Spanish heritage speakers. The L2 learners and the heritage speakers were undergraduate students at an American university. These two groups completed a proficiency language test, a linguistic background questionnaire, and a clitics test. The proficiency test consisted of parts of the DELE and had a maximum possible score possible of 50 points. The mean score was 27.2 (SD: 5.9) for L2 learners (low-intermediate level) and 37.9 (SD: 5.9) for heritage speakers (high-intermediate level).

As for the linguistic background questionnaire, it served the purpose of determining who was a heritage speaker and who was an L2 learner. The questionnaire was based on the resources available on the National Heritage Language Resource Center website (Gignoux, 2009; Montrul, 2012; Torres, 2012). According to the results of the questionnaire, the group of Spanish heritage speakers was heterogeneous. Out of the 24 participants, 23 of them were second-generation immigrants and 1 of them was a third-generation immigrant. Furthermore, 21 of them were of Mexican descent, whereas the other 3 were from Guatemala, Ecuador, and Spain heritage, respectively. Out of the 24, only 5 were raised in English-dominant environments (i.e., English was the main language spoken at home and the only language spoken at school). The other 19 were raised in a bilingual environment (i.e., Spanish was spoken predominantly at home and to some extent at school).

Lastly, the clitics test aimed to determine whether participants had any knowledge of clitics in Spanish. Participants were presented with sentences in Spanish where they had to replace objects by clitics. The maximum score

possible was 6 points. The mean score was 4.7 (SD: 0.9) for L2 learners and 5.6 (SD: 0.6) for heritage speakers.

Regarding the native group, all speakers were from Spain. According to Company (2006), the Peninsular variety of Spanish is the one that presents the lowest clitic rate. Thus, it made sense to use these speakers for a priming study, since they still had a chance to increase their clitic production by a meaningful percentage.

5. Methodology and procedure

Following Bock (1986), a picture description task was used. Given the nature of the research questions, participants completed this task in four different phases using a computer. Firstly, there was a baseline phase, in which participants were not primed. Its goal was to determine the rate of clitic production for each group. Participants saw pictures with a verb in the infinitive. They were asked to create a sentence using the verbs given to describe the pictures. They were allowed to use whatever tense they wanted, and they could add as many details as they wished. All sentences were orally recorded for analysis. To hide the actual goal of the experiment, participants were told they were taking part in a memory task. After seeing a number of pictures, a question asking whether they had seen a given picture popped up. The question required clicking a 'yes' or 'no' answer and automatic feedback was provided on the screen.

Then, participants proceeded to the treatment phase, where priming was administered. Here, participants had a double task: they were presented with pictures accompanied by full sentences in Spanish that they had to read (primes) and they also had to produce their own descriptions in those cases where only a verb was provided (targets). The goal was for them to produce the same structure in the targets as in the primes, without explicitly being told so. Participants were also told this was a memory task, so distractor questions asking about the presence of pictures were also provided. All descriptions were orally recorded.

The third phase consisted of an immediate post-test. It was completed five minutes after the treatment in order to determine whether the effects of priming were still active. The structure of this phase followed the same format as the baseline phase. Lastly, the fourth phase of the study consisted of a delayed post-test that was conducted a week after the treatment phase. This last task was intended to measure long-term effects of priming. It followed the same structure as the baseline and the immediate post-test.

6. Materials

All pictures were presented using the Paradigm software (Perception Research Systems, 2007). For the baseline phase, 21 pictures with verbs were created. There were 14 picture-verb combinations that elicited clitic doubling constructions, and 7 fillers that elicited transitive constructions. Additionally, there was a total of 4 distractor questions intended to distract participants from

the main goal of the study. Pictures were presented in a pseudo-randomized order, in such a way that two distractor questions never appeared one right after the other.

The treatment phase contained both primes and targets in addition to fillers and distractor questions. 16 sets were created. Each set consisted of 4 fillers, 2 prime sentences, and 1 target picture. All items within a set were always presented in that order. In this case, fillers consisted of a picture accompanied by a full sentence with a transitive verb underneath. Primes followed the same format, although sentences contained clitic doubling constructions. As for the targets, these were pictures with a verb in the infinitive, as in the baseline. Furthermore, in half the sets, verbs in the primes and the targets were the same, whereas in the other half, each verb was different. Finally, there were 5 distractor questions for the memory task. The order of sets was pseudo-randomized in such a way that distractor questions never appeared between a prime and a target.

The two post-tests (i.e., immediate and delayed) had the same format as the baseline phase.

7. Data analysis and results

To analyze the data, recorded sentences were transcribed. Transcriptions were verbatim, although unrelated errors that were present (e.g., pronunciation or vocabulary) were not taken into account. Each sentence was coded according to the variables of interest: presence or absence of the dative clitic, phase in which it was produced, and repetition (only considered for sentences in the treatment phase). Descriptive statistics were first run to answer the research questions. Thus, means, standard deviations, and percentages of clitic usage were calculated for each group of speakers and phase (Table 2).

Table 2: Means, SD, and percentages of clitic usage by speaker and phase. (L1 = native speakers; HS = heritage speakers; L2 = second-language learners)

Phase		L1 (<i>n</i> = 23)	HS (<i>n</i> = 24)	L2 (<i>n</i> = 28)
Baseline	Mean	3.89	3.44	0.55
	SD	1.86	2.27	1.00
	%	55.59	49.11	7.91
Treatment	Mean	5.57	5.50	2.18
	SD	2.01	2.78	2.31
	%	69.56	68.75	27.68
Immediate post-test	Mean	4.13	4.35	1.73
	SD	1.67	2.51	2.42
	%	58.82	62.20	24.80
Delayed post-test	Mean	4.28	4.00	1.13
	SD	1.97	2.41	2.01
	%	60.99	57.14	16.11

As Table 2 shows, rates of clitic production were similar in the case of native speakers and heritage speakers. L2 learners, on the other hand, produced

fewer clitics when compared to those two groups. This difference is particularly striking in the baseline phase. Results also show that all groups produced more clitic constructions in the treatment phase. In the two post-tests, rates of clitic production decreased in all groups. However, clitic rates are still higher than in the baseline phase in many cases. This information can also be seen in Figure 3, which shows how rates of clitic production develop throughout the phases.

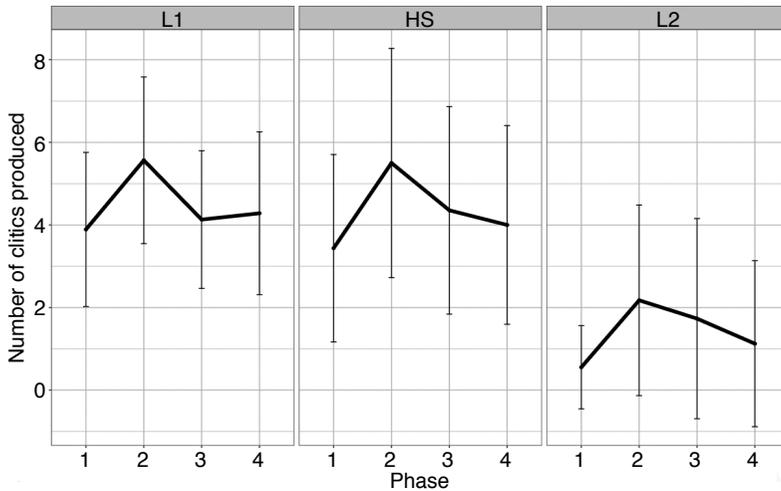


Figure 3: Means and SE of clitics produced by phase and group of speakers. (L1 = native speakers; HS = heritage speakers; L2 = second-language learners; Phase 1 = Baseline; Phase 2 = Treatment; Phase 3 = Immediate post-test; Phase 4 = Delayed post-test)

A mixed-effects binomial logistic regression model was run using the statistical software R (R Core Team, 2013) to see whether clitic production was significant across phases and by type of speaker. The presence or absence of clitic was used as the binomial dependent variable for the model. An interaction between type of speaker and phase was entered as independent variable. Participant and item were included as random effects in the model (Table 3).

Results from this model show that L2 learners produced significantly fewer clitic constructions than native speakers and heritage speakers. Also, no significant differences between the group of native speakers and the heritage group were found. On the other hand, the interaction between type of speaker and phase was in many cases significant, meaning that each group responded differently to priming depending on the phase.

Table 3: Results of the main mixed-effects binomial logistic regression model. (HS = heritage speakers; L2 = second-language learners; Phase 2 = Treatment; Phase 3 = Immediate post-test; Phase 4 = Delayed post-test)

Fixed effects					
	Estimate	SE	Z value	P value	Significance
(Intercept)	0.287	0.416	0.689	0.491	
Type of speaker-HS	-0.663	0.552	-1.201	0.229	
Type of speaker-L2	-4.050	0.569	-7.118	<0.001	***
Phase-2	0.756	0.183	4.124	<0.001	***
Phase-3	0.175	0.181	0.970	0.332	
Phase-4	0.293	0.182	1.611	0.107	
Speaker-HS*Phase-2	0.629	0.275	2.292	0.0219	*
Speaker-L2*Phase-2	1.431	0.318	4.496	<0.001	***
Speaker-HS*Phase-3	0.699	0.270	2.591	<0.001	***
Speaker-L2*Phase-3	1.815	0.322	5.637	<0.001	***
Speaker-HS*Phase-4	0.222	0.266	0.833	0.404	
Speaker-L2*Phase-4	0.854	0.327	2.609	0.009	**
Random effects					
	Variance	SD			
Participant (Intercept)	3.139	1.772			
Item (Intercept)	0.314	0.560			

In order to better examine how the groups responded to structural priming in each phase, estimated marginal means were calculated drawing from the aforementioned model. This measure can inform whether rates of clitic production were significant from phase to phase; that is, whether the increase or decrease in the number of clitic constructions produced in each phase was significant or not (Table 4). The table shows that many of the differences between phases were significant. More specifically, it provides a clear picture of how structural priming modified these speakers' initial preferences. In the case of native speakers, priming made them produce more clitics than in the baseline. However, this effect did not extend to the immediate post-test nor the delayed post-test. In the case of heritage speakers and L2 speakers, the priming intervention was successful at making them produce more clitics in each phase (if compared to the baseline), including the delayed post-test. This means that the effects of structural priming were long-lasting for these two groups.

Table 4: Estimated marginal means.

(L1 = native speakers; HS = heritage speakers; L2 = second-language learners;
Phase 1 = Baseline; Phase 2 = Treatment; Phase 3 = Immediate post-test;
Phase 4 = Delayed post-test)

Type of speaker	Contrast	Estimate	SE	Z ratio	P value
L1	Phase 1-Phase 2	-0.756	0.183	-4.124	<0.05
	Phase 1-Phase 3	-0.175	0.181	-0.970	0.767
	Phase 1-Phase 4	-0.293	0.182	-1.611	0.372
	Phase 2-Phase 3	0.581	0.184	3.161	<0.05
	Phase 2-Phase 4	0.464	0.184	2.514	<0.05
	Phase 3-Phase 4	-0.117	0.182	-0.644	0.918
HS	Phase 1-Phase 2	-1.386	0.208	-6.668	<0.001
	Phase 1-Phase 3	-0.875	0.201	-4.358	<0.05
	Phase 1-Phase 4	-0.514	0.195	-2.644	<0.05
	Phase 2-Phase 3	0.511	0.214	2.386	0.079
	Phase 2-Phase 4	0.871	0.210	4.142	<0.05
	Phase 3-Phase 4	0.360	0.204	1.764	0.291
L2	Phase 1-Phase 2	-2.187	0.263	-8.321	<0.001
	Phase 1-Phase 3	-1.989	0.267	-7.466	<0.001
	Phase 1-Phase 4	-1.147	0.272	-4.208	<0.05
	Phase 2-Phase 3	0.197	0.200	0.982	0.759
	Phase 2-Phase 4	1.039	0.218	4.778	<0.001
	Phase 3-Phase 4	0.843	0.223	3.781	<0.05

In order to account for whether lexical repetition between the prime and the target had an enhancing priming effect, data from the treatment was analyzed. A new mixed-effects binomial logistic regression model was run (Table 5). It was found that lexical repetition of the prime enhanced syntactic priming, although it did not reach a significance level of $p < 0.05$.

Table 5: Results of the mixed-effects binomial logistic regression model for the treatment phase.

(HS = heritage speakers; L2 = second-language learners)

Fixed effects					
	Estimate	SE	Z value	P value	Significance
(Intercept)	0.824	0.533	1.546	0.122	
Speaker-HS	0.081	0.616	0.131	0.896	
Speaker-L2	-2.871	0.597	-4.808	<0.001	***
Repetition-Yes	0.788	0.452	1.745	0.081	.
Random effects					
	Variance	SD			
Participant (Intercept)	3.851	1.962			
Item (Intercept)	0.709	0.842			

8. Discussion

In this study, knowledge of Spanish dative clitic constructions was analyzed in three groups of speakers: Spanish native speakers, Spanish L2 speakers, and

Spanish heritage speakers. Additionally, the study investigated whether structural priming had an effect on these speakers' production of such constructions, both immediately and in the long-term (i.e., one week after the treatment).

Results from the baseline showed that Spanish native speakers produced the highest number of dative clitic constructions, compared to the other two groups. These results were as expected, since the native group is the one that has better knowledge of the construction. Indeed, dative clitic constructions were used 55% of the time by this group, which agrees with what Company (2006) found for Peninsular Spanish speakers. Regarding the L2 group, these learners barely produced clitic constructions (7%), as they opted for prepositional constructions instead. The heritage group, on the other hand, used only slightly fewer clitic constructions than the native group (49%). However, the difference between native speakers and heritage speakers was not significant. One could argue, however, that these two groups of speakers are not comparable, since the native group spoke Peninsular Spanish and the heritage group was mostly exposed to Mexican Spanish. A small follow-up study was conducted with nine native speakers of Mexican Spanish, who completed the baseline phase of the study. It was found that Mexican speakers produced clitics 60% of the time. This means that Mexican speakers produced more clitic constructions than the Peninsular group, as was shown by Company (2006). Nevertheless, a t-test showed that this difference was not significant: $t(15.21) = -0.42$, $p > 0.5$. These findings confirm that the heritage group was closer to the native group than to the L2 group. Overall, these results are consistent with Montrul's findings (2004b, 2010).

The treatment examined the effect of structural priming on the three groups of speakers. According to the main binomial model, all groups were primed. This answers the second research question. However, the effect of priming was different in each group. The native group only increased its production of dative clitic constructions slightly. Heritage speakers, on the other hand, produced more clitic constructions than in the baseline, in a way that they ended up pairing with Peninsular Spanish native speakers. Lastly, the L2 group showed the greatest increase in the production of clitic constructions, as predicted. However, many of these participants did not produce any clitic in the baseline phase, despite being familiar with the construction (as the clitic test showed). In a study by McDonough (2006), she found that those participants who had produced the target structure in the baseline showed greater priming effects in the treatment than those who did not. To further explore this idea, the L2 group was divided into two smaller groups: those who had produced at least one clitic construction in the baseline (+Clitic) and those who did not (-Clitic). An independent samples t-test was conducted to compare production of clitic constructions in the treatment phase by each of those two subgroups. There was a significant difference in the production of clitic constructions between the +Clitic group ($M = 3.69$, $SD = 1.94$) and the -Clitic group ($M = 2.15$, $SD = 2.07$), $t(24.56) = 2.32$, $p < 0.5$. This shows that it is not only knowledge of the construction that is required for priming to be particularly effective among L2 speakers, but also actual usage of it.

Regarding lexical repetition, when the verb was repeated in the prime and in the target, speakers showed a higher degree of priming. However, an inferential

analysis showed that lexical repetition was only a significant factor at the 90% confidence interval. This contrasts with studies that have found a more significant lexical boost effect in other languages (e.g., Pickering & Branigan, 1998).

Concerning the third research question, estimated marginal means from the main binomial model showed that priming effects were significant both in the immediate post-test and in the delayed post-test for the group of heritage speakers and the group of L2 speakers. This is consistent with other studies that have shown that priming is an instance of implicit learning and that its effects can still be seen after several days (e.g., Kim & McDonough, 2016; Shin & Christianson, 2012). The fact that L1 speakers did not show priming effects in the long-term could be due to the fact that they already used this construction often (i.e., more than 50% of the time). Thus, it might be hard for priming to increase those initial high rates of clitic production. Still, this hypothesis should be further investigated by testing Spanish native speakers in the long-term with a less frequent construction.

On the other hand, priming was shown to have important pedagogical implications, given the positive long-term priming effects in the L2 and the heritage group. Thus, structural priming could be used in the L2 classroom to promote implicit learning of certain syntactic structures, as previous studies with other languages have shown (e.g., Kim & McDonough, 2016; McDonough & Kim, 2009). Regarding the implications that structural priming could have for heritage speakers, this study proved priming to be a useful tool to make heritage speakers produce language in a more native-like manner.

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