

Processing Relative/Sentence Complement Clauses in Immersed Spanish-English Speakers

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1. Introduction

Numerous studies have suggested that under certain circumstances (e.g., immersion in the second language environment) the production of the native language (L1) in adult second language learners can be influenced by features of the second language (L2) (Flege, 1987; Flege & Eefting, 1987; Pavlenko, 2000; Pavlenko & Jarvis, 2002; Porte, 2003). Comparatively fewer studies have investigated whether the L2 can induce changes in the processing of the L1. To begin to fill this gap, this study examines whether L1 Spanish-L2 English speakers immersed in the L2 environment for an extended period of time show processing strategies in their L1 that are different from monolingual speakers. Immersion was examined because past studies have shown that years of immersion experience in the L2 can impact processing in the L1 (Dussias & Sagarra, 2007). Participants were presented with written sentences in their L1 that were syntactically ambiguous between a relative clause reading and a sentence complement reading. The sentences were disambiguated by the presence of a verb in the subjunctive or indicative mood in the ambiguous clause. To anticipate the findings, participants with more than 3 years of immersion experience in the L2 show processing patterns in their first language that are similar to monolingual controls.

This article is structured as follows. Section 2 reviews previous findings on the effect of the L2 on the L1. Section 3 presents the study and section 4 reports the results. Finally, we discuss the findings in section 5.

2. The influence of the L2 on the L1

Recent findings in the L2 literature suggest that knowledge of a second language can affect the first language system. Although this might be less surprising in cases of early L2 acquisition (e.g., Müller, 1998; Müller & Hulk, 2001, Sánchez, 2004), where the possibility for cross-linguistic influence may be greater because the child may be confronted with two different grammars (Paradis, 2001; Paradis & Genesee, 1996; Paradis & Navarro, 2003), a remarkable finding in the L2 literature is that the L2 can influence the L1 even when the L2 is acquired and mastered well into adulthood, at a time when the native linguistic system is purportedly stable and has become highly entrenched. Evidence that knowledge of a second language affects the native language in adult speakers has been reported in a number of linguistic domains, including the production and perception of speech sounds (e.g., Andrews, 1999; Bullock & Gerfen, 2004; Flege, 1987; Flege & Eefting, 1987; Major, 1992, 1993; MacKay, Flege, Piske & Schirru, 2001), the lexicon and semantic networks (e.g., Ameel, Malt,

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Storms, & van Assche, 2009; Ameel, Storms, Malt & Sloman, 2005; Boyd, 1993; Pavlenko & Jarvis, 2002; van Hell 1998; van Hell & Dijkstra, 2002) and the morpho-syntactic system (e.g., Boyd & Andersson, 1991; Pavlenko, 1997; Seliger & Vago, 1991; Waas, 1996) among others (for a comprehensive discussion, the reader is referred to Pavlenko, 2000).

Many studies investigating changes to the L1 linguistic system have examined speakers in a L2 immersion environment, where L2 speakers are likely to engage in daily interactions with members of the L2 community and where changes to the L1 are more likely to arise by virtue of the intense exposure that speakers have to L2 linguistic input. At the level of the lexicon, for example, studies have shown that immersed L2 learners have reduced access to the first language. In a recent study, Linck, Kroll, & Sunderman (2009) used a translation recognition task and a verbal fluency task to test native English speakers who were either immersed in a Spanish-speaking environment during a semester abroad in Spain or who were studying Spanish in a foreign language classroom environment (i.e., non-immersed learners). Crucially, the experimental tasks were selected because past studies have shown that despite performing in their second language alone, participants show clear evidence of engaging activation of the first language (e.g., Dijkstra, 2005; Gollan, Montoya, & Werner, 2002; Sunderman & Kroll, 2006). In the translation recognition task, participants were asked to indicate whether two words were translation equivalents. The presence of distractor words that resembled the target translations in form or in meaning were used to gauge the level of activation of the L1 while participants performed the task in the L2. In the verbal fluency task, participants were presented with category names (e.g., animals, fruit, etc.) and were asked to produce as many category exemplars as possible within a predetermined amount of time. Linck et al. (2009) reasoned that if immersion experience attenuated access to the first language during processing, in translation recognition the immersed learners would show little sensitivity to the form distractor-word manipulations but increased sensitivity to the semantic distractor-word manipulations, reflecting deeper L2 processing. In the verbal fluency task, participants were expected to produce significantly fewer category exemplars in the L1 compared to the non-immersed learners. The results supported their hypothesis, leading the authors to conclude that accessibility to the L1 was affected during immersion in a second language environment.

Immersion in a second language environment has also been shown to affect L1 phonology. In a series of studies, Flege and colleagues (e.g., Flege, 1987; Flege & Eefting, 1987) have shown that L1 categories undergo restructuring during L2 acquisition, resulting in the development of merged categories containing information from the L1 and the L2. To illustrate, Flege (1987) investigated whether categories of the phonological system of L2 speakers were modified by influence of the other language. Native speakers of French highly proficient in English and native speakers of English with different degrees of proficiency in French were tested in their production of typologically distinct and similar sounds. Results showed that Voice Onset Times (VOT) in the production of /t/ were produced more L2-like and differently to monolingual speakers in both bilingual groups.

Although more research has examined the role of immersion at the phonological and lexical levels, recent work has also shown that syntactic processing in the L1 is influenced by extensive immersion experience in a second language environment (e.g., Balcom, 1998; Chitiri & Willows, 1997; Cook, 1996; Dussias, 2003; Dussias & Sagarra, 2007; Magiste, 1986). In a series of experiments, Dussias (2003) and Dussias & Sagarra (2007) examined the resolution of structural conflicts across the two languages of bilingual speakers using syntactically ambiguous relative clauses, as in *El policía arrestó a la hermana del criado que estaba enferma desde hacía tiempo*/The police arrested the sister of the butler who had been ill_{FEM} for a while. Spanish and English speakers differ in whether they interpret the ambiguous relative clause (*que estaba enferma*/who was ill_{FEM}) as referring to the first noun (*la hermana*/the sister) or the second noun (*el criado*/the butler) in the complex noun phrase. Many past studies have shown that monolingual English speakers show a preference for *low attachment* in that they typically favor the interpretation where the relative clause refers to the structurally closer noun (*criado*). Critically, monolingual Spanish speakers favor a *high attachment* strategy, attaching the relative clause to the syntactically higher, more distant, noun (*hermana*) in the complex noun phrase. The question for L2 speakers was what happens when these preferences are put in competition with one another. Using reaction time measures and eye tracking methodology, Dussias and colleagues found that native Spanish speakers who had learned English as a second language

during adulthood and who had been immersed in a second language environment for an extended period of time, preferred the low attachment strategy even when reading in Spanish, their native language. That is, the preference for high attachment typically found in native Spanish speakers (Carreiras & Clifton, 1999; Carreiras, Salillas & Barber, 2004; Dussias & Sagarra, 2007) had changed once a high level of proficiency was attained in the L2 English. Like past results on word recognition, which demonstrate effects of the L2 on the L1 once L2 speakers achieve a sufficient level of skill in the L2 (e.g., Van Hell & Dijkstra, 2002), these findings suggest that the L2 can come to influence the L1, even at the level of the parser. Dussias considers the interpretation that the dramatic shift to low attachment for the native Spanish speakers may be due to the nature of their exposure to a predominantly English speaking environment in the U.S. The presence of these influences, especially those from the L2 to the L1, suggests a dynamic language system that changes in response to language exposure (e.g., MacDonald & Seidenberg, 2006; Gennari & MacDonald, 2009).

The studies reviewed above have shown that syntactic processing in the L1 is susceptible to change when grammatical information guides processing. Few studies to date, however, have examined whether changes in the L1 can come about when lexically encoded information² is needed to resolve syntactically ambiguous clauses. This is the purpose of the present study. In particular, we test whether functionally monolingual speakers of Spanish and L1 Spanish-L2 English speakers immersed in their L2 environment (English) access lexical information specific to the L1 to resolve temporarily ambiguous sentences during online processing. To test this, we created complex sentences containing a main verb (that obligatorily subcategorized for an embedded clause with a subjunctive verb) followed by two subordinate clauses, the first of which was syntactically ambiguous between a sentence complement (reading and a relative clause reading. In one condition, the two subordinate clauses included verbs in the subjunctive, supporting a sentence complement reading of the ambiguity. In a second critical condition, the first clause included a verb in the indicative, forcing a relative clause interpretation (see Materials).

If immersion does not affect processing in the native language, the Spanish-English group should behave like the Spanish monolingual group in that neither should experience processing costs upon reading the verb in the subjunctive form. Encountering a verb in the indicative mood would, however, result in longer reading times because it is a form that, although grammatically correct, does not meet the requirements of the main verb. The predictions are different if exposure to English impacts processing in Spanish. Because English is not a morphologically rich language, it does not make extensive use of morphological markings to distinguish between verb forms. Another important feature of English is that indicative and subjunctive verbs are often identical in form (e.g., compare “She suggested that I exercise...” [Subjunctive] v. “He thinks that I exercise...” [Indicative]). It is plausible to expect that extensive exposure to these facts of English may bring about reduced sensitivity to Spanish morphological markings in this syntactic context. In this case, we may observe no processing differences between the indicative and the subjunctive forms.

3. The Current Study

3.1. Participants

Twenty-seven functionally monolingual speakers of Spanish from a university in Spain and 27 L1 Spanish speakers who had acquired the L2 in adulthood were recruited at a U.S. institution (immersed group hereafter). Participants received monetary compensation for their participation.

Participants completed a language history questionnaire designed to tap into several aspects of language proficiency by self-reporting language dominance, language use, number of years that the second language was studied, and length of immersion in a country where the second language was spoken. The functionally monolingual Spanish group reported immersion in a L2 environment of no more than a month. Eight participants in the immersed group were excluded from the analyses because they reported having less than three years of immersion in the L2 environment. This decision was

² Koenig, Mauner, and Bienvenue (2002) define lexically encoded information as “that information which is accessed upon recognition of a word [...] and is relatively specific to the relevant verb.” (p. 226)

made because previous studies have shown that changes in L1 processing surface after a period of immersion of about 3 years (Dussias, 2004). Participants in the immersed group reported learning English as their second language, being exposed to English in their daily routines, and having been immersed in the L2 for an average of 7.3 years (range 3 to 16).

3.2. Materials

Participants completed two tasks: (1) A self-paced reading task designed to tap into on-line processing; and (2) a sentence completion task to gauge knowledge of the subjunctive. For the self-paced reading task experiment, participants were presented with written sentences in Spanish that were ambiguous between a relative clause (RC) reading and a sentence complement (SC) reading. This syntactic ambiguity was present until the disambiguating region was reached (i.e., the verb in the first embedded clause). A sample of the materials is provided in Table 1.

Our rationale for the selection of the materials was as follows. If upon reading the verb *aconsejar*, participants access lexically encoded information of the main verb, they should expect the presence of an upcoming verb in the subjunctive form and should interpret the ambiguous clause as a sentence complement clause. In the relative clause condition, the presence of a verb in the indicative mood is expected to cause a momentary feeling of surprise in readers and should signal that the clause needs to be re-analyzed as a relative clause³. This reanalysis process is expected to cause an increase in processing time of the embedded verb *trajeron* in the RC condition relative to the reading time that participants spend at the embedded verb *trajeran* in the SC condition.

Table 1. Example of experimental sentences.

SC condition

El general /les aconsejó/ a los soldados/
 que/ trajeran /la comida/ de casa/ y/
 que/ guardaran/ las cajas/ de cartón/ en el almacén.
The general advised the soldiers
to bring the food from home and
to take the boxes to the warehouse.

RC condition

El general/ les aconsejó/ a los soldados/
 que/ trajeron/ la comida/ de casa/
 que/ guardaran/ las cajas/ de cartón/ en el almacén.
The general advised the soldiers
who brought the food from home
to take the boxes to the warehouse.

A total of 48 pairs of experimental sentences were created, representing the conditions in Table 1. The pairs were identical except for the mood of the verb in the critical region (underlined above) and the presence of the coordinating conjunction (y) in the SC condition. The experimental sentences were

³ An anonymous reviewer correctly points out that both English and Spanish have a preference for a sentence complement clause over a relative clause (see also Demestre and García-Albea, 2004 in support of this observation) and asks whether the effects observed in the relative clause condition might be caused by the presence of the infrequently encountered relative clause, above and beyond the presence of the verb in the indicative mood. At present we are not able to address this question due to limitations in our design – i.e., an additional set of experimental conditions would need to be added to address this question. We are presently designing such an experiment.

counterbalanced. Two lists were created and participants only saw one of the two versions of each experimental sentence. Each list contained a total of 48 experimental trials that were presented in phrases (see segmentation slashes above) to create a more natural presentation. In addition to the experimental sentences, each file also contained 72 filler sentences, which were identical in the two files. Filler sentences also contained subordinate clauses so that the experimental sentences would not be salient to participants (e.g., *Marisa le ha dicho a Luisa que trabaja en la nueva papelería que abrieron ayer*/ ‘Marisa told Luisa that she works in the bookstore that was opened yesterday’; *Carlota le ha confesado a Joaquín que lee el horóscopo chino en el periódico que venden en la calle*/ ‘Carlota confessed to Joaquín that she reads the Chinese horoscope in the newspaper that is sold on the street’). All experimental sentences and half of the filler sentences were accompanied by a *yes/no* comprehension question used to assess participants’ involvement in the task and their comprehension of the sentences. Half of the answers to the comprehension questions were *yes* and the other half were *no*. One third of the questions had answers related to the beginning portion of the sentence, another third to the middle portion, and the last third to the ending portion.

In addition to the self-paced reading experiment, participants were also administered a sentence completion questionnaire, designed to assess their use of the Spanish mood system. The questionnaire was composed of 48 sentence fragments consisting of a matrix clause with a verb that required the use of only subjunctive (16 fragments) or only indicative. Participants were asked to provide completions to the sentence fragments in a grammatically correct and semantically plausible way. Only the critical sentences (those that required the subjunctive verb) were considered in the analysis. A score of 1 was given to sentences completed with a verb in the subjunctive; a score of 0 was assigned to all other responses. An example is given in Table 2. All participants who scored above 75% accuracy⁴ (12 out of 16 sentences) were included in the analysis of the self-paced reading data. Mean percentage for the correct use of subjunctive mood was 94.6% for the monolingual group and 95% for the immersed group.

Table 2. Sample of sentence completion questionnaire

Jacobo les aconsejó a sus vecinos que...
Jacobo advised his neighbors to...

3.3. Hypotheses

We couch our hypotheses in terms of experience-based and usage-based models (e.g., Bybee, 2006; MacDonald, 2013; Seidenberg and MacDonald, 1999; Trueswell and Tanenhaus, 1994), which grant a major role to experience with language and its interaction with the cognitive mechanism to form the mental representations that influence language processing. These models predict changes in the immersed participants’ ability to use Spanish verb morphology in guiding syntactic ambiguity resolution because the subjunctive in English is noticeable in only certain forms and tenses (e.g., ‘I suggested that she try...’ but ‘I suggested that she tried...’) and most often resembles the indicative in form (e.g., ‘She suggested that I try...’). Specifically, then, immersed speakers are expected to show decreased sensitivity to the morphological form of the verb (revealed by reading times at the critical region) at the first subordinate verb (*trajeron/trajeran*) by virtue of their contact with English. Conversely, monolingual speakers should show longer reading times at the critical region in the RC condition (*trajeron*) vis-à-vis the SC condition (*trajeran*). If immersion does not play a role, performance of the immersed participants should mirror that of monolingual speakers.

⁴ Although this cut-off may seem low, it was selected to increase inclusion of participants who may have undergone changes in their production of the subjunctive mood.

3.4. Procedure

Materials were presented on a PC computer screen using a phrase-by-phrase non-cumulative self-paced reading task (Just, Carpenter, & Woolley, 1982) programmed with E-Prime 2.0 Professional. Participants first saw lines of dashes that represented each of the phrases in the sentence. Upon pressing the spacebar on the keyboard, the first line of dashes was replaced by the first phrase. Participants read the phrase and pressed the spacebar. For every subsequent spacebar press, the dashes were replaced by the next phrase. This process was repeated until participants reached the end of the sentence. Time intervals between the appearance of the phrase and the next key press were recorded. After reading the sentence, participants saw the comprehension question or the prompt *No hay pregunta. Pulsa sí para continuar* ‘There is no question. Press yes to continue’. If a question followed the sentence, they responded *yes* by pressing the key C on the keyboard and *no* by pressing the key N on the keyboard. Readers did not receive feedback for their answers. Subsequently, they completed the sentence completion questionnaire. The entire experimental session lasted 90 minutes.

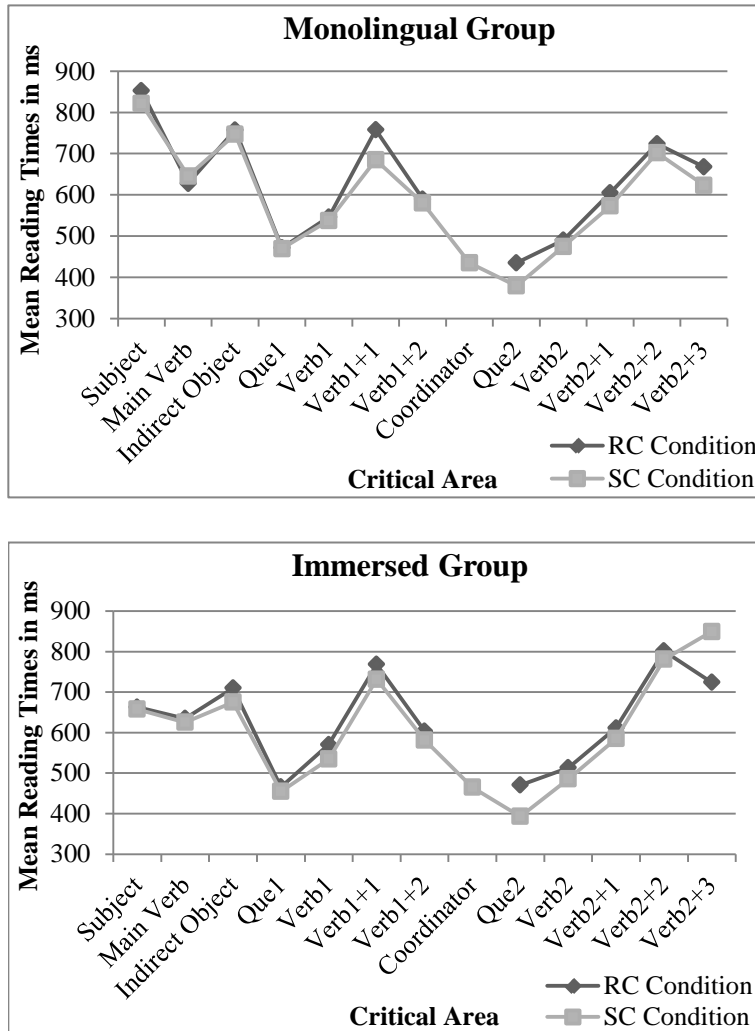
4. Results

Mean reading times (see Figure 1) were calculated for all the phrases in the two experimental conditions (see Table 3 for examples of sentence areas). All reading times over 4000 ms and below 150 ms were excluded from the analysis. In addition, reading times that were 2 standard deviations from each subject’s mean were considered outliers and were excluded from the analysis. All statistical analyses were conducted with the SPSS statistical package.

Table 3. Areas for the RC and SC conditions

Areas	RC condition	SC condition
Subject	El general	El general
Main Verb	les aconsejó	les aconsejó
Indirect Object	a los soldados	a los soldados
<i>Que1</i>	que	que
Verb1	trajeron	trajeran
Verb1+1	la comida	la comida
Verb1+2	de casa	de casa
Conj	--	y
<i>Que2</i>	que	que
Verb2	guardaran	guardaran
Verb2+1	las cajas	las cajas
Verb2+2	de cartón	de cartón
Verb2+3	en el almacén.	en el almacén.

Figure 1. Mean Reading Times in ms. per area for the Monolingual and the Immersed groups.



A two (condition; RC v. SC) by two (group; monolingual v. immersed) repeated measures Analysis of Variance (ANOVA) was conducted on the mean reading times at Verb 1 (subjunctive or indicative) and at Verb1+1 to capture potential spill-over effects. Results showed no significant main effect of condition at Verb 1 ($F(1,44) = 2.89; p > .05$) and no interaction between condition and group ($F(1,44) = 1.10; p > .1$). At Verb1+1, the main effect of condition was statistically significant (for the SC condition, $M = 708.29, SD = 24.23$; for the RC condition, $M = 763.11, SD = 29.61$), revealing that the RC condition took significantly longer to read than the SC condition ($F(1,44) = 16.28; p < .001$). No interaction between condition and group was observed ($F(1,44) = 1.79; p > .1$) indicating that the performance of the two groups was similar.

5. Discussion

In this study, we compared the performance of monolingual Spanish speakers and L1 Spanish-L2 English speakers immersed in their L2. The goal was to examine whether extended immersion in the L2 environment affected the way participants processed sentences in their native language. Participants were presented with temporarily SC and RC ambiguous sentences, disambiguated by the

presence of a subjunctive or indicative verb. The results showed that monolingual speakers make use of lexical information encoded in the main verb to assign category identity to the ambiguous phrase. Participants with at least three years of immersion experience in the L2 showed the same pattern. These findings suggest that intense exposure to English did not affect the immersed group's ability to use Spanish morphology to resolve the syntactic ambiguity.

Given that past studies have shown that immersion experience can bring about changes in the L1 processing system (e.g., Dussias & Sagarra, 2007; Flege, 1987; Flege & Eefting, 1987; Pavlenko, 2000; Pavlenko & Jarvis, 2002), a question that remains is why our participants, who had immersion histories similar to those of past studies, did not show effects of immersion. One reason may have to do with the heterogeneity of the group. Although our participants had been immersed in an English environment for at least three years, closer examination revealed that 10 participants had been immersed for less than 5.8 years and the remaining participants had been immersed for over 7 years (with some participant reporting up to 16 years of immersion in the L2 environment). Past studies have demonstrated that naturalistic exposure is more likely to impact processing at the high end of the 'immersion spectrum,' when participants have been immersed for more than 9 years (e.g., Pliatsikas & Marinis, 2012; Gillon Dowens, Vergara, Barber & Carreiras, 2010). It is possible that the heterogeneity of our participants may have washed out effects of immersion. To investigate this possibility, we conducted a post-hoc analysis comparing reading times of participants immersed for less than 6 years and with those of participants immersed for over 7 years. The results revealed a marginal difference between the two groups at Verb1+1 ($p=.060$), tentatively suggesting that years of immersion experience is a critical variable.

Another possibility may have to do with the type of structure under investigation. Whereas most past studies have investigated syntactic ambiguity that is presumably structure-driven (e.g., relative clause ambiguity resolution in Dussias & Sagarra, 2007), the present study examined a structure where ambiguity resolution was lexically-driven and where information was highly entrenched in the linguistic system (as is the case of contexts that obligatorily subcategorize for the subjunctive). It is possible that different sources of information are differentially affected by immersion such that effects of naturalistic exposure become evident in the processing of relative clause ambiguity resolution, but are harder to obtain when the relevant information is encoded lexically and must be obligatorily expressed. We are currently conducting a number of follow-up experiments in our lab to address these possibilities.

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