TRANSFER EFFECTS IN BILINGUAL SENTENCE PROCESSING

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This study investigates transfer effects in second language (L2) sentence processing. Although the evidence for such effects is mixed, recent studies have found that during online sentence comprehension, L2 readers are insensitive to certain types of morphological marking that are required in the L2 but not in the first language (L1) (e.g., Jiang 2004b, 2007). The present study tested two other conditions in which L2 readers may show similar interference from their L1: (1) a condition in which the L1 and L2 indicate a grammatical relationship with comparable morphology, but under different rules (i.e., a "similar but different" condition), and (2) a condition in which morphological marking is required in the L1 but not in the L2 (i.e., an "L1+L2-" condition). In a self-paced reading task, Spanish learners of English (along with comparison groups of English native speakers and Chinese learners of English) were tested on two sentence types designed to assess the influence of these potential sources of interference. One sentence type involved possessive pronouns in order to examine a "similar but different" condition; while the other involved personal and non-personal direct objects in order to examine an "L1+L2-" condition. Overall, Spanish-English bilinguals did not show processing difficulty (i.e. slowdowns in reading times) consistent with interference effects in either of these conditions. However, late Spanish learners of English showed a trend indicating interference effects in the "L1+L2-" condition, or, more specifically, when reading English sentences involving personal direct objects. We interpret these findings to suggest limits, or boundary conditions, on theories of L1-to-L2 transfer in the processing of grammatical morphology during online L2 sentence comprehension.

INTRODUCTION

In the field of second language acquisition (SLA), *transfer* has been defined as some influence (either facilitation or, more often, interference) of the first language (L1) on the second language (L2) due to similarities and differences between these two languages (Odlin, 1989). Indeed, transfer phenomena have been noted at essentially all levels of L2 representation, including in the L2 phonological (Flege & Davidian, 1984; Hancin-Bhatt, 1994), lexical (Jiang, 2002, 2004a), syntactic (Helms-Park, 2001; Montrul, 2001), and discourse/pragmatic (Yu, 2004) systems. Recently, there has also been growing interest in whether and to what extent the transfer of L1 representations and/or processing routines can influence real-time L2 sentence comprehension.[i] Although the evidence for such transfer effects is somewhat mixed (see below for review), one subcomponent of sentence processing – the

processing of grammatical morphology – seems to be particularly sensitive to L1 influence (e.g., Jiang, 2004b, 2007). The present study sought to further explore L1-to-L2 transfer in the processing of L2 grammatical morphology during online sentence comprehension.

Given the importance generally attributed to transfer in SLA research investigating the development of L2 representational systems (and particularly in early, Contrastive Analysis approaches to L2 development (see e.g., James, 1980; Zobl, 1982)), there is surprisingly little evidence for L1 influence on online L2 sentence comprehension. Indeed, studies investigating the processing of a wide range of L2 sentence types have demonstrated at best weak and inconsistent indications of L1 interference. Consider the L2 processing of sentences involving long-distance *wh*-movement. It is well documented that languages differ in terms of whether they allow the *wh*-element to remain in its canonical position (so-called *wh-in-situ* languages; e.g. Chinese, Japanese) or require the *wh*-element to move (or appear in a different structural position) in such sentences (so-called *wh*-movement languages; e.g. English, Spanish). Juffs (2005) examined whether this cross-linguistic difference led to differences in the judgments and reading profiles on L2 English (grammatical and ungrammatical) long-distance *wh*-movement sentences by learners from both of these language types – specifically, by Spanish-English (*wh*-movement L1), Chinese-English (*wh-in-situ* L1), and Japanese-English (*wh-in-situ* L1) bilinguals. Interestingly, the Spanish-English bilinguals judged the grammaticality of these sentences more accurately than both the Chinese-English and Japanese-English bilinguals, suggesting that *wh*-movement in the L1 provides an advantage for judgments on L2 English *wh*-movement sentences. However, the word-by-word reading profiles on these sentences were similar for all three groups, indicating comparable online processing regardless of L1 background. A clearer indication that L1 background is irrelevant to the L2 processing of *wh*-movement sentences is provided by a set of experiments examining whether learners of English from *wh*-movement L1s (in this case, Greek and German) and from *wh-in-situ* L1s (in this case, Japanese and Chinese) posit and use intermediate gap positions in the L2 processing of long-distance *wh*-movement sentences (Marinis, Roberts, Felser, & Clahsen, 2005). It was found that in contrast to English native speakers, none of these learner groups seemed to use intermediate gap positions to shorten the *wh*-dependency distance and, thus, to facilitate the processing of these sentences. That is, regardless of the overt *wh*-movement requirements in their respective L1s, these groups of learners appeared to process L2 English *wh*-movement sentences comparably.

Similarly, inconclusive results have been found in a number of studies investigating whether L1 parsing preferences – in particular, preferences related to establishing structural relationships between phrases – influence online L2 sentence comprehension. Most of these studies have focused on sentences involving relative clause attachment ambiguity, such as *Someone saw the servant of the actress who was on the balcony*. Note that in this sentence, the relative clause *who was on the balcony* can modify the

nonlocal noun *the servant* (high attachment) or the local noun *the actress* (low attachment). Crucially, there is considerable cross-linguistic variability in the preferred attachment site for such relative clauses. English speakers, for instance, generally prefer low attachment, while Spanish speakers prefer high attachment (see e.g., Carreiras & Clifton, 1999). Although a number of studies have investigated whether L1/L2 differences in attachment preferences influence the online L2 comprehension of these sentences, the results have been mixed – some have shown evidence for L1-to-L2 transfer at lower proficiency levels (Frenck-Mestre, 1999, 2002), others have shown convergence on L1 attachment preferences at higher levels of proficiency (Dussias, 2001; Frenck-Mestre, 1999, 2002), while still others have found no indication of an online attachment preference in the L2 (Dussias, 2003; Felser, Roberts, Marinis, & Gross, 2003; Fernández, 2002, 2003; Papadopoulou & Clahsen, 2003; for review, see Clahsen & Felser 2006).

Another class of processing preference that has been purported to influence L2 sentence comprehension relates to cross-linguistic differences in the weightings of linguistic cues. According to MacWhinney's Competition Model (1997, 2002), for instance, various cues to sentence interpretation – including word order, agreement, animacy, and case marking – differ in terms of their importance/reliability across languages, and the relative weightings of these cues in the L1 are carried over to the processing of the L2. For instance, English speakers have been found to 'weigh' word order – a reliable cue to grammatical function in this language – as the primary cue to sentence interpretation; whereas speakers of German, a language with relatively freer word order, tend to give subject-verb agreement more weight (see e.g., Bates & McWhinney, 1981; Kilborn, 1989). Interestingly, Kilborn (1989) found that consistent with the predictions of the Competition Model, both English learners of German as well as German learners of English transferred their respective L1 cue biases to the processing of the L2. Similar indications of L1-to-L2 cue transfer have been reported in a number of other studies looking into the interpretation strategies of L2 learners from a wide range of L1s (see e.g., Harrington, 1987; Kilborn & Ito, 1989; Liu, Bates, & Li, 1992). However, it is important to note that all of these studies have used variants of an interpretation task that does not seem particularly sensitive to *online* L2 sentence processing. In this task, participants are presented with grammatical and ungrammatical word strings in either the L1 or L2, and are asked to identify the 'actor' in each string. In light of the fact that this task involves an after-the-string metalinguistic judgment, the extent to which these studies shed light on real-time L2 sentence comprehension is questionable.

Another potential source of L1 interference in L2 sentence processing is the transfer of syntactically-relevant lexico-semantic information. Indeed, a number of studies have investigated whether L1 verb subcategorization information, or information that specifies a verb's (internal) arguments, may affect online L2 sentence comprehension. For instance, Frenck-Mestre and Pynte (1997) examined the eye movement patterns of English native speakers and French-English bilinguals on English sentences involving

subcategorization mismatches between the L1 and L2. Specifically, English sentences like the following were tested: *Every time the dog barked/obeyed the pretty little girl showed her approval.* Note that in this sentence pair, there is no comma separating the subordinate clause verb (*barked/obeyed*) from the noun phrase (NP) that begins the main clause (*the pretty little girl*). When this subordinate clause verb is intransitive (*barked*), it is impossible for the immediately following NP to be part of the subordinate clause, and a clause boundary can be established on the basis of this lexico-semantic information. However, when this verb is optionally transitive (*obeyed*), readers are likely to initially (mis)interpret the following NP as a direct object, only to experience processing difficulty when this interpretation is disconfirmed at the main clause verb (*showed*). Crucially, in French both *barked* and *obeyed* are intransitive, so subcategorization transfer should prevent misinterpretation in both of these sentences. As predicted, English native speakers showed a reading slowdown (and more regressive eye movements) at the main clause verb in sentences with optionally transitive subordinate clause verbs. Interestingly, French-English bilinguals showed a slowdown at verbs like *obeyed* relative to English native speakers, indicating that these bilinguals may have been aware of the subcategorization mismatch between English and French. However, at the main clause verb, these bilinguals patterned with the native speakers, suggesting that they were using the subcategorization properties of the L2 verb. Comparable findings have since been obtained in studies by Dussias and Cramer (2006), Dussias and Cramer-Scaltz (2008), Jiang (2007), and Juffs (1998), all of which suggest that bilinguals (at least at higher levels of proficiency) converge on native-like processing of L2 verbs despite subcategorization differences between the L1 and L2.

In light of this weak and inconsistent evidence for L1-to-L2 transfer, recent studies indicating L2 learners' insensitivity to grammatical morphology during online L2 sentence processing are of particular interest (e.g. Event-Related Potential work by Hahne and Friederici, 2001, Weber-Fox and Neville, 1996, and others, syntactic priming studies by Guillelmon and Grosjean, 2001, and reading experiments by Jiang, 2004b, 2007). Here, we focus on the reading studies by Jiang (2004b), who uses the same methodology that we do. In the first of these, Jiang tested both English native speakers and highly-proficient Chinese learners of English on the following sentence types (where '*' indicates ungrammaticality) in a self-paced reading task:

1a. The key to the *cabinet was rusty* from many years of disuse.
1b. The key to the *cabinets was rusty* from many years of disuse.
2a. The bridge to the *island was about* ten miles away.
2b. * The bridges to the *island was about* ten miles away.

The pattern of results for English native speakers indicated that they were sensitive to the plural –s morpheme in these sentences. Specifically, these native speakers showed processing difficulty on sentence (1b) relative to (1a) as well as on the ungrammatical sentence (2b) relative to the grammatical (2a)

at and immediately after the copula (*was*). The results for sentence type (1) can be attributed to a "broken agreement effect" found in both production (Bock & Cutting, 1992; Bock & Eberhard, 1993; Bock & Miller, 1991) and comprehension (Nicol, Forster, & Veres, 1997; Pearlmutter, Garnsey, & Bock, 1999) studies, whereby a plural local noun (*cabinets*) interferes with agreement processing between a singular head noun (*key*) and subsequent agreement targets (in this case, the verbal agreement target *was*). The results for sentence type (2), on the other hand, can be attributed to the detection of ungrammaticality when there is a mismatch between two elements in a plurality-based agreement relationship (in this case, between *bridges* and *was*). The Chinese learners of English, on the other hand, showed no statistically significant differences for either of these sentence types. Jiang interpreted these findings to indicate that non-native speakers are unable to integrate plurality and, specifically, the plural morpheme –s into their L2 competence in such a way that it can be activated automatically during online L2 sentence comprehension.

In a follow-up to this experiment, Jiang (2007) tested both English native speakers and highly-proficient Chinese learners of English the following sentence types, again with a self-paced reading task:

3a. The child was watching *some of the rabbits* in the room.

3b. * The child was watching *some of the rabbit* in the room.

Although English native speakers showed a reading slowdown at and immediately after the incompatible singular noun *rabbit* in sentence (3b), the Chinese learners of English showed no such slowdown. Again, Jiang interpreted this result to indicate that plural morphological marking cannot be integrated into adult learners' L2 competence such that it is automatically available during online L2 sentence comprehension. However, although Jiang argues that the plural –s morpheme is "nonintegratable" for adult L2 learners generally, it is important to note that the non-native speaker subjects in both of these studies had Chinese as their L1. In light of the fact that in Chinese, plurality is not marked with a specific grammatical morpheme (analogous to English plural –s) and does not contribute to agreement processes, a plausible explanation for these results might appeal to L1-to-L2 transfer. Specifically, under a transfer explanation, these results would suggest that L2 learners are insensitive to morphological marking that indicates grammatical feature / relationships in the L2, but not in the L1.

Based on these findings, the present study sought to expand on our understanding of interference effects in morpho-syntactic processing during online L2 sentence comprehension. Essentially, there are four types of relationships that can hold between components of the morpho-syntactic systems in an L1 and an L2:

(a) The morpho-syntactic marking for a grammatical feature/relation is the same (or very similar) in the L1 and L2 (i.e. "same/similar").

(b) A certain grammatical feature/relation is morphologically marked in the L2, but not in the L1 (i.e. "L1-L2+").
(c) Both the L1 and L2 indicate a grammatical relationship with comparable morphology, but under different rules (i.e. "similar but different").
(d) A certain grammatical feature/relation is morphologically marked in the L1, but not in the L2 (i.e. "L1+L2-").

Of course, little if any interference would be expected if a "same/similar" relationship held between a particular component of the L1 and L2 morpho-syntactic systems during the processing of L2 sentences involving that component. If anything, there might be facilitation in such cases. However, if our interpretation of the Jiang's (2004b, 2007) findings is correct, then an "L1-L2+" relationship should interfere with online L2 sentence comprehension. The present study sought to examine whether similar interference effects would obtain under "similar but different" and "L1+L2-" relationships.

THE EXPERIMENT

In this experiment, Spanish learners of English were tested on two sentence types specifically designed to assess the effects of "similar but different" and "L1+L2-" relationships on the processing of grammatical morphology during online L2 sentence comprehension. In order to allow for the clearest indication of transfer under these conditions, the performance of this group was compared with that of English native speakers and Chinese learners of English. Crucially, the contrasts between Spanish and English that were targeted in this experiment do not exist between Chinese and English. Therefore, we predicted that if transfer is operative under the conditions of interest, the performance of the Spanish learners should differ from that of both comparison groups. The first sentence type of interest involved possessive pronouns. This sentence type (described in more detail below) allowed for a test of L2 sentence comprehension where a "similar but different" relationship held between a component of the morpho-syntactic systems of the L1 and L2. The second sentence type involved personal and non-personal direct objects (or, essentially, human and non-human direct objects). This sentence type (again, described in detail below) allowed for a test of L2 sentence comprehension where a "L1+L2-" relationship held between a component of the morpho-syntactic systems of the L1 and L2. These sentence types were examined using a self-paced "moving window" reading task, and reading times for the different regions of the sentences were recorded. Relatively slower reading times were taken to reflect processing difficulty.

Possessive Pronouns

In order to better understand the questions of interest in this study, it is first necessary to detail the relevant structural contrasts between Spanish and English as well as our predictions for each sentence type. Again, sentences involving possessive pronouns were selected in order to test L1-to-L2 transfer

under a "similar but different" relationship. In English, possessive pronouns always agree in both person and number with their antecedent; in Spanish, however, third person possessive pronouns agree in person with their antecedent and in number with the noun they modify. This difference between English and Spanish is illustrated in the English sentences (4a)-(4d) and their respective Spanish translations (5a)-(5d). As shown in the English examples, the number of the possessive pronoun matches that of its antecedent (*author*$_{sing}$– *her*$_{sing}$ in (4a) and (4b); *authors*$_{plu}$ – *their*$_{plu}$ in (4c) and (4d)). In Spanish, however, the number marking on the third person possessive pronoun does not change as a function of antecedent plurality, but rather matches only with the number specification of the noun it modifies (*su*$_{sing}$ – *artículo*$_{sing}$ in (5a) and (5d); *sus*$_{plu}$ – *artículos*$_{plu}$ in (5b) and (5c).

4a. The author wrote *her article*s at the coffee shop.
(*Singular/Matching*)
4b. The author wrote *her article* at the coffee shop.
(*Singular/Mismatching*)
4c. The authors wrote *their article*s at the coffee shop. (*Plural/Matching*)
4d. The authors wrote *their article* at the coffee shop. (*Plural/Mismatching*)
5a. La autora escribió *su artículo* en la cafetería.
5b. La autora escribió *sus artículos* en la cafetería.
5c. Los autores escribieron *sus artículos* en la cafetería.
5d. Los autores escribieron *su artículo* en la cafetería.

If "similar but different" relationships between components of the L1 and L2 morpho-syntactic systems cause interference during online L2 sentence processing, we predicted that this discrepancy in number marking would yield inflated reading times when Spanish-English bilinguals encountered "mismatched" NPs in English sentences. That is, these learners should show processing difficulty in sentences (4b) and (4d) when the number of the possessive pronoun does not match the number of the noun it modifies (*her articles* in (4b); *their article* in (4d)). Similar "mismatch" effects should not occur for English native speakers or for Chinese-English bilinguals, given that English and Chinese do not require number agreement between the possessive pronoun and the noun it modifies.

Personal vs. Non-personal Direct Objects

Sentences involving personal and non-personal direct objects were chosen to examine L1-to-L2 transfer under an "L1+L2-" condition. Spanish requires the function word "a" (essentially, a preposition) before personal direct objects (i.e. before "human" direct objects) but not before non-personal direct objects (i.e. not before "non-human" direct objects).[ii] English, however, does not require such marking. Again, this contrast between English and Spanish can be seen in the English sentences (6a)-(6d) and their respective Spanish translations (7a)-(7d). Specifically, (6a) has a personal direct object *the dancer,* and thus its Spanish translation (7a) requires "a"-marking (shown

in bold below) on this NP. Sentence (6b), on the other hand, has a non-personal direct object *the painting*, and therefore, there is no "a"-marking prior to the direct object in its Spanish translation (7b). It is important to notice also that this marking is not required whenever a personal NP appears in any object position, but is specific to direct objects. For instance, when these NPs occur as an object of a preposition phrase (PP), as in the example sentences (6c) and (6d) and their translation (7c) and (7d), Spanish does not distinguish between the personal and non-personal with this "a" function word.

6a. The artist saw *the dancer* at the trendy nightclub. (*Direct Object/Personal*)

6b. The artist saw *the painting* at the trendy nightclub. (*Direct Object/Non-personal*)

6c. The artist was next to *the dancer* at the trendy nightclub.(*Object of PP/Personal*)

6d. The artist was next to *the painting* at the trendy nightclub. (*Object of PP/Non-personal*)

7a. El artista vio ***a*** *la bailarina* en la discoteca de moda.

7b. El artista vio *el cuadro* en la discoteca de moda.

7c. El artista estaba cerca *de la bailarina* en la discoteca de moda.

7d. El artista estaba cerca *del cuadro* en la discoteca de moda.

If "L1+L2-" relationships between components of the L1 and L2 morpho-syntactic systems cause interference during online L2 sentence processing, we predicted that Spanish-English bilinguals would build up an expectation for some type of marking on personal direct objects. This would result in slower reading times for the personal direct object in (6a) relative to the non-personal direct object in (6b). Note, however, that this involves a comparison of two different words, so even if we obtained different reading times at this region, it would be unclear whether this disparity was due to uncontrolled-for differences between these lexical items or to the predicted transfer effect. In order to tease out the nature of this effect, it was therefore critical to examine sentences in which these same NPs acted as the object of a PP. Again, because a personal object of a PP is not marked with an additional "a", an expectation for such marking should not influence the comprehension of sentence (6c) (relative to (6d)). That is, Spanish-English bilinguals should show essentially no difference in their reading times for personal and non-personal objects of the PP. It is also important to note that, as in English, this type of marking for personal direct objects is not required in Chinese. Therefore, we do not expect a comparable pattern of results for either English native speakers or Chinese-English bilinguals.

Relative Clauses

In addition to the sentence types described above, we also tested sentences involving subject-extracted relative clauses and object-extracted relative clauses. A number of studies (see e.g., King & Just, 1991), including those conducted in our lab (see e.g., Nicol, Forster & Veres, 1997), have found

that subject-extracted relative clauses (8a) are easier to process than object-extracted relative clauses (8b).

8a. The critics laughed at the poet *who liked the performer*.
(*Subject-Extracted*)
8b. The critics laughed at the poet *who the performer liked*.
(*Object-Extracted*)

These sentences were therefore included to ensure that the self-paced moving window reading task employed in this study was sensitive to processing difficulty. That is, with a sufficiently sensitive task, it was predicted that the consistent asymmetry between the processing of subject- and object-extracted relative clauses would be obtained for all of the subject groups. Findings consistent with this asymmetry would also allow us to interpret null results with more confidence. This was important for the two control groups (for whom we did not expect interference effects), and for the group of major interest, the Spanish-English bilinguals, in the event that they did not show interference effects.

Method

Participants. Three groups of participants were tested – 48 native speakers of English, who participated in the experiment for course credit, and two groups of non-native speakers, who were paid for their participation. One of the non-native speaker groups consisted of 24 Spanish-English bilinguals; the other was a comparison group of 24 Chinese-English bilinguals. According to a questionnaire administered just prior to the experiment, 20 members (83%) of the Spanish-English group considered themselves to be Spanish-dominant. Twenty-three (96%) of these participants reported Spanish as the first language they acquired, while a single subject reported being a simultaneous Spanish-English bilingual. The average age of acquisition (AoA) for these Spanish-English participants was 11.4, with a fair amount of variability among the subjects (*SD* 7.7). The Chinese-English group was more homogenous than the Spanish-English group, with 23 (96%) of the participants considering themselves Chinese-dominant, and all reporting Chinese as the first language they acquired. The average AoA for the Chinese-English group was very similar to that of the Spanish-English group at 11.8, but the variability among these participants was much smaller (*SD* 2.98). All participants were classified students at the University of Arizona.

Materials. For the two structures of interest (i.e., Possessive Pronouns and Personal vs. Non-personal Direct Objects), 48 sentence quadruplets similar to those in examples (4a)-(4d) and (6a)-(6d) were created and counterbalanced across four presentation lists.[iii] Possessive Pronoun items were created such that there were four regions per item (where hash marks indicate the divisions between regions): *The author(s) # wrote # her / their article(s) # at the coffee shop*. Region 1 contained a subject NP; Region 2 contained a verb; Region 3 had a direct object consisting of a third person possessive pronoun and singular or plural noun; and Region 4 consisted of an

adverb or adverbial phrase. Region 3 was the critical region of interest. There were also four regions in the Personal vs. Non-personal Direct Objects items: *The artist # saw / was next to # the dancer / the painting # at the trendy nightclub*. Region 1 had a subject NP; Region 2 contained a transitive verb (Direct Object condition) or was+preposition (PP condition); Region 3 had personal or non-personal object NP; and Region 4 had an adverbial phrase. Again, Region 3 was the critical region. For this condition, we made sure (a) that all subject NPs were personal (because if both subject and object NPs are non-personal, then the object NP tends to take "a" marking regardless of its personal or non-personal status), and (b) that all of the English verbs, when translated into Spanish, were regularly followed by "a" marking in cases where they take personal direct objects. In addition, 16 relative clause pairs were created and counterbalanced across presentation lists 1 and 2 and across lists 3 and 4. These relative clause sentences had three regions: *The critics # laughed at the poet # who liked the performer*. / *who the performer liked*. Region 1 had a subject NP; Region 2 had a verb and an object NP; and Region 3 had the subject- or object-extracted relative clause. Finally, 20 filler items were created. These filler sentences were matched with experimental items in terms of length and represented various syntactic structures. The filler items were the same across the four lists. To ensure that participants were engaged in the task, 20 comprehension questions (8 for each sentence type of interest, 4 for the relative clause sentences) were included; these appeared at various points throughout the experimental session. Overall, each participant read 132 sentences, plus 10 practice sentences.

Procedure. Prior to taking the main experiment, all participants filled out a language questionnaire. The findings from this questionnaire are reported above in the *Participants* section. The main experiment employed the self-paced, non-cumulative moving-window reading paradigm. This technique has been shown to be sensitive to a variety of lexical and structural manipulations (see e.g. Juffs, 2001; Just, Carpenter, & Woolley, 1982, among many others). We employed a variable (often phrase-length) 'window' size (for more detail, please see the *Materials* section above). Filler items were divided into 3-6 regions, depending in part on sentence length. The entire session lasted approximately 30 minutes.

In the self-paced moving window task, each sentence appeared initially as a series of dashes, with each dash corresponding to a letter of a word in the sentence. Participants pressed the right button on a button box to see the first segment of the sentence. The participant read this segment and again pressed the right button to move on to the next segment. When the next segment appeared, the first segment reverted to dashes, with the interval between each button press recorded by the computer. The participant continued in this manner until the end of the sentence. When the sentence finished, the subject was either asked a comprehension question or prompted to proceed to the next item (by pressing on a foot pedal). Under each comprehension question, two possible answers were provided – one on the left side of the screen and another on the right. The subject indicated the correct

answer by pressing the corresponding (LEFT or RIGHT) button on the button box. DMDX software was used to present stimuli and record reading times as well as responses to comprehension questions (Forster & Forster, 2003).

Results

Reading times (RTs) for items on which comprehension questions were answered incorrectly were eliminated from the analysis. The mean error rates on comprehension questions for the native English speakers, Spanish-English bilinguals, and Chinese-English bilinguals were 5%, 15% and 18%, respectively. The RT data for items on which a participant spent 4 seconds or longer reading any region were also excluded (accounting for 1.05% of the remaining data points). RTs that were two standard deviations above or below a subject's mean RT for a given region of each sentence type were replaced with the value two standard deviations above or below the subject's mean RT for that region. These trimmed values accounted for 4.21% of the remaining data. The mean RTs for each participant group are reported in the tables below. For each region, an analysis of variance (ANOVA) was conducted with participants (*F1*) and items (*F2*) as random factors. In order to demonstrate that our self-paced moving window reading task was able to detect processing difficulties, we will first report the results from the Relative Clause sentences. We will then report the data from the Possessive Pronoun sentences and Personal vs. Non-personal Direct Object sentences.

Relative Clauses

Recall that previous research has shown a robust difference between subject- and object-extracted relative clause sentences, with object-extracted relative clauses being more difficult (and thus, incurring longer RTs) than subject-extracted relative clauses. RT differences at this relative clause (i.e. in Region 3; *…who liked the performer/…who the performer liked*) can, therefore, be taken to indicate that the task used in this study was sensitive to processing difficulty. Mean RTs at this critical region for all three participant groups appear in Table 1. As expected, all three groups read object-extracted relative clauses significantly slower than subject-extracted relative clauses – **native English speakers,** $F1(1,46)=62.01$, $p<.001$; $F2(1,14)=67.25$, $p<.001$; **Spanish-English bilinguals**, $F1(1,22)=14.42$, $p<.005$; $F2(1,14)=16.80$, $p<.005$; and **Chinese-English bilinguals**, $F1(1,22)=6.97$, $p<.05$; $F2(1,14)=6.81$, $p<.05$.

Table 1: Mean RTs (in milliseconds) for subject- vs. object-extracted relative clause sentences at the relative clause (Region 3) for each participant group.

	Native English	*Spanish-English Bilinguals*	*Chinese-English Bilinguals*
Subject-Extracted	1321	1813	2094
Object-Extracted	1653	2072	2273

Possessive Pronouns

Native English Speakers:

The results for the English native speakers are shown in Table 2. In **Region 1**, the main effect of Plurality was significant, *F1*(1,44)=11.61, *p*<.005; *F2*(1,44)=20.43, *p*<.001, with plural subjects (*The authors*) taking longer to read than singular subjects (*The author*). However, there was no significant effect for Number Congruence (i.e., "Matching" vs. "Mismatching"), *F*s<1. The interaction between Plurality and Number Congruence was significant by subjects, but only approached significance by items, *F1*(1,44)=4.58, *p*<.05; *F2*(1,44)=3.96, *p*=.053. The Plurality effect obtained in Region 1 carried over to **Region 2**, *F1*(1,44)=7.91, *p*<.01; *F2*(1,44)=8.15, *p*<.01, but neither the effect of Number Congruence nor the interaction was significant in this region (Number Congruence: *F*s<1; interaction: *F1*=2.89, *F2*<2). In **Region 3**, again the main effect of Plurality was significant, *F1*(1,44)=6.06; *p*<.05; *F2*(1,44)=5.10 *p*<.05, with NPs containing the plural possessive pronoun *their* (*their articles* and *their article*) taking longer to read than NPs containing the singular possessive pronoun *his/her* (*her article* and *her articles*). The main effect of Number Congruence was not significant (*F*s<1), but its interaction with Plurality approached significance in both the by-subjects and by-items analyses, *F1*(1,44)=3.48, *p*=.069; *F2*(1,44)=3.27, *p*=078. This trend toward an interaction reflects the fact that the matched condition in singular sentences (*her article*) was read more quickly than its mismatched counterpart (*her articles*), while the mismatched condition in plural sentences (*their article*) was read more quickly than its matched counterpart (*their articles*). There were no significant effects in **Region 4 (**Plurality: *F*s<1; Number Congruence, *F*s<1; interaction: *F1*<2, *F2*<1.5).

Table 2: Mean RTs per region for Possessive Pronoun sentences; native speakers.

	Region 1 The author/authors	*Region 2* wrote	*Region 3* her/their article/articles	*Region 4* at the coffee shop
Singular/Matching	649	586	648	803
Singular/Mismatching	627	570	669	793
Plural/Matching	673	596	688	795
Plural/Mismatching	691	604	679	814

"Singular" and "Plural" refer to the number specification of the sentence subject; "Matching" and "Mismatching" refer to whether the number of the possessive pronoun matches the noun it modifies.

Spanish-English Bilinguals

The data for the Spanish-English bilinguals are displayed in Table 3. In **Region 1**, a significant main effect of Plurality was obtained, *F1*(1,20)=12.57, *p*<.005; *F2*(1,44)=12.49, *p*<.005, with plural subjects (*The authors*) taking longer to read than singular subjects (*The author*). However, neither the main effect of Number Congruence (*F1*<1, *F2*(1,44)=3.56, *p*=.066) nor its interaction with Plurality (*F1*<1.5, *F2*<1) was significant. In **Region 2**, there were no significant effects (Plurality: *F*s<1, Number Congruence: *F1*<1.5, *F2*<1; interaction: *F*s<1). In **Region 3**, there was again a significant effect of Plurality, *F1*(1,20)=10.48, *p*<.005; *F2*(1,44)=10.63, p<.005, indicating that NPs containing the plural possessive pronoun *their* (*their articles* and *their article*) took longer to read than NPs containing the singular possessive pronoun *his/her* (*her article* and *her articles*). Furthermore, although there was no significant main of effect of Number Congruence, *F1*(1,20)=2.30, *p*=.145; *F2*<2, the interaction of Plurality with Number Congruence was significant, *F1*(1,20)=5.90, *p*<.05; *F2*(1,44)=6.32, *p*<.05. Contrary to the transfer-based predictions for this sentence type, these Spanish-English bilinguals did not experience processing difficulty whenever there was a mismatch between the number of the possessive pronoun and noun it modified. Rather, like the English native speakers, the matched condition in singular sentences (*her article*) was read more quickly than its mismatched counterpart (*her articles*), while the mismatched condition in plural sentences (*their article*) was read more quickly than its matched counterpart (*their articles*). In **Region 4**, there were no significant effects (Plurality: *F*s<1.5, Number Congruence: *F1*<2, *F2*<1; interaction: *F*s<1).

Table 3: Mean RTs per region for Possessive Pronoun sentences; Spanish-English bilinguals.

	Region 1 The author/authors	*Region 2* wrote	*Region 3* her/their article/articles	*Region 4* at the coffee shop
Singular/Matching	690	684	768	1028
Singular/Mismatching	725	673	839	990
Plural/Matching	765	693	865	1030
Plural/Mismatching	769	682	845	1029

Chinese-English Bilinguals

Table 4 shows the data for the Chinese-English bilinguals. In **Region 1**, there was a robust effect of Plurality, *F1*(1,20)=25.49, *p*<.001; *F2*(1,44)=15.80, *p*<.001, with plural subjects (*The authors*) taking longer to read than singular subjects (*The author*). There was, however, no significant effect for Number Congruence (*F*s<1), and the interaction between Plurality and Number Congruence only approached significance, *F1*(1,20)=3.58, *p*=.073, *F2*(1,44)=3.90, *p*=.055. As was the case with the English native speakers, the effect of Plurality seen in Region 1 was observed in **Region 2** as

well, *F1*(1,20)=6.14, *p*<.05, *F2*(1,44)=6.92, *p*<.05. No other effects were significant in this region (all *F*s<1). In **Region 3**, there was again a significant effect of Plurality, *F1*(1,20)=9.76, *p*<.01; *F2*(1,44)=7.22, *p*<.05, but no effect of Number Congruence (*F*s<1). The interaction between Plurality and Number Congruence was also significant, *F1*(1,20)=4.95 , *p*<.05; *F2*(1,44)=5.12, p<.05. Consistent with the results for the other two subject groups, this pattern again indicates (a) that NPs containing the plural possessive pronoun *their* (*their articles* and *their article*) took longer to read than NPs containing the singular possessive pronoun *his/her* (*her article* and *her articles*) and (b) that the matched condition in singular sentences (*her article*) was read more quickly than its mismatched counterpart (*her articles*), while the mismatched condition in plural sentences (*their article*) was read more quickly than its matched counterpart (*their articles*). In **Region 4**, there were no significant effects (Plurality: *F*s<1; Number Congruence: *F1*<2, *F2*=2.02; interaction: *F*s<1).

Table 4: Mean RTs per region for Possessive Pronoun sentences; Chinese-English bilinguals.

	Region 1 The author/authors	*Region 2* wrote	*Region 3* her/their article/articles	*Region 4* at the coffee shop
Singular/Matching	843	743	945	1109
Singular/Mismatching	878	758	985	1128
Plural/Matching	986	798	1058	1103
Plural/Mismatching	927	797	997	1141

Personal vs. Non-personal Objects

Native English Speakers

The results for the English native speakers are shown in Table 5. In **Region 1**, the RTs for the four sentence variants were virtually identical, and, not surprisingly, there were no significant effects (all *F*s<1). **Region 2** contained different lexical items across the sentence variants (e.g. *saw* in Direct Object sentences vs. *was next to* in Object of PP sentences), and RTs were much shorter when there was only a verb in this region, *F1*(1,44)=74.30, *p*<.001, *F2*(1,44)=65.92, *p*<.001. Neither the effect of Personal-ness (Personal vs. Non-Personal) nor the interaction of this factor with Grammatical Role (i.e., Direct Object vs. Object of PP) was significant (*F*s<1). The difference due to length disparities in Region 2 also appeared to influence RTs in **Region 3**, yielding a significant effect of Grammatical Role, *F1*(1,44)=12.18, *p*<.005, *F2*(1,44)=7.03, *p*<.05. There was also a trend suggesting that Non-Personal NPs (*the painting*) were generally easier to process than Personal NPs (*the dancer*), *F1*(1,44)=4.12, *p*<.05; *F2*(1,44)=1.02, *p*=.296. The interaction between these factors, however, was not significant (*F*s<1). In **Region 4**, the main effect of Grammatical Role approached significance in the by-subjects

analysis, *F1*(1,44)=3.16, *p*=.082; *F2*(1,44)=2.27, *p*=.139, the main effect of Personal-ness was not significant, *F1*<2; *F2*(1,44)=2.47, *p*=.123, and there was a trend toward an interaction between these factors, *F1*(1,44)=3.90, *p*=.055; *F2*(1,44)=4.07, *p*=.05.

Table 5: Mean RTs per region for Personal vs. Non-personal Object sentences; native English speakers.

	Region 1 The artist	*Region 2* saw/ was next to	*Region 3* the dancer/ the painting	*Region 4* at the trendy nightclub
Direct Object/Personal	642	573	745	821
Direct Object/Non-Personal	640	571	728	858
Object of PP/Personal	641	647	777	822
Object of PP/Non-Personal	635	650	750	816

Spanish-English Bilinguals

The data for the Spanish-English bilinguals are displayed in Table 6. In **Region 1**, there were no significant effects (all *F*s<1). In **Region 2**, there was a significant main effect of Grammatical Role, *F1*(1,20)= 40.18, *p*<.001; *F2*(1,44)=40.78, *p*<.001, which again likely reflects the length disparity between sentences that had only a verb in this region (Direct Object sentences) and sentences that had the verb *was* plus the beginning of a PP in this region (the Object of PP sentences). The effect of Personal-ness and the interaction were not significant (all *F*s<1). In **Region 3**, although the numerical difference between the Direct Object/Personal and Direct Object/Non-personal conditions and the lack of a difference between their Object of the PP counterparts were consistent with our transfer predictions, the interaction between Grammatical Role and Personal-ness was not significant, *F1*<1.5; *F2*(1,44)=2.40, *p*=.129. The main effects of Grammatical Role and Personal-ness were also not significant (all *F*s<1). In **Region 4**, the main effects of Grammatical Role and Personal-ness were not significant (all *F*s<1), nor was the interaction between these factors, *F1*(1,20)=2.31, *p*=.145; *F2*(1,44)=2.80, *p*=.102.

Table 6: Mean RTs per region for Personal vs. Non-personal Object sentences; Spanish-English bilinguals.

	Region 1 The artist	*Region 2* saw/ was next to	*Region 3* the dancer/ the painting	*Region 4* at the trendy nightclub
Direct Object/Personal	690	658	1007	1048
Direct Object/Non-	697	671	974	1020

personal				
Object of PP/Personal	701	772	991	998
Object of PP/Non-personal	698	777	999	1045

Chinese-English Bilinguals

Table 7 shows the data for the Chinese-English bilinguals. In **Region 1**, there were no significant effects (Grammatical Role: *F*s<1; Personal-ness: *F*s<1; interaction: *F1*<1.5; *F2*<2). In **Region 2**, RTs were again longer in Object of PP sentences than in Direct Object sentences, *F1*(1,20)=21.49, *p*<.001; *F2*(1,44)=23.65, *p*<.001, presumably due to the aforementioned length disparities among these sentences. Neither the effect of Personal-ness nor the interaction was significant in this region (all *F*s<1). In **Region 3**, the effect of Grammatical Role was again significant, *F1*(1,20)=7.64, *p*<.05; *F2*(1,44)=4.40, *p*<.05, possibly reflecting spillover of the processing difficulty in the previous region. The effect of the Personal-ness of the object NP was significant by subjects but not by items, *F1*(1,20)=9.41, *p*<.01; *F2*(1,44)=2.28, *p*=.138, indicating a trend toward longer RTs for Personal NPs (*the dancer*) than for Non-Personal NPs (*the painting*). The interaction of these factors was not significant, *F1*<2; *F2*(1,44)=2.50, *p*=.121. Finally, there were no significant differences in **Region 4** (Grammatical Role: *F1*(1,20)=2.18, *p*=.156; *F2*<2; Personal-ness: both *F*s<1; interaction: both *F*s<1).

Table 7: Mean RTs per region for Personal vs. Non-personal Object sentences; Chinese English bilinguals.

	Region 1 The artist	*Region 2* saw/ was next to	*Region 3* the dancer/ the painting	*Region 4* at the trendy nightclub
Direct Object/Personal	893	733	1175	1217
Direct Object/Non-personal	907	730	1158	1211
Object of PP/Personal	916	862	1273	1182
Object of PP/Non-personal	882	841	1180	1177

Reanalysis of Spanish-English Late Bilinguals

As mentioned above, the Spanish-English bilinguals in this study varied in terms of AoA to a greater extent than did their Chinese-English counterparts. In fact, close consideration of these participants revealed that half of the Spanish-English bilinguals (or 12 participants) began to learn English before the age of 10, whereas only one Chinese participant began learning English at such an early age. In light of this fact, the Spanish learners of English were divided into two groups: those who had begun to acquire English before the age of ten and those who started learning English after age

ten. The latter group (N=10) is of primary interest because transfer effects would presumably be more likely to occur in late L2 language learners. The data for this subgroup of participants was analyzed in order to determine whether there is any indication that they could be showing effects of transfer. We note, however, that we have lost considerable statistical power by looking at only half the participants, so we are primarily interested in whether there are trends toward significant transfer effects or whether this subgroup simply shows the same pattern of performance shown by the group as a whole.

Possessive Pronouns

The fact that there were fewer participants tested on a given presentation list, combined with the increased likelihood that they (as later learners) made errors to comprehension questions, meant that ten items needed to be removed from the data set prior to analysis.

Mean RTs were computed for the region of primary interest (Region 3), and the following region (Region 4), as shown in Table 8. In **Region 3**, there was a significant main effect of Plurality, $F1(1,09)=8.17$, $p<.05$, $F2(1,38)=7.17$, $p<.05$. Number congruence was not significant ($Fs<1$). Although numerically, number congruence appeared to have a differential effect for singular vs. plural subjects (a difference of 75 ms vs. -87 ms), the interaction between these factors was not significant (*F1<3, F2<1).* In **Region 4**, the plurality effect is no longer significant (*F1<3, F2<2).* There was a significant effect of Number Congruence, but only on the analysis by subjects, $F1(1,9)=17.89$, $p<.005$; $F2(1,38)=1.35$, $p=.25$. The interaction of these factors was also not significant ($Fs<1$).

Table 8: Spanish-English Bilinguals (later learners): Mean reading times per region.

	Region 3 her/their hairdresser/hairdressers	*Region 4* for an appointment
Singular/Matching	777	1167
Singular/Mismatching	852	1099
Plural/Matching	996	1250
Plural/Mismatching	909	1155

Personal vs. Non-personal Objects

Just as for the Possessive Pronoun sentences, the regions of primary interest were Regions 3 and 4, the results for which are shown in Table 9. In **Region 3**, there were no significant effects (all $F1s<2$; all $F2s<1$). In **Region 4**, there was a significant interaction of Grammatical Role and Personal-ness in the by-subjects analysis, $F1(1,10)=6.48$, $p<.05$, but not in the by-items analysis, $F2< 1$. The interaction of these factors were not significant ($Fs<1$).

Table 9: Spanish-English Bilinguals (later learners): Mean reading times per region.

	Region 3 the dancer/ the painting	*Region 4* at the trendy nightclub
Direct Object/Personal	1039	1179
Direct Object /Non-personal	1036	1081
Object of PP/Personal	974	1098
Object of PP/Non-personal	1044	1150

DISCUSSION

The results of the present experiment can be summarized as follows: All three participant groups – the English native speakers, Spanish-English bilinguals, and Chinese-English bilinguals – showed a consistent relative clause effect, with subject-extracted relative clauses being read faster than object-extracted relative clauses. On the sentences of primary interest with respect to L1-to-L2 transfer, the participant groups again appeared to exhibit very similar processing patterns. Specifically, for the sentences involving possessive pronouns, all three groups showed an effect for plurality at subject position (Region 1) of the sentence, with singular subjects (*The author*) being read faster than plural subjects (*The authors*). The additional processing load imposed by plurality also showed up in Region 3, or at the position of NP introduced by the third person possessive pronoun *her/his/their*. Indeed, for all three groups, there appeared to be an almost graded effect for plurality in this region, with RTs differing roughly as a function of the number of plural elements (*her article* < *her article**s*** ≤ ***their** article* < ***their** article**s***). These RT differences can most plausibly be attributed to the semantic/syntactic processing costs associated with computing plurality generally, rather than to processing difficulty specifically related to dealing with plurality mismatches between the possessive pronoun and noun it modifies. For the sentences involving personal and non-personal direct objects, there was a consistent length effect in Region 2 across the subject groups. That is, RTs were much shorter when there was only a verb in this region. In the critical region of the direct object/object of the PP, Region 3, no subject group exhibited RT differences suggesting that personal or non-personal NPs were processed differentially as a function of their grammatical role. However, when we confined our analyses to late Spanish learners of English, there was a trend indicating interference effects for sentences involving personal direct objects in the region following these NPs.

Overall then, the group of Spanish-English bilinguals as a whole showed no L1 interference effects during the online comprehension of the L2 sentence types of interest. Again, the presence of a number mismatch between a possessive pronoun and its sister noun, though ungrammatical in Spanish,

appeared to create no processing difficulty for this group. Moreover, the appearance of a personal direct object without a preposition akin to the Spanish "a" also created no processing difficulty for this set of bilinguals as a whole. In other words, with reference to the transfer conditions of particular interest in this study, this group as a whole showed no processing difficulty when either a "similar but different" or "L1+L2-" relationship held between a component of their L1 and L2 morpho-syntactic systems. It is important to note that processing difficulty was not shown under these transfer conditions despite the fact that the self-paced reading task in this experiment was capable of reliably indicating processing disparities among the sentence types tested. This "task sensitivity" was most clearly evidenced by the consistent and reliable RT differences obtained for all three subject groups on subject- and object-extracted relative clauses.

One possible reason for the lack of clear interference effects in this study relates to the L2 proficiency of our Spanish-English bilingual participants. Indeed, these bilinguals may have advanced beyond the developmental stage in which these transfer effects would influence their L2 processing; or, they may have been so highly-proficient in their L2 that they were able to recover rapidly from any L1 interference. It is also important to reiterate that there was considerable variation in the AoA for these Spanish-English bilinguals; that is, both early learners and late(r) learners of L2 English were represented in this group. This is important because most studies investigating L1-to-L2 transfer during online L2 sentence comprehension have tested late L2 learners. And indeed, when we confined our analyses to late L2 Spanish learners of English, there was a suggestion of interference for sentences involving personal direct objects. Although this trend should be interpreted with caution, it may be the case that L1-to-L2 transfer effects (of any kind) are likely to be revealed only in late L2 learners.

Another (or an alternative) explanation for the lack of clear transfer effects in this study relates to the sentence types that were tested. Indeed, it may be the case that the L1/L2 morpho-syntactic contrasts of interest in this study are simply not contrasts that yield L1 interference during online L2 sentence comprehension. If this is correct, it would suggest that there would be little (if any) transfer effects in other cases in which a "similar but different" or "L1+L2-" relationship held between some component of the L1 and L2 morpho-syntactic systems. If these relationships are eliminated as possible conditions under which transfer effects might be obtained in the processing of grammatical morphology during L2 sentence comprehension, then only one clear candidate condition remains for such transfer – the "L1-L2+" condition. Although transfer effects might not always be revealed under this "L1-L2+" condition, it may be the case that such transfer effects can only be revealed under this condition.

A related explanation for the lack of clear transfer effects in this study has to do with the type of effect expected for the Spanish-English bilinguals. Recall that in Jiang (2004b, 2007), possible transfer effects (under an "L1-L2+" condition) were indicated by non-native speakers' insensitivity to some

aspect of the L2 grammar (in that case, plural –s). This insensitivity was revealed as a lack of processing difficulty for non-native speakers at precisely those points in sentences that caused difficulty for native speakers (by virtue of the latter group's sensitivity to plural –s). Note that this is exactly the opposite of the type of effect that was predicted in this study. That is, we expected processing difficulty for non-native speakers (by virtue of their sensitivity to mismatches between the L1 and L2 morpho-syntactic systems) at points that would cause no processing difficulty for native speakers. It may be the case that transfer effects during online L2 sentence comprehension are revealed most readily as insensitivity to aspects of the L2 system due to knowledge of the L1 system, rather than as hypersensitivity to mismatches between these systems.

Although our predictions related to transfer were not confirmed in this experiment, it is important to note one effect that may shed additional light on the nature of the apparent L1 interference in Jiang's (2004b, 2007) earlier studies – the effect for plurality in the possessive pronoun sentences. Again, in these sentences, there was a robust effect for plurality in each of the participant groups. This effect was not predicted, but is perhaps not surprising. Plurals in English are more complex than singulars in a number of ways – they typically have more letters and always encode more complex semantics. This plurality effect was particularly striking in the group of Chinese-English bilinguals. As discussed in detail above, Jiang (2004b, 2007) found that highly proficient Chinese learners of English were not sensitive to plural –s in such a way that they experienced processing difficulty for ungrammatical sentences involving plurality-based agreement (specifically, subject-verb agreement (Jiang, 2004b) and NP-internal number agreement (Jiang, 2007)). However, in the present study, similar to the native English speakers and Spanish-English bilinguals, the Chinese-English bilinguals showed a graded slowdown effect for possessive pronoun sentences in Region 3, with fastest reading times for sentences containing no plurals (*The author wrote her article at the coffee shop.*), and the slowest times for sentences containing three plurals (*The authors wrote their articles.…*). Even in the first region of these sentences, this group read singular subjects (*The author*) approximately 100 ms more quickly than plural subjects (*The authors*). It is unlikely that such a large difference can be attributed merely to the addition of one or two letters. Rather, it appears that these Chinese learners of English understood plurals as plural. Of course, it is possible that these subjects still did not compute agreement between the possessive and its antecedent, but it seems clear from these results that they at least had the requisite sensitivity to number marking to be able to do so. If this is correct, then these results would argue against Jiang's (2004b, 2007) representational account for Chinese-English bilinguals' apparent insensitivity to number marking. That is, these bilinguals do not seem to possess inherently deficit representations of plural –s in L2 English; rather, it seems that they are simply not able to deploy this knowledge efficiently during the processing agreement operations that rely on this grammatical morphology.

In sum, although the results of the present study failed to indicate clear transfer effects, they nevertheless suggest some limits, or boundary conditions, on theories of transfer, particularly those that relate to such effects in the processing of grammatical morphology during online L2 sentence comprehension. Indeed, what emerges in this discussion is the observation that L1-to-L2 transfer tends to be revealed when "L1-L2+" contrasts yield insensitivity to certain L2 grammatical forms, particularly when those forms are implicated in agreement/dependency processing operations. Of course, more research is necessary to determine whether this observation holds true across learners of a variety of L2s (and from a variety of L1s) and, more importantly, to develop a model of transfer that captures these facts. With such a theory in hand, we can then begin to think about effective ways to increase sensitivity to relevant grammatical forms through proper instructional techniques.

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Endnotes

[i] Consistent with much of the literature on the (possible) effects of L1-to-L2 transfer on real-time L2 sentence comprehension, this study focused on the morph-syntactic and syntactic processes involved in generating meaningful representations for L2 sentences. It does not address issues related to (possible) transfer effects in "lower-level" processes, such as those involved in orthographic coding or in (non-syntactically-relevant) lexical processing.

[ii] It is important to note that our treatment of "a" marking and its distribution in Spanish is rather cursory. However, a complete explication of the precise nature of this element and its use are beyond the scope of this paper (for more on this element, see Silverstein, 1976; Stockwell, Bowen, & Martin, 1965).

[iii] The complete list of the stimuli will be provided upon request to the first author (kabarto@email.arizona.edu).