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◆ Can English Spanish Emerging Bilinguals Use Agreement Morphology to Overcome Word Order Bias?

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PREVIOUS SECOND LANGUAGE ACQUISITION studies have shown that English-speaking learners of Spanish, especially at the beginning and intermediate levels of proficiency, persistently misinterpret Object-cliticVerb Subject ($O_{cl}VS$) sentences. Due to transfer effects, these learners rely on word order as the most valid cue for agenthood, and, therefore, incorrectly assign the preverbal object clitic the role of agent. In this study we explore whether advanced learners are also prone to such misinterpretation errors, and whether they are able to make use of number agreement morphology to reconfigure their L1 processing strategies. In a self-paced reading study, we manipulated match/mismatch in number agreement between the clitic and the verb: in 50 percent of the target sentences, agreement was not a useful cue for overcoming the word order bias (e.g., $Lo_{cl\text{-}sg}$ $está_{vb\text{-}sg}$ *mirando la chica*, "The girl is looking at him"), whereas in the other 50 percent the clitic and verb mismatched (e.g., $Lo_{cl\text{-}sg}$ $están_{vb\text{-}pl}$ *mirando las chicas*, "The girls are looking at him"), so that agreement provided a useful cue for arriving at the correct interpretation of the clitic as the patient. Comprehension questions were used to probe participants' interpretations of the sentences they had read. Results show that even advanced Spanish learners strongly relied on word order when interpreting $O_{cl}VS$ sentences. However, learner accuracy improved in the mismatching conditions when the morphological cue indexing

agreement mismatch was found on the verb. In addition, participants tended to present longer reading times in the verb region of $Cl_{sg}V_{pl}S_{pl}$ structures.

Introduction

The question of how the human processor decides 'who does what to whom' in sentences with noncanonical word order became a focus of interest for cognitive psychologists in the sixties (e.g., Bever 1970; Fraser, Bellugi, and Brown 1963; Slobin 1963, 1966; Slobin and Bever 1982) and later for researchers in the field of Second Language Acquisition (SLA). LoCoco (1982, 1987) and VanPatten (1984) were the first to explore how English-speaking learners of Spanish interpreted OclVS sentences such as "La mira el estudiante" (her-clitic.fem.sing. look at-3rd p. sing. the student, "The student looks at her") and whether L2 learners transferred the processing strategies that had been identified for them in their L1 (e.g., Bever 1970) to a rich inflectional language like Spanish.

   After over three decades of research, SLA scholars have established that, in $O_{cl}VS$ sentences, English-speaking adult learners—especially, but not only, in the early stages of acquisition—often misinterpret the initial object clitic as the agent instead of the patient of the verb (e.g., Lee 2000; Lee and Malovrh 2009; LoCoco 1987; Montrul 2010; Malovrh and Lee 2010; Sanz and Morgan-Short 2004; VanPatten 1984; VanPatten and Houston 1998; VanPatten and Borst 2012). Authors have also looked into the potential benefits of pedagogical techniques such as input enhancement (Lee 1987) and processing instruction (PI) (e.g., Sanz 1997; Sanz and Morgan-Short 2004; VanPatten and Cadierno 1993) in helping learners overcome processing biases. This literature, however, has left lacunae worth investigating, including the development of processing strategies beyond the initial levels of acquisition, and the role of clitic/verb contrasting morphology in disambiguating semantic function assignment.

   Object clitics and noncanonical sentence interpretation have also been studied from a formal perspective (see Lee 2003, for an overview of studies adopting a formal approach to noncanonical sentences). Several differences distinguish the present study from previous research. First, since we adopt a functionalist approach (the Competition Model; Bates and MacWhinney 1981, 1987, 1989; MacWhinney 2012), rather than a competence approach to language processing, our main focus is not to make dichotomous comparisons between processing behaviors of native and nonnative speakers. Rather, the goal of this research is to take a closer look at what advanced learners of Spanish, who we will refer to as emerging bilinguals, can do when processing $O_{cl}VS$ sentences exhibiting different agreement manipulations; that is, we account for intra-subject processing variation.

   Second, previous studies which have investigated $O_{cl}VS$ in the written modality have either excluded advanced learners from their sample or have not focused on questions related to the impact that clitic/verb contrasting morphology may have on $O_{cl}VS$ sentence processing (e.g., Montrul 2010; Montrul, Foote, and Perpiñán 2008).

   Finally, none of the studies in the previous literature have provided processing information concerning sentence-reading time: instead, reaction time data have

been addressed only in terms of the latency of responses to comprehension questions. For instance, McCarthy (2008) did include the examination of $O_{cl}VS$ sentences in advanced L2 learners, but the author looked mainly at production, measured offline, and the clitics conveyed in the $O_{cl}VS$ sentences analyzed in that study were limited to sentences with inanimate referents. Other studies which have used online procedures such as Self-Paced Reading (SPR) tasks (e.g., Foote 2011), Event Related Potentials (ERPs) (Bañón, Florentino, and Gabriele 2014; Dowens et al. 2010) and eye-tracking (ET) (Grüter, Lew-Williams, and Fernald 2012) addressed different agreement phenomena (e.g., violations to subject-verb agreement, noun-adjective gender agreement, determiner-noun number) in sentences with canonical word order only.

The main interest of this study is to investigate how English-speaking advanced learners of Spanish process $O_{cl}VS$ sentences under different agreement conditions between the clitic and the verb. However, in order to answer this question, we have first looked at previous studies that examined whether advanced learners are able to make use of agreement information online, another question this study addresses. On this issue, previous work by Foote (2011) has attempted to determine whether English-speaking advanced learners, whose L1 exhibits agreement morphology, were able to integrate number knowledge in Spanish during online sentence processing. To test this, Foote used a word-by-word SPR task with canonical (SV) sentences that contained subject-verb number violations. SPR word-by-word methodology measures how much time learners spend reading at their own pace each of the words (regions) in a sentence; this allows researchers to identify which regions present processing difficulties. The assumption is that the longer it takes learners to move from one word to the next, the more costly the processing of cues in that region is. In her study, Foote found that when advanced learners encountered SV ungrammatical sentences, they exhibited slowdowns (i.e., higher processing costs) in the verb region. Such disruptions in the learners' reading comprehension were attributed to be evidence for advanced learners' sensitivity to agreement mismatches and, therefore, their ability to quickly integrate number morphology and compute agreement information online.

Does the sensitivity identified by Foote in SV structures translate into enhanced abilities to process clitic and verbal morphology in noncanonical transitive sentences for learners at this proficiency level? Previous work suggests that $O_{cl}VS$ sentences are challenging for L2 speakers even at advanced levels of proficiency. For instance, Lee and Malovrh (2009) and Malovrh and Lee (2010) investigated the role of clitic morphology in clitic referential resolution in $O_{cl}VS$ sentences in the aural modality; their studies provide empirical evidence suggesting that English-speaking learners who have reached high levels of proficiency in Spanish still present difficulties interpreting these sentences.

In sum, previous research suggests that L2 learners find sentences with non-canonical word order challenging, even at advanced levels of proficiency. By contrast, L2 advanced learners show sensitivity to agreement information in canonical sentences. In our study we addressed the question of whether advanced learners of L2 Spanish could use agreement information to overcome word order bias when

assigning agency to noncanonical sentences. To confirm that agreement informa-
tion can be processed, we tested a college population with an L1/L2 combination
similar to Foote (2011), Lee and Malovrh (2009), and Malovrh and Lee (2010).
We examined the interaction of word order and agreement cues by employing a
within-subjects design that allowed us to compare accuracy rates and processing
costs of $O_{cl}VS$ sentences conveying different agreement conditions: two conditions
presented contrastive agreement cues between the clitic and the verb, and the other
two did not. By comparing learners' online and offline performance in both contras-
tive and non-contrastive agreement conditions, we were able to address whether
emerging bilinguals make use of contrastive agreement morphology between the
clitic and the verb to overcome word order bias.

The Competition Model

The Competition Model (CM; Bates and MacWhinney 1981, 1987, 1989; MacWhinney
2012), the approach that we adopted for our study, is an interactive-activation frame-
work that views sentence processing as a set of probabilistic mappings between form
and meaning (Hernandez, Sierra, and Bates 2000). The model is based on notions
such as *cue validity*, which points to the information value a particular linguistic form
carries within a particular language. *Cue availability* (i.e., frequency in the input) and
cue reliability (i.e., the proportion of times a specific cue is a reliable predictor of a
given form and meaning mapping, for example, agenthood) both contribute to cue
validity.

    Under the CM, the particular interpretation of an input sentence is the result
of a dynamic process of cue activation, according to which linguistic cues compete
and also converge with one another. Depending on how valid and reliable a spe-
cific cue is in leading to the correct interpretation of a sentence, the cue is either
stronger or weaker in the *cue hierarchy* of a particular language; this is reflected in the
chances of its 'winning' the competition with other cues during form and meaning
mappings. *Cue strength* varies across languages. In English, word order is the most
valid cue for sentence interpretation (i.e., the highest in the cue hierarchy) and
subject-verb agreement is the second most important cue (McDonald 1987; Reyes
and Hernandez 2006). By contrast, in Spanish, morphology is the strongest cue
since word order is highly variable and dependent on pragmatic purposes (Bates
and MacWhinney 1989); this makes SVO word order less available and less reliable
(Kail and Charvillat 1988).

    Based on the CM, English-speaking learners of Spanish often misinterpret
$O_{cl}VS$ sentences due to their overreliance on word order as a cue. Because word
order is a highly reliable cue for agenthood in English, the CM model predicts that
English learners incorrectly assign an agent role to object clitics when they appear in
sentence-initial position, even when the case information on the clitic should pre-
vent them from doing so. Object clitics, however, are difficult to detect and hard to
process by English speaking learners with little control over morphology, due to the
richness of object clitics' morphological variation (they are marked for case, gender,
and number). They are also monosyllabic and depend on the verb for phonological

stress. In addition, for MacWhinney (2012), *cue costs* (i.e., the amount of processing required in the activation of forms) are likely to arise during the processing of agreement markers because these markers cannot be used to assign thematic roles directly. By contrast, word order is low in processing cost: the first noun (regardless of its ending) is the subject/agent of the verb that follows.

With regard to L2 development, the CM defines L2 learning as the process of resetting cue weights from an L1-based cue hierarchy to another that more closely approximates the L2 cue hierarchy. When the same cues are present in two languages, as is the case for agreement cues in English and Spanish, learners need to weight these cues according to their validity in each of the two languages. Therefore, learning the correct interpretation of $O_{cl}VS$ sentences in Spanish entails moving away from a strategy that strongly relies on word order as a cue for assigning agency toward progressively increasing reliance on verbal and clitic morphology.

With increased L2 proficiency, learners ideally should have "fine-tuned" the L2 cue weight settings to L2 cue validity, resulting in clearly differentiated L1 and the L2 cue hierarchies. However, L1 transfer effects still occur at advanced levels of proficiency (Sanz, Park, and Lado 2014). Therefore, questions that arise in the case of $O_{cl}VS$ sentences include: can emerging bilinguals in their third year of college overcome the problems inherent to the processing of Spanish morphology, i.e., cue detectability and cue cost? Can they take advantage of the contrastive value of number markers to come to the right interpretation of noncanonical sentences?

CM scholars Hernandez, Bates, and Avila (1994) investigated the interaction of word order and number agreement in a picture agent-choice task. Sentences conveying different word order were presented aurally to a group of early English Spanish bilinguals. The authors compared the bilinguals' processing profiles in sentences in Spanish in which agreement information was either a useful cue, or a not useful cue, for determining agenthood (e.g., *El perro las vacas están correteando*; 'The dog the cows are chasing' vs. *El perro la vaca está correteando*; 'The dog the cow is chasing'). The researchers found that in sentences in which word order and agreement information conflicted, participants were better at deciding who the agent of the sentence was. On the contrary, when agreement showed no contrast (e.g., *El perro la vaca está correteando*; 'The dog the cow is chasing'), word order still played a strong role in the bilinguals' sentence interpretations. What this research shows us is that bilinguals can exhibit processing patterns of "in-betweeness" or amalgamation and that they seem to benefit from contrastive morphological information when processing noncanonical sentences.

The role of conflict and contrast on $O_{cl}VS$ sentence processing behaviors, therefore, is a variable worth studying with emerging bilinguals, who may exhibit, as in the case of early English Spanish bilinguals, qualitative differences in their processing mechanisms. As MacWhinney (1997) pointed out in relation to agreement morphology, what makes a cue such as agreement useful is not only its availability in the input but also its contrastive effects. The above sentences are good examples to illustrate how contrast availability works. In the first case, *El perro la vaca está correteando*; 'The dog the cow is chasing,' verbal morphology does not contrast in number for either NP, as both NPs are singular. The agreement cue is available but not contrastive, and therefore it is less informative; it also leads to more than one possible

interpretation ('The dog is chasing the cow' or 'The cow is chasing the dog'). By contrast, in the sentence *El perro las vacas están correteando*; 'The dog the cows are chasing,' the verb agrees with the second noun only; the agreement cue is not only available, but is also contrastive.

Target Items: Characteristics of Clitics

Clitics are defined as a type of pronoun that behaves like a single word syntactically and like an affix morphophonologically, since they can attach to an adjacent verb (see Zwicky 1985). This study focuses on third-person direct object clitics, which have received the most attention in Spanish SLA in part due to their complex phonological, pragmatic, and morphosyntactic characteristics. These characteristics are summarized in table 11–1.

Agreement Morphology Usage during Sentence Processing

In the early literature on $O_{cl}VS$ sentences in Spanish, VanPatten (1984) studied how English-speaking learners interpreted aural $O_{cl}VS$ sentences in a picture agent-choice task: he argued that learners ignored verbal morphology when deciding 'who does what to whom.' However, the accuracy scores of the sentences conveying contrastive agreement were not analyzed independently in this study, and the number of tokens for which verb morphology was manipulated for testing purposes was too small ($k = 4$).

Lee and Malovrh (2009) and Malovrh and Lee (2010) investigated whether clitic morphology influenced clitic referential resolution in $O_{cl}VS$ sentences such *María habla frecuentemente con su papá. Lo admira María mucho.* "María speaks with her father frequently. Maria admires him a lot." These sentences involve agreement computations between the object clitic and its antecedent. The authors found that advanced level students processed aural $O_{cl}VS$ strings in the third person at either a 60 percent or 78 percent level of accuracy depending on whether they were enrolled in a sixth semester or in an upper level course (Malovrh and Lee 2010, 242). Of interest for this study, Lee and Malovrh (2009) and Malovrh and Lee (2010) claim that the object clitic system only begins to restructure at the advanced levels, suggesting that difficulties in $O_{cl}VS$ sentences persist up to the higher levels of proficiency. However, contrastive clitic-verb morphology of the type that is the focus of this study has not been addressed in previous research on $O_{cl}VS$ –type structures.

Our study intended to shed light on the process of resetting L2 cue weights from a hierarchy that is L1-based to another that more closely approximates the L2 hierarchy; to do so, we investigated the role of contrasting agreement morphology in such realignment. We predicted that emerging bilinguals' tendency to rely on word order when processing $O_{cl}VS$ sentences would be circumvented by contrastive number morphology between the clitic and the verb. To test this prediction, we used a noncumulative SPR paradigm (word-by-word) and analyzed both participants' reading times and their accuracy in the comprehension questions. We predicted that

◆ Table 11–1.   Properties of third-person direct object clitics in Spanish

Properties	Examples
They are inflected for *gender* and *number*: Masculine-singular: *lo* (him) Feminine-singular: *la* (her) Masculine-plural: *los* (them) Feminine-plural: *las* (them)	*A veces **lo** saluda la profesora con algo de indiferencía.* "Sometimes the professor greets him with some indifference." *Por la mañana **las** acompaña el padre a la escuela.* "In the morning the father accompanies them to school."
They are pronominal forms that can refer to animate or inanimate nouns	*Ayer ví <u>la película</u> → Ayer **la** ví* "Yesterday, I saw a movie → Yesterday, I saw it" *Ayer ví <u>a María</u> → Ayer **la** ví* "Yesterday, I saw María → Yesterday, I saw her"
They have accusative case when they fulfill a direct object role.	*Quien conoce a Susana sabe que todos **la**/*ella aprecian mucho.* "Anyone who knows Susan knows that everyone appreciates her/ *she."
They are unstressed pronouns that phonologically depend on the verb (e.g., Suñer 1988; Everett 1996; Sportiche 1996; Torrego 1995; Uriagereka 1995; Zagona 2002)	*¿**Lo** estás viendo?* "Are you seeing it?"
When the verb is finite, they occupy a preverbal position (i.e., they appear to the right of a verb in an OclVS structure). Exceptions: they can be attached to the right of imperative, gerund, and infinitive forms.	**Pablo quiere **lo**.* "*Paul wants it" *Pablo **lo** quiere.* "Paul it wants"
They must refer to entities that are already present in the context. They are argued to involve a definite feature (Arche and Dominguez 2011).	*¿Me **lo** puedes sostener?* "Can you hold it for me?" (lo, "it," refers to an object in the context)
No lexical material can intervene between the clitic and the verb (Jaeggli 1982)	**Lo <u>por tres horas</u> buscó.* " *She looked for three hours for him."
They are homophonous with the definite article (e.g., *la*, 'the' sing. fem.) (Ellis 2006) and with the complementizer of relative pronouns (e.g., *la que*, 'what' sing. fem.) (Lee and Malovrh 2009)	***La** chica* "the girl" ***La** conozco* " I know her" ***Los** gatos en el patio* "the cats in the yard" ***Los** alimento* " I feed them"
They may co-occur with a phonologically independent and coreferential pronoun (i.e., clitic-doubling) (See Sanchez and Al-Kasey 1999)	***La** ví a ella.* " I saw her"

as accuracy improved, sentences with agreement mismatches should result in slower RTs than sentences with agreement match (Hernandez, Sierra, and Bates 2000).

Research Questions and Predictions

The following research questions (RQs) and corresponding predictions were posed:

> RQ1: Do advanced learners of L2 Spanish who are native speakers of English prefer word order for the interpretation of O_{cl}VS sentences during reading comprehension, as suggested by Lee and Malovrh (2009) and Malovrh and Lee (2010) for aural stimuli?

Due to the persistence of word order as a cue, we expect L1 transfer effects to continue at the advanced level in the written modality as well.

> RQ2: Given that advanced learners are sensitive to agreement morphology, can contrastive agreement cues help advanced learners of L2 Spanish who are native speakers of English come to the right interpretation of O_{cl}VS sentences?

When verb and clitic number mismatch (e.g., $Lo_{cl\text{-}sg}$ $están_{vb\text{-}pl}$ *mirando las chicas*, "The girls are looking at him"), we expect readers to be more likely to arrive at the correct interpretation of experimental sentences, resulting in higher accuracy rates. When verb and clitic match in number (e.g., $Lo_{cl\text{-}sg}$ $está_{vb\text{-}sg}$ *mirando la chica*, "The girl is looking at him"), we expect L2 learners of Spanish who are native speakers of English to prefer word order information for the interpretation of O_{cl}VS sentences, resulting in lower accuracy rates in comprehension questions.

> RQ3: Do number mismatches between object clitics and verbs lead to higher processing costs?

If learners misinterpret the clitic pronoun as the agent of the sentence, and if this creates an expectation that the clitic and verb should agree in number, we expect higher processing costs (i.e., higher RTs) when verb and clitic mismatch in number (e.g., $Lo_{cl\text{-}sg}$ $están_{vb\text{-}pl}$ *mirando las chicas*, "The girls are looking at him") as opposed to when they match in number (e.g., $Lo_{cl\text{-}sg}$ $está_{vb\text{-}sg}$ *mirando la chica*, "The girl is looking at him'"). We expect this difficulty to arise at the verb regions or in the regions after it.

Methodology

Participants

Participants in this study ($n = 38$) were native speakers of English (twenty-four female; *mean age*: 18.94) and were advanced learners of L2 Spanish. Proficiency level in L2 Spanish was based on their institutional enrollment in an advanced Spanish course. All participants in this study were enrolled in an Advanced II non-intensive course at Georgetown University and were recruited to participate in this study in exchange for extra credit in their Spanish course. Students were enrolled in these courses either based on results of a fall validation exam, from their performance on a placement exam, or from previous course enrollment. All participants completed the grammar section of the Placement Exam created by the Spanish and Portuguese Department at Georgetown University. The grammar section of the placement

exam consisted of thirty-seven four-option multiple-choice items targeting a range of grammatical structures in Spanish. All participants obtained a score of 60 percent or more in the test (the maximum scored obtained was 86 percent); z-scores were calculated to guarantee that the scores were within two standard deviations from the mean. Learners also completed a language questionnaire based on Li et al. (2013). Five participants declared that they spoke languages other than English: Hindi ($n = 1$), Amharic ($n = 1$), Hebrew ($n = 1$), French, Chinese, and German ($n = 1$), and German ($n = 1$). No participant spoke any other foreign language. In addition, to ensure that participants stayed on task throughout the experiment, only participants with at least 70 percent or higher accuracy in their responses on the comprehension questions for filler items were included in the analysis. Overall, from an original sample of forty-one participants, three participants were excluded from analysis: two for not being native speakers of English ($n = 2$) and another for not meeting the 70 percent filler criterion ($n = 1$).

Materials

The study comprised two separate experiments and seventy-two fillers, distributed across four lists in a Latin Square design. Sentences included highly frequent vocabulary taken from textbooks used in lower level courses (e.g., *Vistazos*). Table 11−2 shows an example of each of the experimental items.

The first experiment consisted of twenty-four $O_{cl}VS$ item sets. $O_{cl}VS$ sentences consisted of transitive sentences presented in the present continuous tense (auxiliary *estar* "to be" + gerund). The twenty-four sentences were arranged in a 2 × 2 design, with agreement (match/mismatch) and number (singular/plural) as factors. In the match conditions, the clitic and the verb were both either singular or plural (conditions B and C respectively); in the mismatch conditions, either the clitic was singular and the verb plural or the clitic was plural and the verb singular (conditions A and D respectively) (see table 11−2). Both NPs in the target sentences were animate, and were either in masculine or feminine.

Transitive sentences were preceded by a contextual phrase that contained a suitable referent for the clitic. The subjects of the contextual sentence for the $O_{cl}VS$ sentences consisted of common professions ending in *-o, -a, -or,* or *-ora* (e.g., *abogada,* "lawyer") and common nouns (e.g., *chicas,* "girls") or nationalities (e.g., *china,* "Chinese"). We counterbalanced the gender of the subject and the clitic in the target sentence to reduce ambiguity in the interpretation of the participants' response (Sanz 1997). Direct object clitic pronouns always referred to either the first or second NP introduced by the contextual sentence, and this was done in a counterbalanced fashion.

In order to ensure that participants were sensitive to subject-verb agreement violations overall, we included a second experiment consisting of twenty-four sentences that contained agreement violations in canonical SV configurations. SV sentences were arranged in a 2 × 2 within-subjects design, with grammaticality (grammatical/ungrammatical) and subject number (singular/plural) as factors. For the grammaticality factor, the agreement relationship was manipulated between the

subject noun and the verb: in the grammatical conditions, the subject and the verb always agreed in number and they were either both singular or both plural (conditions B and C respectively). In the ungrammatical conditions, the subject and verb always disagreed in number, so that either the subject was singular and the verb was plural (Condition A) or the subject was plural and the verb singular (Condition D) (see table 11–2). SV sentences included only intransitive verbs (e.g., *volver*, "come back").

Each sentence was followed by a true/false question that probed participants' interpretation of the previous sentence by either conveying a correct agent assignment or an incorrect one. The true/false comprehension questions that followed the SV items were related to content, and never pointed to the grammaticality of the sentence (see table 11–2).

Procedures

Sentences were presented on a PC using an SPR word-by-word procedure (Just, Carpenter, and Woolley 1982). Item blocking and Latin-square assignment was managed by the reading-time software, Linger (Doug Rohde, MIT). The order of experimental and filler items was randomized for each participant. In each experimental trial, participants read a sentence with words masked by dashes. When participants pressed the space bar, a word was revealed and the previous word was re-masked, as seen in figure 11–1.

The time spent on each word was measured as the time elapsed between two successive key presses. The contextual sentences that preceded the target $O_{cl}VS$ items were also masked, except that, unlike the target items, participants were able to read the sentence all at once. This contextual sentence disappeared after participants pressed the space bar to reveal the target $O_{cl}VS$ sentence (word-by-word).

Participants were instructed to read at a natural pace and to answer the end-of-sentence questions as quickly and accurately as possible by pressing one of two keys ("F" key for True or the "J" key for False). Feedback (correct/incorrect) was provided for every item ($O_{cl}VS$, SV and Fillers). Five practice sentences were presented before the experiment. None of the practice sentences consisted of $O_{cl}VS$ sentences, and participants were not informed that SV sentences would contain grammatical agreement errors. Between each block, participants were given a break; they were also informed that breaks could be taken at any point of the experiment. After completing the experiment, participants took the grammar section of the placement test, and they were given an exit questionnaire and were debriefed. The entire experimental session lasted approximately one hour.

Analysis for accuracy and latency

Statistical analysis of accuracy scores for responses to the true/false questions for the $O_{cl}VS$ sentences was carried out using a binomial logistic regression in R (R Development Core Team 2014) with Condition (A–D) and Trial Order as predictor variables. The condition in which both the object clitic and the verb were singular was used as the baseline in the between conditions comparison.

◆ Table 11–2. Sample set of experimental items

Contextual sentence for OclVS sentences:

El/los maestro(s) y la(s) chica(s) está(n) en el parque,
"The teacher(s) and the girl(s) is/are in the park

OclVS sentence conditions:

Mismatch, Cl-sg.: *Ahora lo están buscando las chicas con impaciencia*
CONDITION A "The girls are now looking for him impatiently"

Match, Cl-sg.: *Ahora lo está buscando la chica con impaciencia*
CONDITION B "The girl is now looking for him impatiently"

Mismatch Cl-pl.: *Ahora los están buscando las chicas con impaciencia*
CONDITION C "Now the girls are looking for them impatiently"

Match, Cl-pl.: *Ahora los está buscando la chica con impaciencia*
CONDITION D "Now the girl is looking for them impatiently"

True/ False questions (comprehension) for OclVS sentences:

El/ Lo(s) maestro(s) está(n) buscando a la(s) chica(s).
"The teacher(s) is/ are looking for the girl(s)" FALSE
or
La/La(s) chica(s) está(n) buscando a el/los maestro(s).
"The girl(s) is/are looking for the teacher(s)" TRUE

SV sentence conditions:

Ungram, subj. sg.: ** A veces el perro duermen en la cama*
CONDITION A "*Sometimes the dog (sing.) sleep (pl.) in the bed."

Gram, subj.sg.: *A veces el perro duerme en la cama*
CONDITION B "Sometimes the dog (sing) sleeps (sing) in the bed"

Gram, subj. pl.: *A veces los perros duermen en la cama*
CONDITION C "Sometimes the dogs (pl.) sleep (pl) in the bed"

Ungram, subj. pl.: ** A veces los perros duerme en la cama*
CONDITION D "*Sometimes the dogs (plural) sleeps (sing.) in the bed"

True/ False questions for SV sentences:

El/ Los perro(s) duerme(n) en el piso.
"The dog(s) sleep(s) in the floor." FALSE
or
El/ Los perro(s) duerme(n) en la cama.
"The dog(s) sleep(s) in the bed." TRUE

The _____ _____ _____ _____ _____
(space bar press)
_____ boys _____ _____ _____ _____
(space bar press)
_____ _____ run _____ _____ _____

◆ Figure 11–1. Word-by-word self-paced reading

For latency, only length-regressed reaction times were entered into the statistical analysis. Length-regressed reaction times were computed by first estimating the effect of word length from the entire dataset and then regressing it from the raw reaction times using a linear model (see Hofmeister 2011; Lago et al. 2015). This procedure controls for differences in length between experimental conditions: in Spanish, plural clitics and verbs are one character longer than their singular counterparts; the plural suffix in the third-person plural clitic is -s) and the third-person plural suffix in the copula *estar* is -n).

The residual RT data from the $O_{cl}VS$ sentences were analyzed implementing a mixed-effects linear model with a fixed effect of condition and random effects of subject and items, using the *lme4* package in R (Bates et al. 2014). RT averages more than 2.5 standard deviations from the participant mean by region and condition were excluded (Ratcliff 1993).

Results
Accuracy $O_{cl}VS$ sentences
Table 11–3 shows the mean accuracy scores for $O_{cl}VS$ sentences in each experimental condition. Overall accuracy for all conditions was below 70 percent, which supports the idea the $O_{cl}VS$ sentences are still difficult for advanced learners. Although accuracy in the mismatch plural verb condition (*mean* = 61.40) was numerically higher than in the other conditions, this difference did not reach significance.

In addition, in order to examine how participants' performance changed across the experiment, a logistic regression was run with Condition and Trial Order as predictors. In the mismatch plural verb condition (i.e., Cl sg., V pl.), participants' improvement was more pronounced than in the other conditions. This pattern was confirmed by a Condition × Trial Order interaction for the mismatch plural verb condition (i.e., Cl sg., V pl.). The results are shown in table 11–4 and represented in figure 11–2.

◆ Table 11–3. Mean accuracy in each experimental condition ($O_{cl}VS$ sentences)

Condition	Mean	LowerCI	UpperCI	RT	SEM
A (Clitic sg., Verb pl.)	61.40	54.94	67.48	2877.66	107.10
B (Clitic sg., Verb sg.)	60.08	53.61	66.22	2900.93	108.79
C (Clitic pl., Verb pl.)	56.14	49.64	62.42	2836.57	151.75
D (Clitic pl., Verb sg.)	58.33	51.84	64.54	2799.24	108.22

The effect size of the improvement over the course of the experiment (i.e., Trial Order) was calculated for each experimental condition (Condition × Trial Order). Table 11–5 shows the standard coefficients, which correspond to the effect size in a logistic regression, and the odds ratio, which indexes the proportion by which the accuracy goes up as the order increases.

As seen in table 11–5, the change in accuracy in the mismatch plural verb condition (Cl sg., V pl.) showed the highest effect size ($= 0.46$, *odds ratio* $= 1.93$). The baseline condition (Cl sg., V sg.) was the condition with the lowest effect size ($= 0.20$, *odds ratio* $= 1.22$). The other condition where the verb also mismatched in number with the clitic showed improvement, (Cl pl., V sg.), but the improvement across the experimental trials was numerically smaller and presented a lower effect size ($= 0.21$, *odds ratio* $= 1.51$) than the condition where the mismatch was significant (Cl sg., V pl.). Finally, the condition in which clitic and verb were both plural presented a higher effect size (*std. coef.* $= 0.27$, *odds ratio* $= 1.60$) than the baseline condition and the mismatch singular verb condition (Cl pl., V sg.)

Reaction times in O$_{cl}$VS sentences
Table 11–6 summarizes the residual reaction times (ms) in each of the regions (words) in the O$_{cl}$VS sentences for all of the conditions. Region-by-region reading times are displayed in figure 11–3.

As figure 11–3 shows, the conditions in which verb and clitic mismatched presented higher residual RTs in the verb region (*mean* $= 88.08$ ms) in comparison with the conditions in which the clitic and verb matched in number (*mean* $= 35.05$ ms). Finally, as shown in table 11–6, the condition in which these learners performed significantly better in terms of accuracy (Cl sg., V pl.) also presented the highest residual RT in the clitic region (24.41 ms) and the lowest residual RT in the spill-over region (the determiner of the postverbal subject) (−13.60 ms).

As seen in table 11–7, a mixed-effects linear model, with a fixed effect of condition and random intercepts and slopes by subject and item on the residual

◆ **Table 11–4.** Logistic regression for O$_{cl}$VS sentences (trial order and condition as predictors)

	$\hat{B}$	St. Error	z value	Pr (>|z|)
(Intercept)	0.06229	0.27059	0.230	0.8179
Trial Order	0.02878	0.01965	1.465	0.1430
Condition A	−0.75198	0.39572	1.900	0.0574
Condition C	−0.65972	0.39547	−1.668	0.0953
Condition D	0.46085	0.38626	−1.193	0.2328
Trial Order × Condition A	0.06654	0.02918	2.280	0.0226*
Trial Order × Condition C	0.03924	0.02856	1.374	0.1696
Trial Order × Condition D	0.03069	0.02785	1.102	0.2706

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
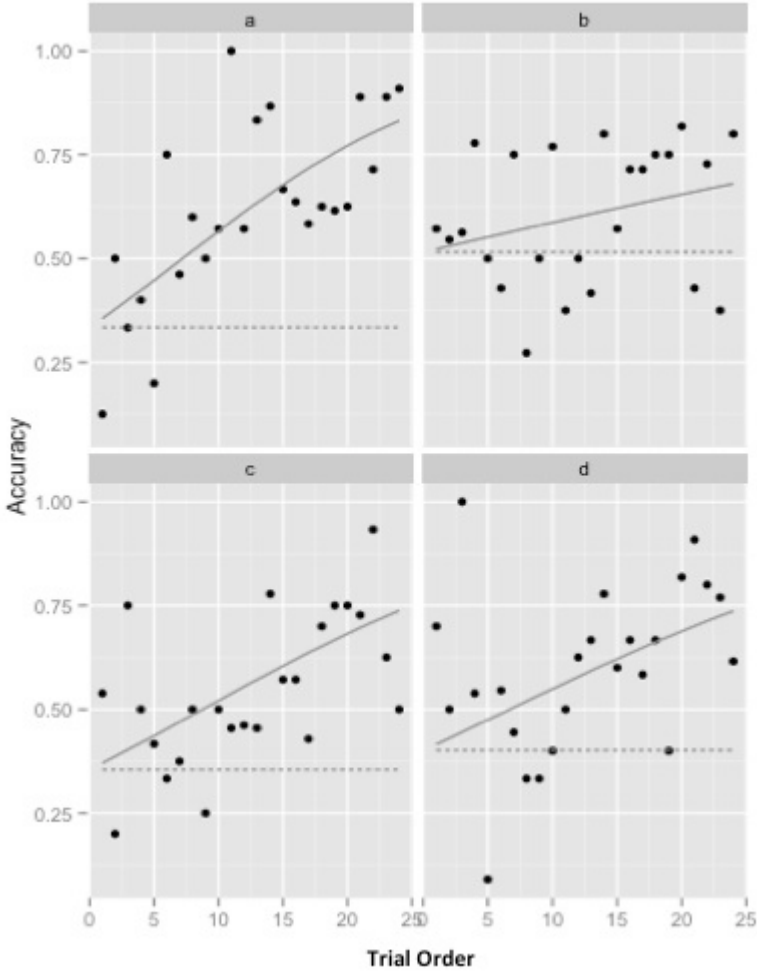
◆ Figure 11–2. Accuracy (Trial Order × Condition). The dots represent the target items; the dotted red lines represent the participants' competency at the beginning of the experiment, and the solid red lines represent the Trial Order effects (the improvement over the course of the experiment)

◆ Table 11–5. Effect sizes (std. coef.) for $O_{cl}VS$ sentences (accuracy)

	Std. coefficient	Odds
A (Clitic sg., Verb pl.)	0.46	1.93
B (Clitic sg., Verb sg.)	0.20	1.22
C (Clitic pl., Verb pl.)	0.27	1.60
D (Clitic pl., Verb sg.)	0.21	1.51

◆ Table 11–6. Mean residual reaction times (ms) in each region and condition (O_{cl}VS sentences)

	Clitic	Auxiliary (*estar*)	Determiner	Noun
A (Clitic sg., Verb pl.)	24.41	105.37	−13.60	−42.56
B (Clitic sg., Verb sg.)	0.47	44.52	53.73	23.49
C (Clitic pl., Verb pl.)	−10.06	25.58	0.99	21.72
D (Clitic pl., Verb sg.)	−13.18	70.79	64.05	72.63
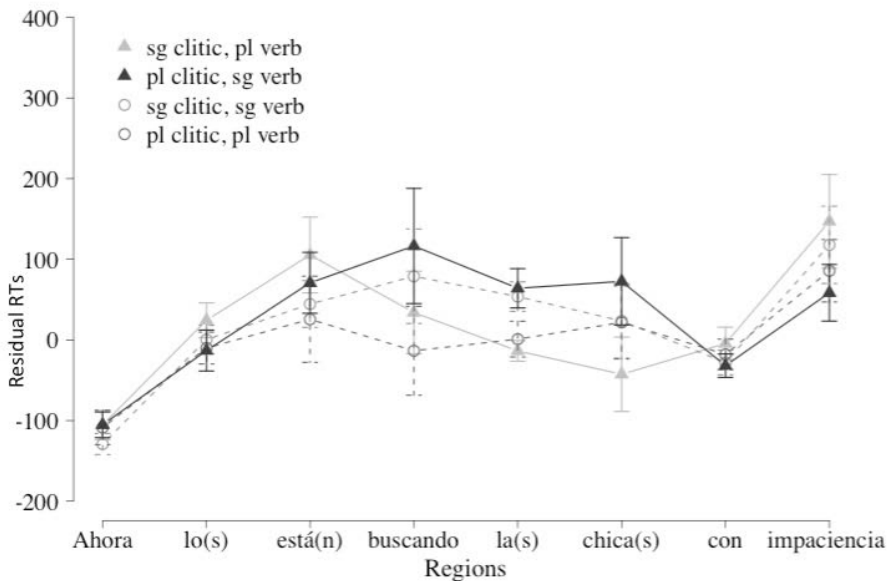
◆ Figure 11–3. Mean residual reaction times (ms) in each condition (O_{cl}VS sentences). Sample sentence: "Now the girl(s) is (are) looking for him (them) impatiently."

reading times showed no statistical differences in the RTs in the auxiliary verb region ($\hat{\beta} = -25.52, t = -0.91$) for the Cl sg., V pl. condition; therefore, the higher processing costs observed in the auxiliary verb region for the condition in which the clitic is singular and the verb plural remain as a tendency in the data, suggesting that this condition seems to be qualitatively more salient than the rest of the conditions.

Reaction times in SV sentences

Figure 11–4 shows the reaction times for the experimental conditions in the SV sentences, which were included to diagnose whether learners showed sensitivity to subject-verb number mismatches in the comprehension of sentences with canonical word order.

◆ Table 11–7. Fixed-effects linear model for residual reaction time data (O_{cl}VS sentences)

	ß	SE	t value
Clitic region			
Intercept (Condition B)	−24.81	19.51	−1.272
Condition A	3.16	13.94	0.227
Condition C	−17.80	13.94	−1.277
Condition D	−24.52	13.89	−1.765
Auxiliary verb region			
Intercept (Condition B)	21.50	39.76	0.541
Condition A	−25.52	27.79	−0.918
Condition C	−108.75	27.67	−3.930
Condition D	−11.41	27.62	−0.413
Gerund region (verb+1)			
Intercept (Condition B)	3.598	63.309	0.057
Condition A	−35.099	42.329	−0.829
Condition C	−86.218	42.255	−2.040
Condition D	8.311	42.284	0.197
Determiner region (verb+2)			
Intercept (Condition B)	11.4462	15.6379	0.732
Condition A	−32.3778	13.6778	−2.367
Condition C	−51.0511	13.7241	−3.720
Condition D	0.5412	13.7687	0.039

Note: Estimates with $|t| > 2$ are considered significant effects at the $\alpha = .05$ level (e.g., Baayen, Davidson and Bates 2008).

As seen in figure 11–4, learners showed a tendency to spend more time reading the verb region for the ungrammatical conditions.

In order to shed more light on these results, we calculated the effect sizes for the verb region and the region immediately afterwards (i.e., spillover 1). For purposes of comparison, these effect sizes are presented in table 11–8, together with those calculated for Foote's study, which did report significant mismatch effects.

Table 11–8 shows that, in comparison to Foote (2011), the differences in variance in the present study were larger, suggesting a difference in participant's variability in reading patterns and/or differences in materials across studies. Additionally, whereas effect sizes were stronger in the spillover region in Foote's study, this study yielded larger effect sizes in the verb region than in Foote's, suggesting that these learners might also be sensitive to agreement violations. In a supplementary power analysis, we obtained that in order to have enough power to find the same effect size
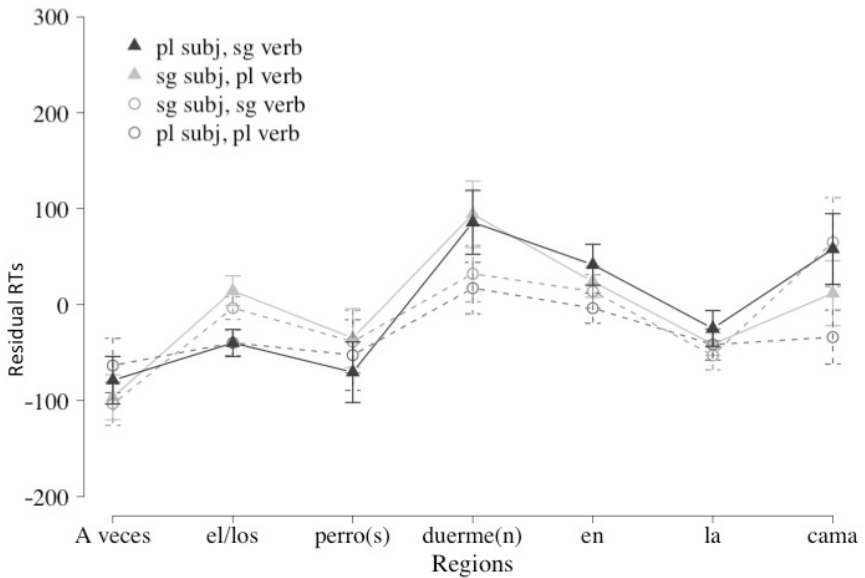
◆ Figure 11–4. Mean residual reaction times (ms) for SV sentences. Sample sentence: "Sometimes the dog(s) sleep(s) in the bed."

◆ Table 11–8. Effect sizes for ungrammatical sentences in Foote (2011) and the present study

Study	Region	Differences in means	SD	Cohen's *d*
Foote (2011) (Bilinguals)	Verb	3	88	0.04
	Spillover 1	79	137	0.81
This study	Verb (singular)	62	523	0.12
	Spillover 1	10	246	0.04
	Verb (plural)	68	502	0.15
	Spillover 1	45	322	0.16

observed in the spillover region of Foote's experiment, our study would need to have between 614 and 2454 observations per cell (between 2.7–10.7 times as much data).

Discussion

The goal of the study was to provide both an online and offline account of how English-speaking advanced learners of Spanish process $O_{cl}VS$ sentences conveying

different agreement manipulations according to the presence or absence of number agreement between the clitic and the verb.

In relation to learners' accuracy in the interpretation of O_{cl}VS structures (RQI), overall scores showed that reliance on word order when interpreting O_{cl}VS sentences is still prevalent among learners in their third year of Spanish coursework at the college level. This means that after years of exposure to the Spanish language, learners still exhibit difficulties interpreting O_{cl}VS sentences and that these difficulties can affect the correct interpretation of sentences containing object clitic (i.e., the patient is interpreted as the agent of the action denoted by the verb). These results extend Lee and Malovrh's (2009, 2010) findings in the aural modality. Yet, the tendency for learners to rely on word order does not seem to be entirely fixed: learners performed significantly better in the mismatching plural verb condition across the course of the experiment (i.e., Cl sg., V pl.), suggesting that the contrastive agreement cues between the clitic and the verb helped learners arrive at the correct interpretation of O_{cl}VS sentences.

This finding, that the improvement in accuracy was stronger only in the mismatching condition with a singular clitic and a plural verb, supports the idea that not all number contrasts are the same. Specifically, only plural number markers attached to the verb (rather than the clitic) proved helpful or qualitatively more beneficial in L2 cue hierarchy activation. One explanation for this may be related to the fact that clitics are functional morphemes, whereas verbs are lexical morphemes. As a result, detectability of agreement cues may be enhanced since they are attached to content words. Likewise, the nature of the verb itself (in this case the auxiliary *estar*, "be") may also have played a role. As mentioned earlier, auxiliary verbs are a specific type of verb that learners encounter more frequently in the classroom (e.g., Guntermann 1992), and this may have enhanced the saliency of the agreement cue, favoring processability. A final explanation is that, as previous research has found (McCarthy 2008), learners seem to rely on morphological defaults in comprehension; therefore, they will be more predisposed to establish agreement between a plural element in sentence-initial position (in this case, a clitic, *los*, "them") and a singular unmarked verb, which, in turn, would lead to a greater number of interpretation errors. This, however, would not seem to apply to the opposite pattern (e.g., *Lo están buscando las chicas*, "The girls are looking for him"), since plural verbs are marked, and consequently, agreement between a singular clitic and a plural verb appears less likely to the learner (or, from a CM perspective, less "plausible," following Haskell and MacDonald 2003).

The online behavior (RQ3) did not completely support the findings we obtained for accuracy data; that is, we cannot claim that contrastive agreement entails higher processing costs. However, it is worth noting that learners did show a slight slowdown at the verb region in the mismatch plural verb condition (Cl sg.,V pl.); in this condition, the verb region presented higher RTs in comparison with the conditions in which the clitic and verb matched in number.

Lastly, with respect to the experiment with SV sentences that was included as a control, RT data partially support Foote's (2011) findings, since learners showed an overall tendency to spend more time on the verb region in the sentences that

were ungrammatical, suggesting that learners were sensitive to subject-verb agreement violations and, in consequence, they were able to use inflectional morphology online. Even though this tendency in the RT data was not significant, the effect size observed in the post-verbal region in our study, the region where Foote (2011) found a grammaticality effect, is consistent with the effect size found in the post-verbal region in Foote's study. This supports the idea, once again, that learners were able to use number morphology online. Low power, participant characteristics, and the nature of the stimuli, may contribute to explaining why this tendency was not significant. Specifically, regarding the nature of the stimuli, Foote's ungrammatical sentences consisted of embedded sentences (e.g., *Veo que tu padre es/*son the Texas*, "I see that your father is/*are from Texas") and one out of two of the experiments she conducted included the *ser* copula (a highly irregular verb in Spanish). Copulas are highly frequent in the input and even more in the classroom; in addition, the singular plural form (*es/son*) look and sound very different when compared to, for example, *come/comen* (he eats/they eat), the verbs used in the present study, and this salient nature of Foote's verbs may have helped learners detect agreement violations more easily, which facilitated their processing.

Conclusions

The present study adds to previous literature on sentence processing in emergent bilinguals by showing English speaking L2 learners' reliance on the contrastive value of number markers between the clitic and the verb when processing $O_{cl}VS$ sentences in Spanish. Specifically, our results show that contrastive agreement helps learners overcome word order bias, in that the L2 weight settings and the L2 cue validity tend to align more easily when the $O_{cl}VS$ sentences convey contrastive agreement. These results support the findings in Hernandez, Bates, and Avila (1994) for English Spanish bilinguals and extend the findings to classroom learners.

Results also show that integration of inflectional morphology during real-time sentence processing depends on the location of the plural morpheme, whether on the clitic or the verb. The question of whether this is due to a higher detectability of agreement cues in content words (i.e., verbs), to the nature of the verb itself, to markedness, or to plausibility seems to be a fruitful line of investigation for future research. For example, comparisons involving different types of verbs (auxiliary vs. non-auxiliary) would shed light on the issue of salience. Likewise, differences in contextual factors, such as study abroad immersion, and the provision or absence of feedback given to learners would also be informative as to the potential for pedagogical interventions to accelerate $O_{cl}VS$ sentence processing.

In conclusion, the fact that emerging bilinguals are able to use contrastive agreement during $O_{cl}VS$ sentence processing suggests that they do not necessarily behave in the same way that learners in the lower levels would when processing noncanonical sentences. Research with different populations, including emerging bilinguals enrolled in upper level Spanish courses, heritage speakers, and Spanish native speakers could be beneficial to better understanding the potential differential effects of individual differences such as language proficiency and experience on the rate at

which cue realignment takes place when processing transitive sentences that do not follow the SVO canonical word order in Spanish.

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