Processing *ser* and *estar* to locate objects and events

An ERP study with L2 speakers of Spanish

Paola E. Dussias, Carla Contemori and Patricia Román
Penn State University

In Spanish locative constructions, a different form of the copula is selected in relation to the semantic properties of the grammatical subject: sentences that locate objects require *estar* while those that locate events require *ser* (both translated in English as 'to be'). In an ERP study, we examined whether second language (L2) speakers of Spanish are sensitive to the selectional restrictions that the different types of subjects impose on the choice of the two copulas. Twenty-four native speakers of Spanish and two groups of L2 Spanish speakers (24 beginners and 18 advanced speakers) were recruited to investigate the processing of 'object/event + *estar*/*ser*' permutations. Participants provided grammaticality judgments on correct (object + *estar*; event + *ser*) and incorrect (object + *ser*; event + *estar*) sentences while their brain activity was recorded. In line with previous studies (Leone-Fernández, Molinaro, Carreiras, & Barber, 2012; Sera, Gathje, & Pintado, 1999), the results of the grammaticality judgment for the native speakers showed that participants correctly accepted object + *estar* and event + *ser* constructions. In addition, while 'object + *ser*' constructions were considered grossly ungrammatical, 'event + *estar*' combinations were perceived as unacceptable to a lesser degree. For these same participants, ERP recording time-locked to the onset of the critical word '*en*' showed a larger P600 for the *ser* predicates when the subject was an object than when it was an event (*La silla es en la cocina vs. La fiesta es en la cocina). This P600 effect is consistent with syntactic repair of the defining predicate when it does not fit with the adequate semantic properties of the subject. For *estar* predicates (La silla está en la cocina vs. *La fiesta está en la cocina), the findings showed a central-frontal negativity between 500–700 ms. Grammaticality judgment data for the L2 speakers of Spanish showed that beginners were significantly less accurate than native speakers in all conditions, while the advanced speakers only differed from the natives in the event+*ser* and event+*estar* conditions. For the ERPs, the beginning learners did not show any effects in the time-windows under analysis. The advanced speakers showed a pattern similar to that of native speakers: (1) a P600

Revista Española de Lingüística Aplicada 27:1 (2014), **54–86**. DOI 10.1075/resla.27.1.03dus
ISSN 0213–2028 / E-ISSN 2254–6774

response to 'object + *ser*' violation more central and frontally distributed, and (2) a central-frontal negativity between 500–700 ms for 'event + *estar*' violation. Findings for the advanced speakers suggest that behavioral methods commonly used to assess grammatical knowledge in the L2 may be underestimating what L2 speakers have actually learned.

Keywords: ERPs, L2 sentence processing, ser/estar, locative predicates, objects and events

1. Introduction

Language teachers and adult learners of Spanish alike often express frustration when teaching or learning the distinction between the Spanish copulas *ser* and *estar* (English *to be*), and with good reason. *Ser* and *estar* overlap in some contexts and are in complementary distribution in other contexts (Bosque & Demonte, 1999; Bull, 1965; Butt & Benjamin, 2000; Camacho, 2012; King & Suñer, 2004). A precise linguistic analysis of the distribution of the two copulas has been elusive because their use is governed by an intricate set of semantic and pragmatic factors involving large discourse contexts (Brown & Torres-Cortés, 2012; Luján, 1981; Maienborn, 2005; Schmitt, 1996, 2005; Schmitt, Holtheuer, & Miller, 2004). Despite being the focus of much linguistic research across various frameworks and perspectives (e.g., Clements, 1988, 2005; Delbecque, 1997; Gallego & Uriagereka, 2011; Geeslin, 2005; Geeslin & Guijarro-Fuentes, 2008; González-Vilbazo & Remberger, 2005; Luján, 1981; Maienborn, 2005), the lack of a clear consensus on the most appropriate treatment for *ser* and *estar* can be evidenced in the large number of articles published on the subject and by ongoing debates in different scholarly venues that have been dedicated solely to the discussion of the two copulas. It is not surprising, then, that traditional textbook descriptions normally offer 'rule-of-thumb' explanations that do not capture the nuanced distributions of the two copulas.

Across many studies that have examined the acquisition of *ser* and *estar* by second language learners, a consistent observation is that mastery of the Spanish copulas arrives late in the course of becoming a proficient user of Spanish (Geeslin 2000; Geeslin & Guijarro-Fuentes, 2006; Gunterman, 1992; Ryan & Lafford, 1992; VanPatten, 1985, 1987). VanPatten (1987) documents 5 stages for the acquisition of *ser*/*estar*, shown below (examples from VanPatten, 2010):

Stage 1. Lack of copula verbs for any functions

* Juan muy inteligente

'John very intelligent'

Stage 2. Acquisition and overgeneralization of *ser*
Juan es alto
'John is tall'
*Juan no es aquí
'John is (be SER) not here'

Stage 3. Appearance of *estar* with -ndo to express progressive function
Juan está estudiando
'John is (be ESTAR) studying'

Stage 4. Appearance of *estar* with true locatives
Juan no está aquí
'John is (be ESTAR) not here'

Stage 5. Appearance of *estar* with adjectives to express conditions
Juan está muy contento
'John is (be SER) very happy'

Of these, the copula+adjective construction has been the most widely investigated. There are several reasons for this. Correct use of *ser* and *estar* in this context requires knowledge of how syntactic, semantic and discourse factors interact with one another to determine copular selection; therefore, it poses interesting challenges for learners (Holtheuer, 2009; Maienborn, 2005). Also, adjectival predicates allow for the greatest co-occurrence of *ser* and *estar*, making the structure an ideal tool for linguists to test and refine different theoretical approaches to explain the mechanisms underlying copula selection (e.g., Clements, 1988, 2005; Cortés-Torres, 2004; Delbecque, 1997; Fernández Leborans, 1999; Geeslin, 2005; Geeslin & Guijaro-Fuentes, 2008; Leonetti, 1994; Luján, 1981; Salazar, 2007).

Relative to the voluminous research on *ser*/*estar* with predicate adjectives, the alternation between *ser* and *estar* in prepositional phrase predicates has received less attention, likely because the rules that govern the use of *ser* and *estar* in this context are relatively straightforward. When the locative preposition expresses a single location e*star* is used (1), but if the preposition includes path, *ser* is used (2) (Zagona, 2010; examples from Camacho, 2012). With locative predicates (the construction under investigation in the experiment reported here), the choice between *ser* and *estar* depends on the sentential subject being located. Objects are located with *estar* (3) and events are located with *ser* (4) (Zagona, 2010).

(1) Los turistas están/*son en Egipto
'The tourists are (be ESTAR)/*(be SER) in Egypt'

(2) Este regalo es/*está para José
'The present is (be SER)/*(be ESTAR) for José'

(3) La pelota está/*es en la mesa
'The ball is (be ESTAR)/*(be SER) on the table'

(4) La fiesta es/*está en la discoteca
'The party is (be SER)/*(be ESTAR) at the disco'

Although it may seem easy to predict which copula is used in locative phrases, performance by second language learners is not error free (Pérez-Leroux, Álvarez, & Battersby, 2010). We saw earlier that accurate use of *ser* and *estar* in locatives occurs late in the acquisition process. In Van Patten's (1987) five stages of transitional competence presented earlier, this happens in Stage 4. Other studies present evidence suggesting that learners of Spanish master *estar* in conditional contexts before *estar* in locative contexts (Ryan & Lafford, 1992). We should also stress that moving through these stages of acquisition takes time (VanPatten, 2010) and that errors are still present even in the language samples of advanced speakers of Spanish (Gunterman, 1992). What this tells us is that the acquisition of the copula in locative predicates poses difficulties and that adult second language speakers produce erroneous *ser* and *estar* forms in locative contexts.

A recent study by Pérez-Leroux et al. (2010) provides evidence illustrating this point. Using a scale acceptability judgment, intermediate and advanced learners of Spanish (L1 English) judged target sentences contrasting *ser* and *estar* to locate objects and events. Participants first read a supportive discourse context and then selected the most appropriate *ser/estar* continuation. Results showed that for object locations, the intermediate learners correctly accepted *estar* but performed significantly below the native speaker mark in all other contexts. The advanced learners correctly rejected *ser* and correctly accepted *estar* to locate objects. However, they were not able to contrastively use the two copulas when locating events. The authors concluded that although these learners had received explicit instruction on the use of the copula in locative contexts, they continued to have difficulty expressing location for events, even at higher levels of proficiency.

One common methodological thread across the vast majority of studies investigating *ser* and *estar* is the focus on behavior. Because one fundamental concern of second language research is to determine where native and second language learners differ in their endstate competence, the vast majority of tasks have included grammaticality or acceptability judgments — which are taken as indicators of competence — or production tasks that compare native and second language performance to determine how well second language learners produce the target forms. As a result, a variety of behavioral methods have been employed to examine the acquisition of the Spanish copulas; these include spontaneous speech samples (e.g., Sera, 1992; Silva-Corvalán & Montanari, 2008), structured or semi-structured interviews (e.g., Geeslin, 2000, 2006; Gunterman, 1992; Ryan

& Lafford, 1992), sentence completion tasks (e.g., Sera, 1992); picture matching tasks (e.g., Schmitt et al., 2004), grammaticality or acceptability tasks (e.g., Bruhn de Garavito & Valenzuela, 2006; Pérez-Leroux et al., 2010; Schmitt et al., 2004; VanPatten, 1987), picture description tasks (e.g., Geeslin, 2000, 2006; Woolsey, 2008) and corpus-based analyses (e.g., Collentine & Asención-Delaney, 2010). But recent psycholinguistic evidence suggests that other data collection methods, including the recording of brain activity as measured by event-related potentials (ERPs), may reveal aspects of L2 acquisition that are obscured when using behavioral measures (e.g., McLaughlin, Osterhout, & Kim, 2004; Misra, Guo, Bobb, & Kroll, 2012; Osterhout, McLaughlin, Pitkänen, Frenck-Mestre, & Molinaro, 2006; Tokowicz & MacWhinney, 2005). For example, McLaughlin et al. (2004) showed that adult classroom learners who had only received 14 hours of classroom instruction in their L2 French showed an N400 component that discriminated between French words and pseudowords, despite the fact that behaviorally the learners performed at chance in a word-nonword judgment task. Similarly, Tokowicz and MacWhinney (2005) found that adult English learners of Spanish judged sentences containing determiner gender agreement violations in Spanish near chance levels, but their ERP waveforms discriminated between grammatical and ungrammatical sentences. These findings suggest that during second language learning, aspects of a new language may be overlooked if researchers only use behavioral assessments (McLaughlin et al., 2004).

The use of methods for neuroscience research has enabled analyses of language processing at very high temporal and spatial resolutions, reshaping long-standing debates about similarities and differences between native and second language processing. For example, ERP and functional magnetic resonance imaging (fMRI) studies have added new data to the long-standing debate on the role of age of acquisition in attaining native-like competence. These studies now show that past claims that L2 grammatical abilities decline with increase in age are likely to have been confounded with proficiency and dominance (e.g., Steinhauer, White, & Drury, 2009). More generally, the multidimensional nature of ERPs (with components characterized in terms of temporal resolution, amplitude, and scalp distribution) has allowed scholars to examine the timecourse of language processing, challenging the traditional position that there are hard constraints that necessarily distinguish second language from native language processing (Kroll & Dussias, 2013).

It has long been known in ERP research that distinct linguistic processes lead to different neural responses. Lexico-semantic processing has been shown to elicit a negative ongoing wave between 200–600 ms, with a maximum amplitude at around 400 ms over centro-parietal sites, the so-called 'N400' (Kutas & Hillyard, 1980). The N400 can be modulated by factors such as cloze probability, with its

amplitude being affected by expectancy (see Kutas & Federmeier, 2011, for a recent review on the N400). A second component, the P600, is a positive ongoing wave between 400–900 ms with its maximum amplitude at around 600 ms (e.g., Hagoort, Brown, & Groothusen, 1993; Osterhout & Holcomb, 1992). The P600 has been linked to the detection of morpho-syntactic violations, including violations of phrase-structure and subcategorization (e.g., Ainsworth-Darnell, Shulman, & Boland, 1998; Hagoort et al., 1993; Neville, Nicol, Barss, Forster, & Garrett, 1991; Osterhout & Holcomb, 1992) and number, gender, and case violations (Foucart & Frenck-Mestre, 2012; Frenck-Mestre, Osterhout, McLaughlin, & Foucart, 2008; Osterhout & Mobley, 1995). The P600 has generally been interpreted as signaling structural or morpho-syntactic reanalysis and repair, suggesting a later, non-automatic process. Recent evidence shows that a P600 can also be elicited in contexts in which syntax and semantics are in competition (e.g., in sentences which are grammatically correct but which contain semantic anomalies; Kim & Osterhout, 2005).

One recent study by Leone-Fernández et al. (2012) combined grammaticality judgments and ERP methodology to examine responses when native speakers of Spanish read grammatical and ungrammatical combinations of object and event subjects followed by one of the Spanish copulas and a locative predicate. Off-line syntactic acceptability ratings showed that while participants clearly accepted 'object+*estar*' and clearly rejected 'object+ *ser*' in locative constructions, the data for event subjects was not as clear-cut. 'Event+*ser*' was rated as completely grammatical but 'event+*estar*' was considered only marginally ungrammatical. ERP responses to similar stimuli showed a P600 component that was larger for the ungrammatical 'object+*ser*' than for the grammatical 'event+*ser*' sentences, reflecting online repair when the predicate did not fit the semantic properties of the grammatical subject. When the same participants processed grammatical 'object+*estar*' vs. ungrammatical 'event+*estar*' constructions, ERP responses were different. Constructions in which events occupied the subject position showed more positive ongoing amplitudes between 280 and 380 ms, followed by a longer positive wave starting around 400 ms. These findings suggest that the different subject-predicate combinations triggered syntactic reparatory processes at the structural level that were likely caused by the semantic properties of the grammatical subject.

Leone-Fernández et al. (2012) is not the first study to show differences in native speakers of Spanish in the use of *ser* and *estar* with locative predicates. Sera (1992) found that while adults used *estar* to talk about locations of object 100% of the time, they used *ser* to locate events only 81% of the time. Children as old as 11 years of age showed a similar pattern, suggesting that locating events with *ser* is an area where variability is observed.

The findings reviewed here can be summarized as follows. Behavioral data, including off-line judgments and data collected via production tasks (e.g.,

Leone-Fernández et al., 2012; Sera, 1992) show that native speakers of Spanish almost categorically reject *ser* to locate objects and consider *estar* the only grammatical option. Brain responses (e.g., P600 effect) associated with repair processes of ungrammatical constructions support this observation (Leone-Fernández et al., 2012). Also, although Spanish speakers allow a surprisingly high number of *estar*+prepositional phrase predicates to locate events (Sera, 1992), they nevertheless demonstrate high skill in discriminating between the two copulas in this context. Findings coming from the L2 acquisition literature show a somewhat different picture. Advanced learners typically pattern with native speakers in rejecting *ser* to locate objects, although their accuracy is somewhat below that of the native speakers. However, even at advanced levels of proficiency, these same speakers have difficulty discriminating between *ser* and *estar* to locate events.

As noted earlier, recent investigations of the neural basis of grammatical processing (e.g., Steinhauer et al., 2009; Tokowicz & MacWhinney, 2005) reveal implicit processes that reflect L2 knowledge that is otherwise hidden from behavioral records. Whereas behavioral findings may support a set of assumptions about what L2 speakers 'know' about the L2 grammar, brain responses may lead to entirely different conclusions. Hence, in the study reported here we use event-related potentials to ask whether second language speakers of Spanish are sensitive to the selectional restrictions that the different types of subjects impose on the choice of the two Spanish copulas in locative constructions.

2. Method

2.1 Participants

Fifty native English speakers who had acquired Spanish during adulthood and twenty-seven native speakers of Spanish (L2 English), who served as a bilingual control group, participated for payment after giving informed consent. Participants were students at a large university in the U.S. The L2 speakers were recruited from two sources. A group of beginning learners was recruited from a pool of 400 college-age students enrolled in second-semester Spanish classes,[1] and a group of advanced speakers was recruited from a pool of doctoral and post-doctoral students who used Spanish daily for academic and professional purposes. Eight of the L2 speakers of Spanish and three of the native speakers were excluded due to excessive eye movement or other artifacts in the raw EGG data. Hence, forty-two

1. To be placed in second-semester Spanish classes, students must have between 2 and 3 years of high school Spanish.

L2 speakers (18 advanced high; mean age: 27.9, SD: 8.2; 24 beginning learners; mean age: 19.7, SD: 5.9) and 24 native speakers were included in the final ERP analyses. All participants were strongly right-handed as assessed by a version of the Edinburgh Handedness Inventory (Oldfield, 1971), had normal or corrected-to-normal vision and had no history of neurological or language disorders.

To provide a more precise characterization of the linguistic abilities of the L2 speakers, all participants completed a language background questionnaire that included self-ratings on reading, listening, reading and writing abilities in the L1 and the L2. Participants were also administered a sub-section of a standardized grammar test in Spanish (Diplomas de Español como Lengua Extranjera/DELE), as well as a verbal fluency task in their L2 to assess spoken fluency. Both proficiency measures are explained in the Materials section below. A summary of the results for each of the measures is provided in Table 1.[2]

A one-way Analysis of Variance (ANOVA) carried out on the language background questionnaire in Spanish showed significant differences among the three groups for total length of residence in a Spanish-speaking environment ($F(2, 53) = 105.18$, $p < 0.01$), overall daily exposure to Spanish ($F(2, 53) = 11.47$, $p < 0.01$), and proficiency self-ratings in speaking ($F(2, 53) = 104.15$, $p < 0.01$), listening ($F(2, 53) = 133.26$, $p < 0.01$) and reading ($F(2, 53) = 105.17$, $p < 0.01$). Planned comparisons confirmed that the advanced speakers had overall significantly more exposure to Spanish than the beginners (for total length of residence in a Spanish-speaking environment, $t(33) = 4.95$, $p < 0.01$ and overall daily exposure to Spanish $t(33) = 3.87$, $p < 0.01$). Significant differences also emerged in the self-rating measures (speaking $t(33) = 8.70$, $p < 0.01$; listening $t(33) = 9.94$, $p < 0.01$; and reading $t(33) = 9.24$, $p < 0.01$). The Spanish native group self-rated significantly higher than each of the L2 groups in all the measures (all ps < 0.01). The analysis also revealed significant differences among the three groups in the DELE ($F(2, 53) = 25.40$, $p < 0.01$) and the verbal fluency task ($F(2, 53) = 109, 55$, $p < 0.01$). Planned comparisons reflected higher scores for the advanced speakers compared to the beginning learners in the DELE ($t(33) = 9.05$, $p < 0.01$) and the verbal fluency task ($t(33) = 11.89$, $p < 0.01$). The Spanish native group outperformed the advanced group and the beginners in both tasks ($p < 0.01$ in all planned comparisons).

2. Data collection for the entire experiment was done over a two-day period. Due to attrition, the data reported in Table 1 come from 21 of the 24 native Spanish speakers, 19 of the 24 beginning learners and 16 of the 18 advanced speakers.

Table 1. Participant information: Mean (SD)

	Spanish Native		Advanced		Beginners	
	Spanish – L1	English – L2	Spanish – L2	English – L1	Spanish – L2	English – L1
Self-reported measures						
Age of exposure	0 (0)	9.1 (6.1)	16.1 (4.4)	0 (0)	13.7 (4.7)	0 (0)
Age of arrival in a country where the language is spoken	0 (0)	19.9 (10)	21.3 (3.7)	0 (0)	–	0 (0)
Length of residence in a country where the language is spoken	21.2 (8.3)	7.2 (6.7)	1.4 (1.3)	27.1 (7.7)	0 (0)	19.8 (6.2)
Speaking (1–10)	9.3 (0.9)	7.7 (1.1)	8.0 (0.9)	9.7 (0.5)	4.1 (1.6)	9.6 (0.6)
Listening (1–10)	9.6 (0.5)	8.1 (1)	8.7 (0.6)	9.8 (0.3)	4.1 (1.7)	9.6 (0.6)
Reading (1–10)	9.2 (8.3)	8.3 (0.7)	8.3 (0.9)	9.8 (0.3)	4.2 (1.6)	9.5 (0.6)
Average daily exposure (%)	34.2 (23.7)	64.9 (24.4)	23.0 (12.6)	74.9 (14.3)	8.5 (9.6)	91.6 (9.5)
Language proficiency DELE-MELICET	41.7 (5.5)	37 (8.5)	32 (6.3)	47 (2.5)	17.8 (2.7)	45 (2.9)
Words Produced in Verbal fluency task	48.5 (9.1)	N/A	38.1 (6.5)	N/A	15.9 (4.4)	N/A

2.2 Materials and procedure

The experiment was administered over a two-day period. On the first day, participants took part in the ERP experiment. On the second day, they were administered the Language History Questionnaire, the DELE, the verbal fluency task, as well as two pencil-and-paper task: a sentence completion task to assess participants' knowledge of the *ser/estar* copulas and a translation production task to assess knowledge of the object and event nouns used in the experimental stimuli in the ERP experiment.

2.2.1 *Proficiency measures*

Spanish proficiency test (DELE). As we mentioned above, the Spanish proficiency test was based on the Diplomas de Español como Lengua Extranjera (Diplomas of Spanish as a Foreign Language, DELE) and contained 50 items distributed across a cloze test and two multiple-choice tasks. In the cloze test participants selected one of the several options to complete sentences from a newspaper article, as illustrated in (5). In the multiple-choice tasks, participants were presented with single

sentences and chose from one of four options to complete either a missing word (6) or to select a synonym for a word in italics (7):

(5) Ni tónicos, ni vitaminas, ni cursos de lectura veloz pueden conseguir tantos resultados en los niños [(a) que; (b) como; (c) cuales] la práctica constante de hábitos saludables.
'No natural tonics, vitamins or classes for speed reading can produce so many results in children [(a) that; (b) as; (c) which] the constant practice of healthy habits'

(6) Nadie conseguirá aprobar ese examen _____ se prepare a conciencia. Es muy duro. [(a) menos si; (b) a menos que; (c) solo si; (d) como si]
'No one will manage to pass that exam, _____ they prepare for it. It is very hard. [(a) even less; (b) unless; (c) lest (d) as if]'

(7) Llegamos al aeropuerto a las tres y a *duras penas* cogimos el avión, no sin antes hablar por teléfono con una de nuestras familias. [(a) con dificultad; (b) con mucho retraso; (c) sin prisa]
'We arrived at the airport at three and *barely* managed to catch our flight, but not before talking to our families. [(a) with difficulty; (b) with much delay; (c) without rushing]'

Verbal Fluency Task. In this task, participants were given 30 seconds to verbally generate as many members of a specified semantic category as possible. Each participant was presented with four categories from a group of eight (i.e., instruments, colors, furniture, body parts, vegetable, animals, fruit, clothing). Only words produced in Spanish that belonged to the target category were counted as correct, as shown in example (8). For the learners, words that had one incorrect phoneme were counted as target responses, as shown in example (9). When participants produced a word that contained two or more incorrect phonemes, the answer was counted as incorrect, as shown in (10). In addition, words that did not belong to the target category, and words that did not match the target language were also coded as incorrect.

Category: Colors

(8) Naranja [for Spanish *anaranjado* or *naranja* (*orange*)]

(9) Naranjo

(10) Anaranjo

2.2.2 *Translation task*

Participants completed a translation task that included the 280 lexical items in Spanish that functioned as the grammatical subject for the locative constructions

in the ERP experiment. The aim of the task was to ensure that participants knew the meaning of the words presented during the ERP session. One hundred forty items were object nouns (e.g., house, statue) and 140 were event nouns (e.g., party, wedding). All objects and events used were matched for lexical frequency by using the LEXESP database (Sebastián-Gallés, Martí, Carreiras, & Cuetos, 2000).

Participants were tested individually. They sat in front of a computer screen and translated the Spanish words into English by typing their responses using a keyboard. Responses with spelling mistakes were considered correct if the English word was the correct translation for the Spanish word (e.g., for *aspiradora*: 'vaccum' [sic]; 'vacum cleaner' [sic]; 'vaccuum cleaner' [sic]).

For the beginning learners, the translation task was simplified to a translation recognition task (e.g., Kroll & Stewart, 1994; Linck, Kroll, & Sunderman, 2009). Translation recognition has been regularly used in psycholinguistic research with beginning L2 learners. Because the task does not require overt production, it is better suited for the linguistic abilities of less proficient L2 speakers. At the same time, the task allows participants to process words in a natural and meaningful way, providing researchers with a useful tool to measure lexical competence during early stages of L2 development (Sunderman, 2014). The beginners in this study were given the same 280 words and were asked to select the correct translation among three choices, two of which were semantically related (e.g., for the Spanish word *aspiradora* — (a) vacuum, (b) duster, (c) mop).

2.2.3 *Sentence completion task*

All participants completed a 24-item sentence completion task to assess knowledge of the distribution of *ser*/*estar* in locative constructions. The task included 12 sentences with locative predicates and 24 filler sentences that required choice of the copula with adjectival and DP predicates. For six of the locative constructions, the grammatical subject was referential (i.e., an object) and required *estar*, exemplified in (11). For the remaining six sentences, the subject was an event and required *ser*, illustrated in (12). The 12 target sentences also had continuations that acted as distractors (underlined in the examples):

(11) Mi amigo _*está*_ en Chile ahora. Es estudiante y no es muy rico.
'My friend is (be ESTAR) in Chile now. He is (be SER) a student and is (be SER) not very rich'

(12) El concierto va a _*ser*_ en la escuela. Los músicos son peruanos.
'The concert will be (be SER) at the school. The musicians are (be SER) Peruvians'

Participants were tested individually. They sat in front of a computer and were instructed to complete the sentences with either *ser* or *estar*, and to use the verb tense that was most appropriate. Sentences were considered correct when the response was a correct form of the copula with approximated inflection for tense and person. Completions with minor spelling mistakes were considered correct, so long as the copula was correctly used.

2.2.4 *ERP experiment*

Two hundred-eighty nouns were selected, 140 were events (e.g., fiesta/'party') and 140 were objects (e.g., estatua/'statue'). All event and object nouns were matched for lexical frequency using the LEXESP database (Sebastián-Gallés et al., 2000). For each of the 140 event and object nouns, two versions of a sentence were created. One version included the noun, followed by the copula *ser* and a prepositional phrase introduced by the locative preposition *en*; the other version included the same noun and prepositional phrase, this time separated by the copula *estar*. The resulting 560 sentences were counterbalanced across four experimental lists in a Latin square design. Each list contained 140 experimental sentences that resulted from crossing the two experimental factors: noun type (object vs. event) and copula type (*estar* vs. *ser*). Participants saw 35 sentences in each of the four conditions (half grammatical and half ungrammatical), as exemplified below:

Condition 1 (object+estar+locative):	La estatua está en el parque. (Correct) 'The statue is (be ESTAR) in the park'
Condition 2 (object+ser+locative):	*La estatua es en el parque. (Incorrect) 'The statue is (be SER) in the park'
Condition 3 (event+ser+locative):	La fiesta es en el parque. (Correct) 'The party is (be SER) in the park'
Condition 4 (event+estar+locative):	*La fiesta está en el parque. (Incorrect) 'The party is (be ESTAR) in the park'

One hundred-forty distractor sentences were also included in which the two Spanish copulas were used in other constructions; this was done to divert the participants' attention from the locative constructions. Half were correct and half were incorrect. Finally, 30 filler sentences, 15 with incongruent verb tense (e.g., **Ayer, la niña le enviará una carta a su novio*/Yesterday, the girl will send a letter to her boyfriend) were also presented. In all, each list contained 310 sentences, half of which were syntactically anomalous. The experimental sentences, the distractors and the fillers were pseudo-randomly interleaved; this resulted in the items being presented in a different order to each participant, yet the items in each stimulus type were evenly distributed throughout the duration of the experiment.

During ERP recording participants were seated in a comfortable chair in front of a computer monitor. They were instructed to read each sentence as naturally as possible and to minimize movements and eye blinks while reading. Each trial consisted of a blank screen displayed for 1000 ms, followed by a fixation cross and by the stimulus sentence, which was presented one word at time in a Rapid Serial Visual Presentation (RSVP) fashion. Each word appeared on the screen for 400 ms followed by a 200 ms ISI. Sentence-ending words were presented with a period to signal to participants the end of the sentence. After each sentence, a 'good/bad' prompt appeared, asking for a grammaticality judgment. Participants were instructed to respond 'good' to sentences that were well formed according to Spanish grammar rules and 'bad' to sentences that were ungrammatical.

ERP data acquisition and analysis

Grammaticality judgments were recorded using a button box. The assignment of *correct* and *incorrect* buttons on the button box was counterbalanced across participants. Accuracy data for the three groups of participants was compared by using a repeated measure ANOVA with verb (*ser* vs. *estar*) and grammaticality (correct vs. incorrect) as within-subjects factors, and group (natives, advanced, beginners) as a between-subjects factor. Interactions were followed by pairwise comparisons with Bonferroni correction.

Continuous EEG was recorded from 19 tin electrodes attached to an elastic cap (Electrocap International) in accordance with the 10–20 system. Eye movements and blinks were monitored by four electrodes, two placed above and below the left eye and two placed at the outer canthus of each eye. Electrodes were referenced online to an electrode placed over the left mastoid. EEG signals were amplified with a bandpass of 0.01–100 Hz (3db cutoff). ERP waveforms were filtered off-line below 30 Hz. Impedances were held below 5 kW and below 15 kW at eye electrodes. Continuous analog-to-digital conversion of the EEG and stimulus trigger codes was performed at a sampling frequency of 250 Hz. The ERPs were time-locked to the target preposition *'en'* and then selected based on marker positions from 200 ms before to 2000 ms after the target event. Eye blink artifacts were mathematically corrected based on a model artifact computed from a minimum of 50 individual artifacts in each participant using a spatial filter transform based on Berg and Scherg (1991) and implemented in Scan 4.3 (Neuro Scan Labs, Sterling, USA). Remaining artifacts were manually removed. This resulted in a rejection of 13% of epochs on average across conditions. Baseline correction was performed using the average EEG activity in the 200 ms preceding the onset of the target word (the preposition *en*). Separate ERPs were obtained averaging the single epochs of interest for each of the experimental conditions, each of the subjects and each of the electrode sites.

The statistical analyses were conducted on the mean amplitudes within a specific window of interest (500–700 ms) selected from the visual inspection of the grand-averaged waveforms and previous research (e.g., Leone-Fernández et al., 2012). Separate analyses of variance were conducted on the midline electrodes (Fz, Cz, Pz), frontal (right hemisphere: Fp2, F4, F8, FC6, FC2; left hemisphere: Fp1, F3, F7, FC5, FC1), central (right hemisphere: C4, T8, CP6; CP2; left hemisphere: C3, T7, CP5, CP1), and posterior (right hemisphere: P4, P8, O2; left hemisphere: P3, P7, O1). Electrode sites were treated separately in order to identify topographic and hemispheric differences. ANOVAs on midline electrodes included electrode as an additional within-subjects factor (3 levels), ANOVAs on central electrodes included hemisphere (2 levels) and electrode pair (5 levels) as additional within-subjects factors, and ANOVAs over posterior electrodes included hemisphere (2 levels) and electrode pair (3 levels) as additional within-subjects factors. The Greenhouse-Geisser correction for inhomogeneity of variance was applied to all repeated measures on ERP data with greater than one degree of freedom in the numerator. In such cases, the corrected *p*-value is reported. ERP data for each group of participants were analyzed separately.[3] We performed two comparisons between the experimental conditions. First, we compared the object+*ser* condition with the event+*ser* condition for each group of participants. Secondly, we compared the object+*estar* with the event+*estar* condition.[4] For both comparisons, the ERP data were time locked to the presentation of the preposition *en* (in), and the analyzed segment (1000 ms) overlapped with the presentation of the determiner *el*/*la* (the).

Effects for the topographical factors will only be reported when they interact with the experimental manipulations. Post-hoc comparisons were carried out through paired sample t-tests run in a pairwise manner for each region between the two critical conditions.

3. Although ERP studies on second language sentence processing usually report analyses that compare two or more groups, we decided to keep our groups separate for two main reasons. First, the native speakers of Spanish were proficient in English and lived in a context of English immersion. Also, the three groups differed significantly in age ($F(2, 62) = 9.100$; $p < 0.01$). Therefore, analyses that included all three groups could be confounded by these factors.

4. We could not compare the conditions with *ser* and *estar* due to length and frequency differences between the verbs.

3. Results

3.1 Translation task

Results from the translation task, which assessed knowledge of the event and object nouns used in the ERP experiment, are provided in Table 2.

Table 2. Mean score (SD) per group on the translation task.

Group	Object	Event
Spanish Native	83 (9.3)	76 (10.57)
Advanced	80 (12.1)	76 (14.1)
Beginners	75 (11)	70 (10.2)

We compared the responses of the three groups by conducting an ANOVA with noun type (object vs. event) as a within-subjects factor and group (Spanish natives, advanced speakers and beginning learners) as a between-subjects factor. The total number of target responses for the two types of nouns was transformed into proportions and then converted with angular transformation. Interactions were followed using pairwise comparisons with Bonferroni correction. The ANOVA showed a main effect of noun type ($F(1, 53) = 80.64$; $p < 0.01$), a main effect of group ($F(1, 53) = 3.92$; $p = 0.026$) and an interaction between noun type and group ($F(2, 53) = 4.65$; $p < 0.01$). Pairwise comparisons indicated that all groups were significantly more accurate translating object nouns than event nouns (native speakers: $t(20) = 12.25$, $p < 0.01$; advanced speakers: $t(15) = 3.479$, $p < 0.01$; beginning learners: $t(18) = 3.26$, $p < 0.01$). Native speakers were more accurate than beginning learners with object nouns ($t(38) = 3.56$, $p < 0.01$) and the event nouns ($t(38) = 2.07$, $p < 0.05$). A marginal difference was found between advanced speakers and the beginners for object nouns ($t(33) = 2.018$, $p < 0.052$), with the advanced speaker being more accurate than the beginning learners.

To summarize, the results of the translation task showed two main findings. First, all three groups were significantly more accurate in translating object nouns than event nouns. Second, no difference emerged between the natives and advanced L2 group. One question that arises from these results is why the native speakers did not perform at ceiling on the translation task. As shown in Table 2, accuracy was 83% for object nouns and 76% for event nouns. It seems unlikely that the native speakers were not familiar with the list of object and event nouns used in the experiment, as these are frequent Spanish words (e.g., fiesta/'party', conferencia/ 'conference', mochila/'backpack'). The beginning learners' 75% accuracy for object nouns and 70% accuracy for event nouns confirms that these were very familiar words. In addition, the native speakers' high scores on the DELE and the

verbal fluency task indicate that they are highly proficient speakers of Spanish. A more likely explanation for the performance by the natives on the translation task is that they had difficulty searching for English words that were suitable translations for the Spanish nouns, resulting in lower than expected accuracy scores. In sum, we can safely assume that the objects and events employed in our materials were familiar to the three groups of speakers.

3.2 Sentence completion task

The result of the sentence completion task, which was designed to assess knowledge of the distribution of *ser*/*estar* with locative predicates, is given in Table 3.

Table 3. Percentage (SD) of correct responses per group on the sentence completion task.

Group	Object + Estar	Event + Ser
Spanish Native	97 (0.5)	94 (0.8)
Advanced	97 (0.3)	60 (1.9)
Beginners	72 (2)	60 (1.8)

We compared the responses of the three groups by conducting an ANOVA with construction ('object+*estar*' and 'event+*ser*') as a within-subjects factor, and group (Spanish natives, advanced speakers and beginning learners) as a between-subjects factor. The total number of target responses for the two constructions were transformed into proportions and then converted with the angular transformation. Interactions were followed using pairwise comparisons with Bonferroni correction. The ANOVA revealed a main effect of construction ($F(1, 53) = 15.29$; $p < 0.01$), a main effect of group ($F(2, 53) = 26.34$; $p < 0.01$) and an interaction between construction and group ($F(2, 53) = 3.48$; $p = 0.038$). Pairwise comparisons revealed that the advanced learners were significantly more accurate on the 'object+*estar*' than the 'event+*ser*' condition ($t(15) = 5.22$, $p < 0.01$), while no such difference between the two conditions emerged in the Spanish native speakers. A significant difference emerged between the Spanish natives and the advanced speakers on the 'event+*ser*' condition ($t(35) = 4.28$, $p < 0.01$), with the Spanish native speakers being more accurate than the advanced group. A significant difference also emerged between the advanced speakers and the beginning learners on the object+*estar* condition ($t(33) = 3.20$, $p < 0.05$), with the advanced speakers being more accurate than the beginning learners. Finally, comparisons between the native speakers and the beginning learners revealed that Spanish natives were significantly more accurate on both the event+*ser* ($t(38) = 4.986$, $p < 0.01$) and the object+*estar* condition ($t(38) = 3.413$, $p < 0.01$).

To summarize, the findings for the sentence completion task showed that the Spanish natives were equally accurate using the *ser* predicate with event nouns and the *estar* predicate with object nouns. The results for the advanced L2 speakers revealed that although they were significantly less accurate on the event+*ser* construction, they were as accurate as the native speakers on the object+*estar* condition. The beginning learners showed an above-chance performance on both object+*estar* and event+*ser* conditions, but were less accurate than the natives in both, suggesting that the acquisition of the *ser*/*estar* distinction with object and events is still not clear-cut.

3.3 ERP experiment

Grammaticality judgment. Responses to the grammaticality judgment task were analyzed by calculating the mean percentages of the correct answers for the four conditions. In Table 4, we present the results split by group and condition. The total number of sentences correctly judged by the participants was transformed into proportions and then converted with angular transformation.

Table 4. Percent accuracy (SD) in the grammaticality judgment task.

	Event+Ser+PP	*Event+Estar+PP	Object+Estar+PP	*Object+Ser+PP
Spanish Native	81 (6.8)	59 (8.4)	90 (5.1)	84 (5.1)
Advanced	46 (9.9)	39 (10.9)	85 (4.4)	78 (7)
Beginners	53 (8)	29 (6)	70 (5)	46 (9.4)

We carried out an ANOVA with verb (*ser* vs. *estar*) and grammaticality (correct vs. incorrect) as within-subjects variables and group (Spanish natives, advanced speakers and beginning learners) as a between-subjects variable. The ANOVA showed a main effect of verb ($F(2,63) = 5.23$; $p < 0.05$), a main effect of group ($F(2,63) = 40.55$; $p < 0.01$), and a main effect of grammaticality ($F(2,63) = 23.73$; $p < 0.01$). There was also an interaction between verb and group ($F(2,63) = 6.66$; $p < 0.01$), between verb and grammaticality ($F(2,63) = 63.59$; $p < 0.01$), and a second order interaction among verb, grammaticality and group ($F(2,63) = 5.26$; $p < 0.01$). The pairwise comparisons indicated that all participants were significantly more accurate on 'object+*estar*' constructions than on 'event+*ser*' constructions (natives: $t(23) = 2.44$, $p < 0.05$; advanced: $t(17) = 5.55$, $p < 0.01$; beginners: $t(23) = 3.07$, $p < 0.01$). The three groups of speakers were also significantly more accurate rejecting 'object+*ser*' than rejecting 'event+*estar*' constructions (natives: $t(23) = 6.42$, $p < 0.01$; advanced: $t(17) = 5.19$, $p < 0.01$; beginners: $t(23) = 2.65$, $p < 0.01$). In addition, the native speakers were significantly more accurate than the advanced

speakers accepting 'event+*ser*' constructions ($t(40) = 4.85$, $p < 0.01$) and rejecting 'event+*estar*' constructions ($t(40) = 2.36$, $p < 0.05$). The advanced speakers were significantly more accurate than the beginners accepting 'object+*estar*' sentences ($t(40) = 3.602$, $p < 0.01$) and rejecting 'object+*ser*' sentences ($t(40) = 4.09$, $p < 0.01$). Finally, the native speakers were significantly more accurate than the beginners on all conditions ['event+*ser*': $t(46) = 4.89$, $p < 0.01$; 'event+*estar*': $t(46) = 4.75$, $p < 0.01$; 'object+*estar*': $t(46) = 5.23$, $p < 0.01$; 'object+*ser*': $t(46) = 5.92$, $p < 0.01$].

Electrophysiological measures. The results of the ERPs measurements will be presented separately for each of the three groups of participants (Spanish native speakers, L2 advanced speakers, L2 beginners).

Native Speakers

In Figure 1, we present the plot grand average waveform for the 'event+*ser*' condition vs. the 'object+*ser*' condition in Spanish native speakers, and in Figure 4 we present the plot grand average waveform for the 'object+*estar*' vs. the 'event+*estar*' condition in the same group of participants.

Visual inspection of Figure 1 reveals differences between the grammatical 'event+*ser*' condition and the ungrammatical 'object+*ser*' condition, starting at around 500 ms after the presentation of the preposition, and lasting until

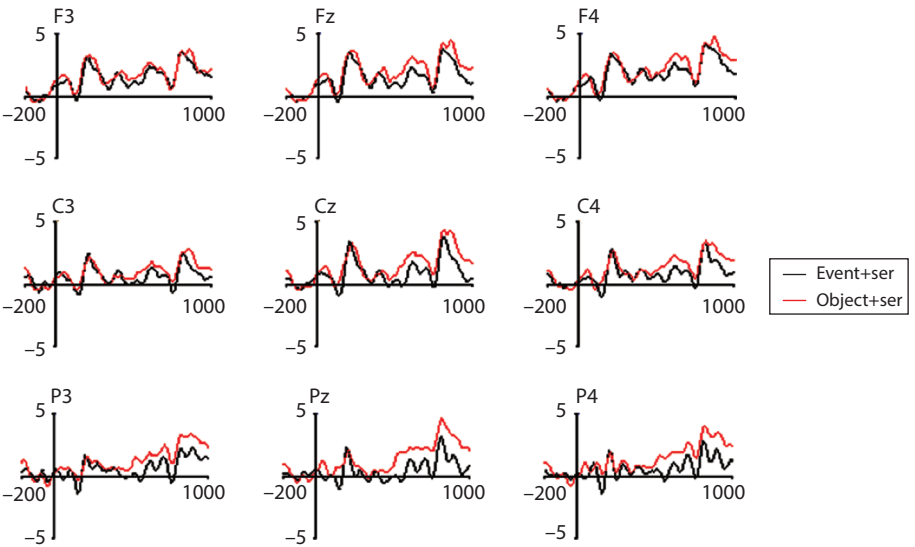

Figure 1. Grand-averaged ERPs for the '*ser*+predicate' condition in the Spanish native speaker group time-locked to the preposition *en*. Positive values are plotted up. The black line corresponds to the syntactically acceptable condition ('*ser*' headed by an event noun); the red line corresponds to the syntactically unacceptable combination ('*ser*' headed by an object noun).

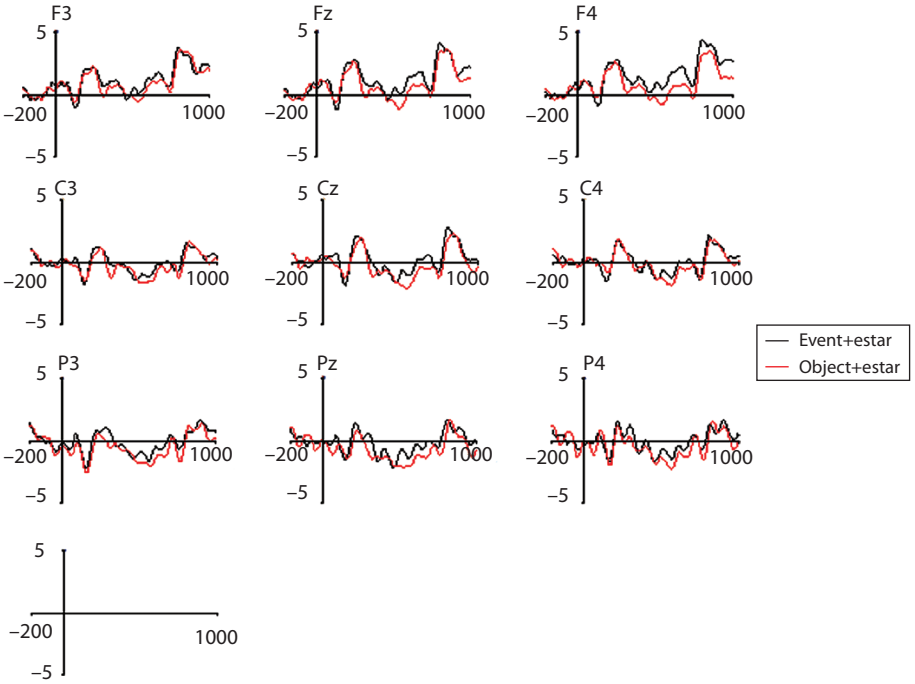

Figure 4. Grand-averaged ERPs for the '*estar*+predicate' condition in the Spanish native group time-locked to the preposition *en*. Positive values are plotted up. The black line corresponds to the syntactically acceptable condition ('*estar*' headed by an object noun); the red line corresponds to the syntactically unacceptable combination ('*estar*' headed by an event noun).

approximately until 700 ms. The 'object+*ser*' condition was more positive than the 'event+*ser*' condition, with the largest amplitude differences at 600 ms. Figure 4 also reveals differences between the grammatical object+*estar* and the ungrammatical event+*estar* conditions in the 500–700 ms time-window relative to the presentation of the preposition onset. The 'event+*estar*' condition showed more negative amplitudes than the 'object+*estar*' condition.

The topographical maps in Figure 7 and 8, resulting from the subtraction of the two conditions show that while the differences between the *ser* predicates emerging as a positivity show a posterior scalp distribution, the negativity emerging for the *estar* predicates show a more anterior distribution. In order to confirm these observations, separate ANOVAs were performed for the *ser* and the *estar* sentences, in the same time window, between 500–700 ms after the presentation of the preposition.

Event +ser (grammatical) vs. Object +ser (ungrammatical)

The ANOVA of the mean amplitude values corresponding to the 500–700 ms time window showed a main effect of grammaticality in the midline, $F(1, 23) = 8.07$, $p < 0.01$. No effects emerged in the frontal region, while in the central and posterior region a main effect of grammaticality was found (central region: $F(1, 23) = 5.43$, $p < 0.05$; posterior region: $F(1, 23) = 12.95$, $p < 0.05$). In the posterior region, an interaction between grammaticality and electrode emerged ($F(2, 46) = 4.61$, $p < 0.05$). The post-hoc analysis on the single electrodes showed that the effect in the posterior region was statistically significant at O1, O2, P3, P4 and P8 (O1: $t(23) = 3.42$, $p < 0.01$; O2: $t(23) = 4.54$, $p < 0.01$; P3: $t(23) = 2.70$, $p < 0.01$; P4: $t(23) = 3.58$, $p < 0.01$; and P8: $t(23) = 2.50$, $p < 0.05$).

Object +estar (grammatical) vs. Event +estar (ungrammatical)

There were no effects in the midline and in the frontal region. A marginal significant interaction between electrode and grammaticality was found in the central

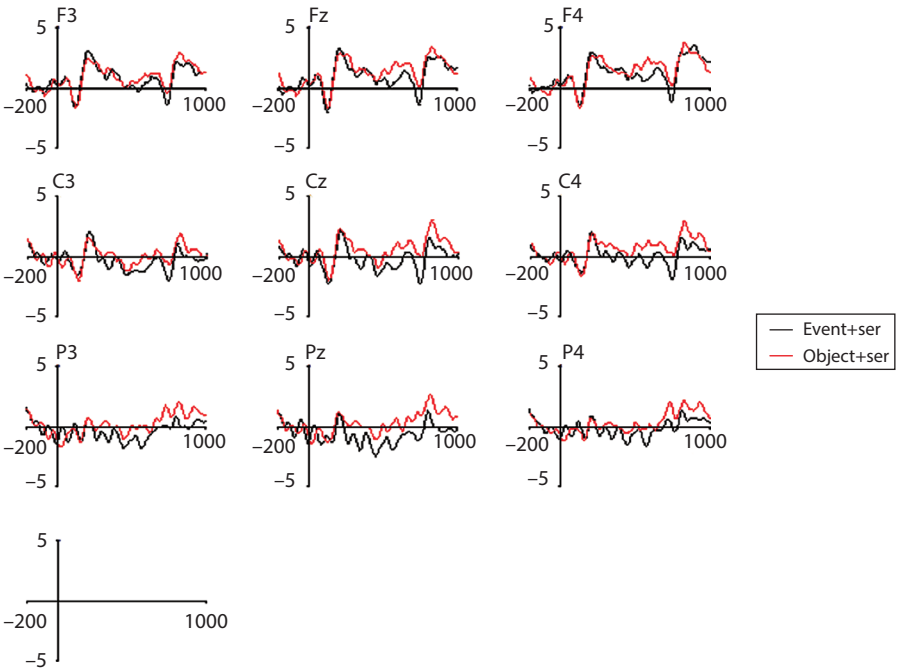

Figure 2. Grand-averaged ERPs for the '*ser*+predicate' condition in the L2 Spanish advanced group time-locked to the preposition *en*. Positive values are plotted up. The black line corresponds to the syntactically acceptable condition ('*ser*' headed by an event noun); the red line corresponds to the syntactically unacceptable combination ('*ser*' headed by an object noun).

region, $F(3, 69) = 2.60$, $p < 0.05$. The post-hoc analysis however, did not show any significant difference at any electrode site for the central region.

Advanced Speakers

In Figure 2, we present the plot grand average waveform for the 'event+*ser*' condition versus the 'object+*ser*' condition in Spanish L2 advanced learners, and in Figure 5 we present the plot grand average waveform for the 'object+*estar*' versus the 'event+*estar*' condition for the same group of participants.

Visual inspection of Figure 2 reveals differences between the grammatical 'event+*ser*' condition and the ungrammatical 'object+*ser*' condition, starting at around 500 ms after the presentation of the preposition, and lasting until approximately until 700 ms. The 'object+*ser*' condition was more positive than the 'event+*ser*' condition, similarly to what we observed for the native speakers. Figure 5 also revealed a more negative going pattern for the ungrammatical event+*estar* condition compared to the grammatical object+*estar* in the 500–700 ms time-window relative to the presentation of the preposition onset.

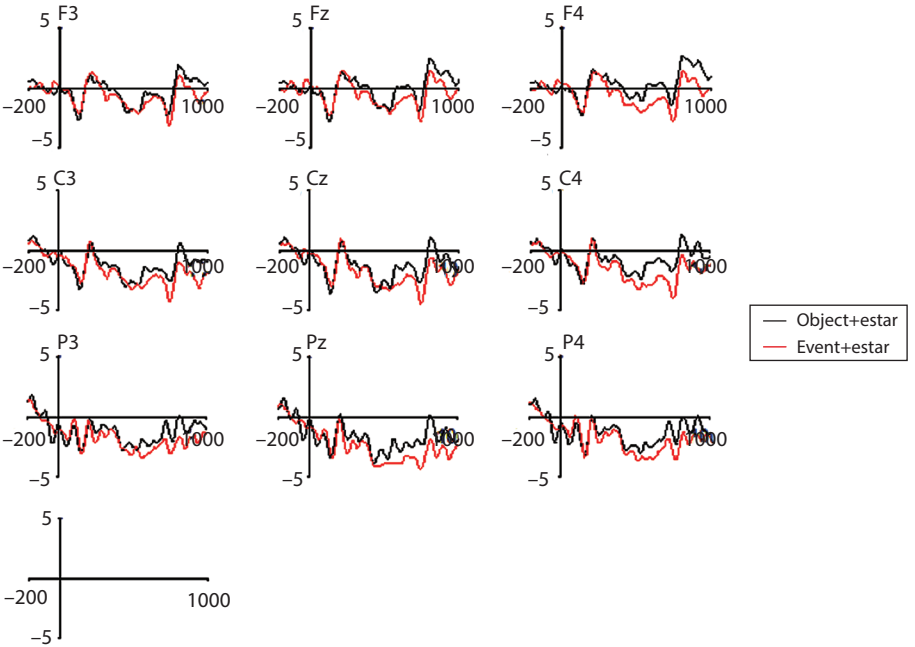

Figure 5. Grand-averaged ERPs for the '*estar*+predicate' condition in the L2 advanced group time-locked to the preposition *en*. Positive values are plotted up. The black line corresponds to the syntactically acceptable condition ('*estar*' headed by an object noun); the red line corresponds to the syntactically unacceptable combination ('*estar*' headed by an event noun).

The topographical maps in Figure 7 and 8, resulting from the subtraction of the two conditions show that while the differences between the *ser* predicates show a more anterior scalp distribution compared to the native speakers, the differences between the *estar* predicates show a similar frontal distribution as in the native speakers. In order to confirm these observations, separate ANOVAs were performed for the *ser* and the *estar* sentences, in the same time window, between 500–700 ms after the presentation of the preposition.

Event +ser (grammatical) vs. Object +ser (ungrammatical)

The ANOVA of the mean amplitude values corresponding to the 500–700 ms time window indicated a main effect of grammaticality in the midline, $F(1, 17) = 5.01$, $p < 0.05$, and in the frontal region, $F(1, 17) = 5.09$, $p < 0.04$. In the central region, an interaction between hemisphere and grammaticality interaction was found, $F(1, 17) = 7.14$, $p < 0.01$. The post-hoc analysis showed that the effect in the central region between the two experimental conditions was statistically significant at C4 ($t(17) = 2.34$, $p < 0.03$).

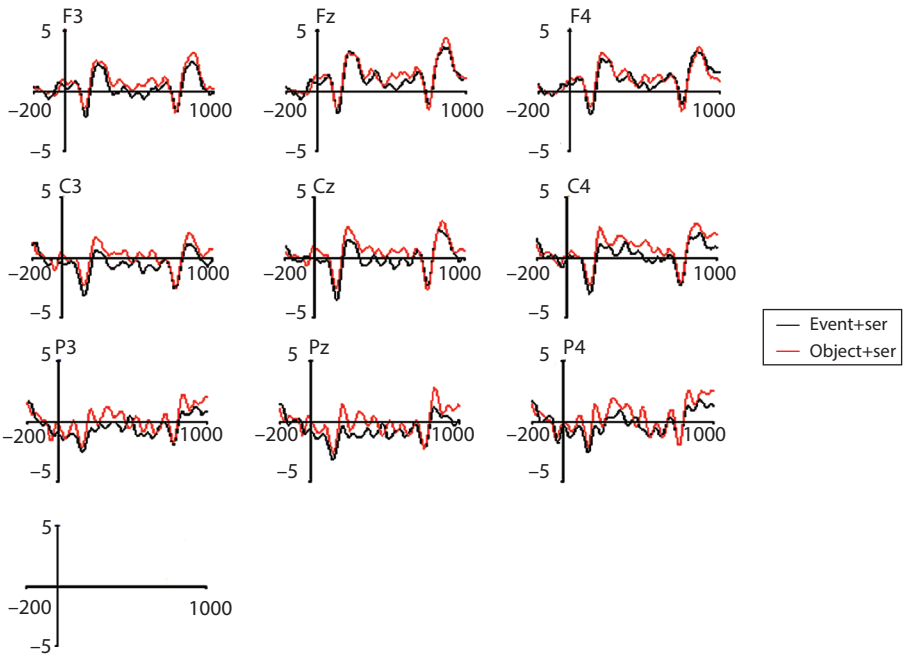

Figure 3. Grand-averaged ERPs for the '*ser*+predicate' condition in the Spanish beginner group time-locked to the preposition *en*. Positive values are plotted up. The black line corresponds to the syntactically acceptable condition ('*ser*' headed by an event noun); the red line corresponds to the syntactically unacceptable combination ('*ser*' headed by an object noun).

Object +estar (grammatical) vs. Event +estar (ungrammatical)
No effects emerged in the midline or in the frontal region. In the central region, the main effect of grammaticality was significant, $F(1, 17) = 4.45$, $p < 0.05$.

Beginning learners
In Figure 3, we present the plot of the grand average waveform for the 'event+*ser*' condition versus the 'object+*ser*' condition in the beginning learners, and in Figure 6 we present the plot of the grand average waveform for the 'object+*estar*' versus the 'event+*estar*' condition in the same group of participants.

Visual inspection of Figure 3 reveals a more positive going fluctuation for the 'object+*ser*' condition relative to the 'event+*ser*' condition, starting at around 500 ms after the presentation of the preposition. Figure 6 does not reveal any difference between the 'object+*estar*' and the 'event+*estar*' conditions in the 500–700 ms time-window.

The topographical maps in Figure 7 and 8, resulting from the subtraction of the two conditions show that while the differences between the *ser* predicates show a posterior scalp distribution in the native speakers, in the beginners the

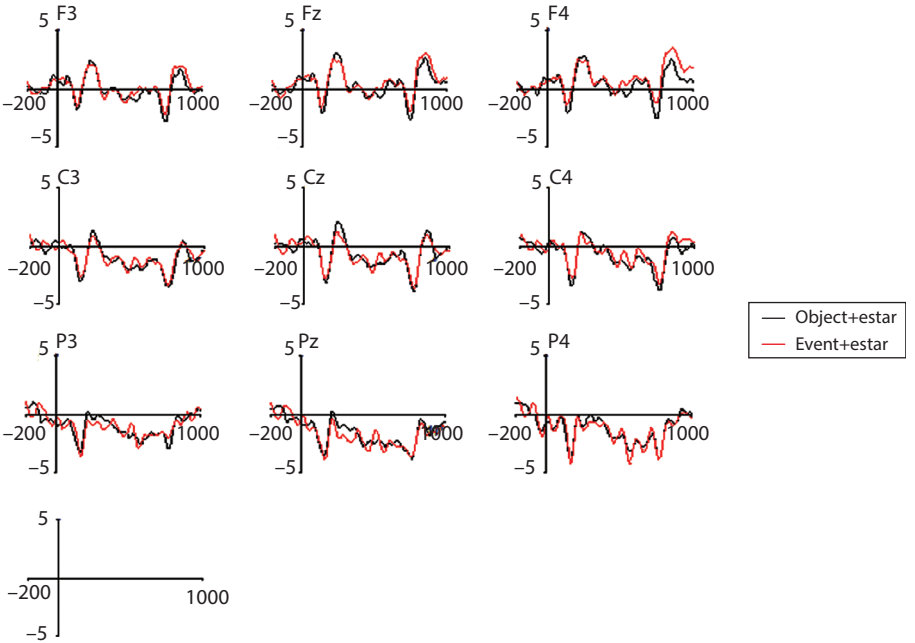

Figure 6. Grand-averaged ERPs for the '*estar*+predicate' condition in the L2 beginner group time-locked to the preposition *en*. Positive values are plotted up. The black line corresponds to the syntactically acceptable condition ('*estar*' headed by an object noun); the red line corresponds to the syntactically unacceptable combination ('*estar*' headed by an event noun).

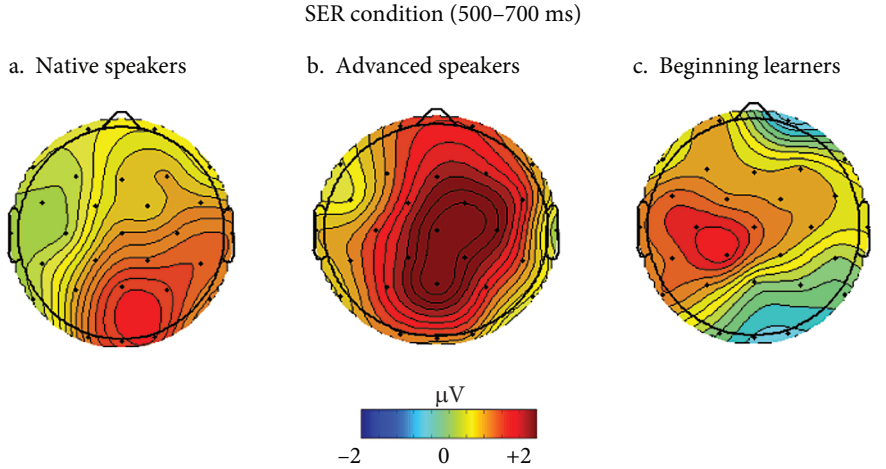

Figure 7. Topographical distribution of the ERP effects for the '*ser*' condition for the three groups of participants. Maps are calculated from the difference amplitude value (syntactically unacceptable minus syntactically acceptable).

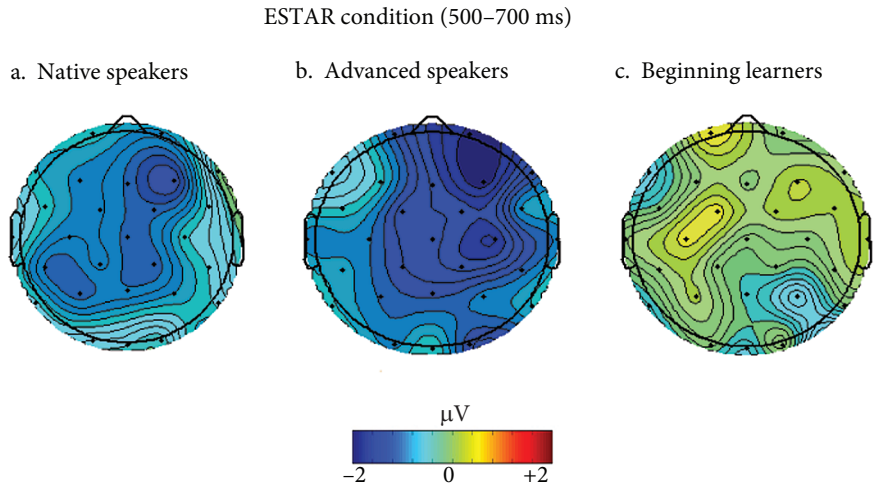

Figure 8. Topographical distribution of the ERP effects for the '*estar*' condition for the three groups of participants. Maps are calculated from the difference amplitude values (syntactically acceptable minus syntactically unacceptable).

distribution is more left-central. For the *estar* conditions, we do not see any effect in the beginners compared to the native speakers.

In order to confirm these observations separate ANOVAs were performed for the *ser* and the *estar* sentences, in the same time window, between 500–700 ms after the presentation of the preposition.

Event +ser (grammatical) vs. Object +ser (ungrammatical)
The ANOVA of the mean amplitude values corresponding to the 500–700 ms time did not reveal significant differences for any of the regions analyzed.

Object +estar (grammatical) vs. Event +estar (ungrammatical)
The ANOVA of the mean amplitude values corresponding to the 500–700 ms time did not reveal significant differences for any of the regions analyzed.

4. General discussion

In the work reported here, we used two off-line measures (a sentence completion task and a grammaticality judgment task) and a measure of linguistic processing with high temporal resolution (event-related potentials) to investigate whether beginning learners and advanced speakers of Spanish are sensitive to violations in the use of the Spanish copulas *ser* and *estar* when locating object and event nouns.

The results from the sentence completion task showed that native speakers of Spanish only provided forms of *estar* when the grammatical subject was referential (i.e., an object) and forms of *ser* when it was an event, showing that they discriminate between the two contexts. The advanced learners of Spanish patterned with the native speakers in that they produced forms of *estar* to locate objects. Unlike the Spanish natives, however, the advanced speakers used forms of *ser* and *estar* if the sentential subject referred to an event, suggesting that they have not yet mastered the copula contrast with event subjects. The beginning learners showed an above-chance performance on both 'object+*estar*' and 'event+*ser*' conditions, indicating that they are not aware of the difference between the two Spanish copulas when locating objects and events.

Two main analyses were conducted for the ERP task. First, we recorded participants' grammaticality judgments and compared the results across the three groups of speakers. Second, we analyzed the ERP measurements for each group separately, focusing on two main comparisons across conditions: 'object+*ser*' vs. 'event+*ser*' and 'object+*estar*' vs. 'event+*estar*'. The results of the two analyses will be discussed separately.

The results of the grammaticality judgment task for the native speakers showed that mention of 'object+*estar*' elicited more correct responses than 'event+*ser*', even though both constructions are grammatically correct in Spanish. They also were significantly more accurate rejecting the ungrammatical 'object+*ser*' than the ungrammatical 'event+*estar*' constructions, confirming the strong ungrammaticality of the 'object+*ser*' condition compared to the less strong violation in the 'event+*estar*' condition (Sera et al., 1999). The result is also in line with previous experimental

findings testing locative constructions in monolingual Spanish speakers (Sera et al., 1999; Leone-Fernández et al., 2012), and suggests that native Spanish speakers are more likely to accept an event noun followed by the copula *estar* in locative constructions than an object noun followed by *ser*. In contrast to the native speakers, the behavioral results of the advanced and beginning learners seem to suggest that they have not acquired the use of the copula *ser* with event subjects; they accepted the correct locative constructions ('event+*ser*') at chance level and also accepted the incorrect 'event+*estar*' construction more than the native speakers. The finding that the advanced speakers and the beginning learners are significantly less accurate than the natives in the conditions that include an event noun are congenial with the results reported in Pérez-Leroux et al. (2010), who demonstrated that even at high levels of proficiency, L2 speakers of Spanish have difficulty expressing location for events. In line with Pérez-Leroux et al., our results also show that the advanced group has acquired the correct locative construction 'object+*estar*' and is accurate in both correctly identifying the 'object+*estar*' constructions and correctly rejecting 'object+*ser*' ones. The beginners seem to be relatively accurate in accepting the correct 'object+*estar*' constructions, while performing at chance in rejecting the grossly ungrammatical 'object+*ser*' sentences. However, their performance is less accurate on both conditions than the natives and the advanced L2 speakers.

In the results of the ERP measurements for native speakers of Spanish, we partially replicated the findings reported in Leone-Fernández et al. (2012). Similarly to Leone-Fernández et al., comparisons between the 'event+*ser*' and the 'object+*ser*' conditions revealed a positivity for the ungrammatical 'object+*ser*' condition relative to the grammatical 'event+*ser*' condition between 500 and 700 ms after the preposition *en*. The effect emerged mainly in the central and posterior regions, indicating a P600-like effect. Interestingly, in our study the advanced speakers — but not the beginners- showed a similar P600 effect as the native speakers in the 500 and 700 ms window. The effect was more centrally and frontally distributed in the advanced speakers compared to the natives. These results show that while the P600 effect was comparable in terms of timing in the native and advanced group, the scalp distribution of the P600 was quite different in the two groups. These distributional differences lead to ask whether distinct syntactic processes in non-native language comprehension elicit ERP components that tap into different neural sources, relative to the components elicited during native language processing. However, it is important to note that our participants did not have near-native proficiency in their L2. Several imaging studies that have examined the neural indices of second language processing have proposed that the syntactic subsystem can be vulnerable to differences in language experience and also show that differences in neural organization for second language processing can be affected by effects of proficiency in the L2 (for reviews see Abutalebi, 2008; Indefrey, 2006; Kotz,

2009). Additionally, some ERP studies have also shown differences in distributions of components during syntactic processing depending on the proficiency of the L2 speakers (e.g., Díaz, 2009; Kotz, Holcomb, & Osterhout, 2008; Pakulak & Neville, 2011). For instance, in a study investigating the effects of proficiency and age of acquisition in learners of English, Pakulak and Neville (2011) found that, compared with lower proficiency participants, higher proficiency participants showed a larger and more widely distributed positivity (P600) to phrase structure violations. Thus, based on previous evidence indicating the importance of proficiency in the distributional properties of the ERP components in L2, we can hypothesize that the difference in the scalp distribution of the P600 that we found between native and advanced speakers of Spanish might be due to the level of proficiency of our group of learners.

For the comparison involving 'object+*estar*' vs. 'event+*estar*', our results for the native speakers were different from those reported by Leone-Fernández et al. (2012). These authors found a centrally distributed positivity, from 280–380 ms after the presentation of the preposition *en*, and a more positive amplitude between 400 and 700 ms at frontal sites, which they interpreted as (a) a P3-related component linked to the detection of an unexpected structure or a potential anomaly, and (b) a longer positivity related to the confirmation of the anomaly and the consequent repair/reanalysis operations. Contrary to what Leone-Fernández et al. (2012) found, in our results the incorrect 'event+*estar*' condition elicited a more negative effect between 500 and 700 ms after the preposition *en* relative to the correct condition 'object+*estar*'. The effect was marginal in both the native and the advanced groups and absent in the beginners. From the topographic plots, we can observe that the negativity is more centrally distributed. The interesting aspect of our result is that both native and advanced speakers showed the same effect, suggesting that both groups detected the anomaly in a very similar way. This result contrasts with the two behavioral measures we collected — the sentence completion and grammaticality judgment task — both of which indicated that the advanced speakers were behaviorally less accurate than the native speaker judging 'event+*estar*' sentences. The discrepancy in the results between the behavioral measures — which suggest that L2 learners were not responsive to certain grammatical violations — and the electrophysiological measures — which indicate that they were — highlights the importance of using implicit measures of processing to accurately characterize learners' knowledge of the second language grammar (McLaughlin et al., 2004; Tokowicz & MacWhinney, 2005).

In concluding, one finding that is seldom discussed in the experimental literature on the copula selection with locative constructions is the disposition of native speakers to accept the copula *estar* when locating events. The findings discussed here as well as those presented elsewhere indicate that native Spanish speakers

appear to 'overuse' *estar* with events in some contexts, as shown in the example below, taken from an cursory search on the Internet (relevant portion in bold):

> "…pero las ofertas q hemos encontrao son en hoteles que están en el arenal. Qué es el arenal? Hay en el arenal buena fiesta? **Dónde está la fiesta en Mallorca**??? Qué zona recomendais para ir si lo q buscamos es buena fiesta donde haya bastante ambiente etc…"
> […but the sales that we have found are in hotels that are in the arenal. What is the arenal? Are there good parties in the arenal? **Where is (be SER) the party in Mallorca???** What area do you recommend if what we are looking for is a good party with a fun atmosphere, etc.]

It may very well be that the rules governing the distribution of 'event+*ser*' in Spanish locative constructions are not categorical, as the various syntactic treatments suggest, and that the difficulty L2 learners experience acquiring the rules governing 'event+*ser*' indicates that variable input affects acquisition, as recent proposals put forth in the child acquisition literature suggest (e.g., Miller & Schmitt, 2012).

Author Note

The writing of this article was supported in part by NSF Grant BCS-0821924, NSF Grant BCS-0955090, NSF Grant OISE-0968369, and NIH Grant 1R21HD071758-01A1 to P. E. Dussias. We thank Eleonora Rossi, Janet van Hell and Megan Zirnstein for helpful comments. All errors are our own.

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Authors' address

Paola E. Dussias
Department of Spanish, Italian and Portuguese
The Pennsylvania State University
231 Burrowes Building
University Park, PA 16802

pdussias@psu.edu

About the authors

Paola E. Dussias is Professor of Spanish, Linguistics and Psychology and Associate Director of the Center for Language Science at the Pennsylvania State University. Her research takes a cross-disciplinary approach to bilingual sentence processing. Using a variety of methods, ranging from off-line questionnaires to eye-tracking and ERP methods during reading and spoken language comprehension, she examines the way in which second language readers and listeners

negotiate the presence of two languages in a single mind. Her work, which has been supported by grants from the National Science Foundation and the National Institutes of Health, has appeared in journals such as *Bilingualism, Language and Cognition*, *The International Journal of Bilingualism*, *Studies in Second Language Acquisition*, *Second Language Research*, as well as in a number of edited volumes.

Carla Contemori is a postdoctoral research associate at the Center for Language Science at the Pennsylvania State University. She received her Ph.D. in Cognitive Science at the University of Siena (Italy) in 2011. In 2011 she was granted a Marica De Vincenzi fellowship for post-doctoral research at the University of Reading (UK). Her research interests include first language acquisition in typically developing and language impaired children, and second language acquisition in children and adults. She is additionally interested in theoretical linguistics, and in particular in syntax.

Patricia Román is currently a post-doctoral research associate at the Center for Language Sciences at the Pennsylvania State University. She received her Ph.D. in Experimental Psychology and Behavioral Neuroscience at the University of Granada (Spain) where she focused on studying inhibitory control in memory and language selection. After that, she was awarded with a postdoctoral fellowship from the Spanish Government to work at the Max Planck Institute for Human Cognitive and Brain Sciences (Leipzig). Her research is centered on the behavioral and neural correlates of sentence processing in bilinguals and the mechanisms that deal with the specificities of bilingualism in language processing compared to monolinguals.