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Neural correlates of intra-sentential code-switching in the auditory modality

Carla B. Fernandez[a,*], Kaitlyn A. Litcofsky[b], Janet G. van Hell[a]

[a] Department of Psychology and Center for Language Science, Pennsylvania State University, USA
[b] Department of Communication Sciences and Disorders, Northwestern University, USA

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ABSTRACT

Code-switching, the interchangeable use of two languages, is a hallmark of bilingual language processing. Although code-switching occurs most often in spoken communication, studies examining the neural mechanisms of code-switching typically present code-switched materials visually, using reading paradigms. The present study examined intra-sentential code-switching in the auditory modality in Spanish-English bilinguals, using Event-Related Potential (ERP) and Time Frequency Representation (TFR) analyses. Specifically, this study examined whether listening to code-switched sentences is associated with lexical-semantic integration (indexed by an N400 effect) or sentence-level reanalysis (indexed by an LPC effect), and the extent to which neural patterns associated with listening to code-switched speech are modulated by switching direction (from the dominant language to the weaker language, or vice versa). ERP results showed that listening to a switch from the dominant to the weaker language elicits N400 and LPC effects, while TFR results showed a power decrease in the upper beta frequency band. In contrast, listening to a switch from the weaker to the dominant language elicited only an N400 effect, while TFR results showed a power increase in the alpha frequency band. The findings indicate that cognitive processes involved in listening to intra-sentential code-switches vary by switching direction. More specifically, we propose that listening to dominant-to-weaker language switches engages lexical processes in addition to sentence-level reanalysis to integrate the weaker language into the sentence frame, whereas weaker-to-dominant switches engages lexical-semantic integration accompanied by inhibition processes (i.e., listeners inhibit their dominant language as the sentence unfolds in their weaker language, and this inhibition must be released upon hearing a switch into the dominant language).

1. Introduction

Many bilinguals, such as Spanish-English bilinguals in the Hispanic community living in the US, report using their two languages in a single utterance, and such code-switching has been shown to occur in various natural discourse situations (Grosjean, 2001). Even though bilinguals experience code-switching in natural discourse as an effortless phenomenon, psycholinguistic and neurocognitive research shows that code-switched sentences are harder to process than non-switched sentences (for a review, see Van Hell, Litcofsky, & Ting, 2015). In this paper, we examine the neural signatures associated with listening to code-switched sentences that switch from the dominant to the weaker language and from the weaker to the dominant language.

* Corresponding author.
E-mail address: cbf140@psu.edu (C.B. Fernandez).

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1.1. Experimental studies of intra-sentential code-switching comprehension

Code-switching has been studied extensively by linguists over half a century (for reviews, see Bullock & Toribio, 2009; Isurin, Winford, & De Bot, 2009), but has also garnered increased attention from psycholinguists and neuroscientists. Studies that have used a language switching paradigm, in which bilinguals are presented with a series of single, unrelated pictures, numbers, or words that alternate between languages, have typically found switching costs both in terms of production and comprehension (for reviews, see Bobb & Wodniecka, 2013; Declerck, Koch, & Philipp, 2015). While these studies provide an experimentally-controlled foundation to understand the basic mechanisms associated with switching between isolated items, these tasks are devoid of a richer linguistic context. To study the cognitive and neural correlates of code-switching in natural discourse, an emerging body of research focuses on intra-sentential code-switching (switching that occurs within a sentence), which is a common form of switching in natural discourse (Poplack, 1980).

Several recent psycholinguistic studies on intra-sentential code-switching have used behavioral measures to examine switching costs in the comprehension of sentences (Bultena, Dijkstra, & Van Hell, 2015a, 2015b; Dijkstra, Van Hell, & Brenders, 2015; Kootstra, Van Hell, & Dijkstra, 2012; Litcofsky & Van Hell, 2017, Exp. 1; Tamargo, Valdés Kroff, & Dussias, 2016; Valdés Kroff, Tamargo, & Dussias, 2017; Wang, 2015). For example, Bultena et al. (2015a) conducted a self-paced reading task in which Dutch-English bilinguals read sentences that switched from the first language (L1) Dutch to the second language (L2) English or vice versa, in addition to Dutch or English one-language control sentences. It was found that reading times were slower for sentences that contained a switch. Importantly, this cost was asymmetrical, such that switching from L1 Dutch to L2 English was more effortful than switching from L2 English to L1 Dutch, which parallels the asymmetrical switching cost found in a shadowing task in Dutch-English bilinguals (Bultena, Dijkstra, & Van Hell, 2015b) as well as in self-paced reading in Spanish-English habitual codeswitchers recruited from the Hispanic community in the US (Litcofsky & Van Hell, 2017, Exp. 1).

Overall, behavioral studies have found a cost associated with intra-sentential switching in comprehension. A handful of studies sought to identify the neurocognitive mechanisms underlying intra-sentential switching costs by making use of the Event Related Potential (ERP) technique. ERPs are EEG signals that are time-locked to the processing of a specific cognitive event. Averaged deflections of the waveform provide a direct online measure of neuronal activity related to that particular event of interest. Most studies have focused on two ERP components associated with the comprehension of code-switches: the N400 and the Late Positive Complex (LPC) (Van Hell, Fernandez, Kootstra, Litcofsky, & Ting, 2018). The N400 is a negative-going component that peaks between 300 and 500 ms post-stimulus onset. It is thought to indicate the ease of semantic integration of a word into its preceding context (Kutas & Hillyard, 1984), as well as sentence specific constraints and world knowledge (Federmeier & Kutas, 1999). The LPC is a positive-going component that begins at around 500 ms post-stimulus onset, and has been thought to reflect grammatical processing (Hahne & Friederici, 1999) and sentence-level reanalysis (Kaan, Harris, Gibson, & Holcomb, 2000).

The large majority of these neurocognitive code-switching studies used a reading paradigm in which sentences are presented visually (for a review, see Van Hell et al., 2015). In a seminal study, Moreno, Federmeier, and Kutas (2002) examined code-switching in balanced English-Spanish bilinguals reading sentences in L1 English that ended either in an L2 Spanish word (code-switch), a low-probability synonym of the expected English word (lexical switch), or the expected English word. Compared to the expected words, lexical switches resulted in a classical N400 whereas code-switches were associated with negativity with a left, frontally skewed distribution in the 250–450 ms time window. Code-switches also resulted in a significant LPC effect, which Moreno et al. interpreted as a P300 (Donchin, 1981), such that a code-switch represents an unexpected event that requires context updating. In the sentences used by Moreno et al. (2002), the code-switched word was always the sentence-final word. Examining mid-sentence switching, Van Der Meij, Cuetos, Carreiras, and Barber (2011) asked high and low proficiency Spanish-English bilinguals to read sentences in their L2 English that contained a sentence-medial adjective that was either in L1 Spanish or a non-switched adjective in English. Both high and low proficiency bilinguals showed an enhanced N400 and LPC to code-switched adjectives, which were significantly larger in the high proficiency group.

Moreno et al. (2002) and Van Der Meij et al. (2011) studied intra-sentential code-switching in one direction only. Proverbio, Leoni, and Zani (2004) is one of the few studies that examined both switching directions (L1 to L2 and L2 to L1) to examine possible switching direction-related differences in the neural signatures. Testing professional interpreters, Proverbio et al. compared sentences that began in either L1 or L2 and whose sentence-final word was a code-switch, a semantically incongruent word, or a non-switch. Code-switches resulted in an increased N400 that was larger when switching from L1 into L2 than when switching from L2 into L1, but no LPC effect was observed.

The ERP studies reviewed above used sentences that contained a single switched word (insertional switches) that are less common than full alternational switches to the other language as observed in natural discourse, particularly in Spanish-English bilinguals (e.g., Deuchar, Davies, Herring, Parafita Couto, & Carter, 2014; Milroy & Muysken, 1995; Poplack, 1980), and may elicit different ERP signatures. To examine intra-sentential code-switching more naturalistically, Litcofsky and Van Hell (2017; Exp. 2) asked bilinguals to read sentences that contained a sentence-medial, full alternational code-switch into the other language, and compared these with single-language sentences. They studied both switching directions in highly proficient Spanish-English bilinguals. They observed an increased LPC in response to code-switched words only in the dominant-to-weaker switching direction, but no ERP effect in the weaker-to-dominant switching direction. Time frequency analyses revealed a power increase for switches into the dominant language in the theta band (4–7 Hz), and a power decrease for switches into the weaker language in the lower beta band (15–18 Hz). As will be explained in more detail below, theta effects often are associated with lexico-semantic processing (e.g., Bakker, Takashima, Van Hell, Janzen, & McQueen, 2015; Bastiaansen & Hagoort, 2006; 2015) and word-level inhibition in language switching tasks (Liu, Liang, Zhang, Lu, & Chen, 2017), whereas effects in lower beta have been associated with sentence-level binding and unification

(Bastiaansen & Hagoort, 2015; Weiss & Mueller, 2012) or a change to the construction of sentence-level representations (Engel & Fries, 2010; Lewis, Wang, & Bastiaansen, 2015). Based on the combined outcomes of the ERP and time frequency analyses, Litcofsky and Van Hell (2017) propose that reading code-switched sentences that switch from the dominant to the weaker language relates to a change in the construction of sentence-level meaning representations, requiring sentence-level reanalysis mechanisms (as indexed by the LPC and power decrease in lower beta frequency band). In contrast, switching from the weaker to the dominant language relates to word-level inhibitory processes and suppression of the dominant language during weaker language processing that must be released upon encountering a code-switch (as indexed by the power increase in the theta band; for more details, see Litcofsky & Van Hell, 2017).

1.2. Intra-sentential code-switching studies using auditory stimuli

The predominant use of visually-presented materials limits the generalizability of code-switching patterns observed in previous studies given that auditory comprehension is more reflective of code-switching in natural discourse. Although much progress has been made toward understanding the fundamental neurocognitive aspects of code-switching on the basis of reading code-switched sentences, often presented word-by-word in the middle of the computer screen using rapid serial visual presentation (RSVP), there is an important gap in the code-switching literature regarding auditory processing and the neural correlates of listeners' comprehension of code-switched sentences. Comprehending code-switched sentences in the auditory modality may incur greater processing effort since the non-target language must be globally inhibited given that listeners must attend to, and process, larger chunks of words in a sentence, whereas in the visual modality, using RSVP, each word could be processed separately, which potentially requires more local inhibition to suppress the non-target language (particularly when switching from the weaker to the dominant language, see Litcofsky & Van Hell, 2017). Additionally, in the visual paradigm all words are presented for the same duration (e.g., for 300 ms with a 200 ms blank interstimulus interval), whereas words in auditorily presented sentences are typically presented faster, and at variable speed, as reflective of natural speech. This variability in visual versus auditory presentation may induce modality-specific ERP signatures associated with reading versus listening to code-switched sentences.

To our knowledge, only a handful of neurocognitive studies examined the comprehension of code-switched speech, using MEG (Blanco-Elorrieta & Pylkkänen, 2017), fMRI (Abutalebi et al., 2007), or ERP (Liao & Chan, 2016; Ruigendijk, Hentschel, & Zeller, 2015) methodologies. Blanco-Elorrieta and Pylkkänen (2017) examined the comprehension of language switches in two different contexts: a more artificial switching task using isolated words and switches occurring in naturalistic speech. In each trial in the artificial switching task, Arabic-English bilinguals were presented with a cue (a picture of a bilingual who had been introduced as an Arabic-English bilingual interlocutor, a picture of an Arabic-speaking monolingual or an English-speaking monolingual interlocutor, or a color cue indicating a specific language), followed by an auditory stimulus and then a picture, and were asked to judge whether this picture matched the auditory stimulus via button press. The language of the auditory target item differed from that of a preceding trial (switch trial) or was identical (non-switch trial). Mimicing a more naturalistic speech context, bilinguals also listened to clips of real conversations between two Arabic-English bilinguals that included 35 switches from Arabic to English and 35 switches from English to Arabic, as well as 70 single-language control clips. In the artificial switching task, switching effects were observed in the left dorsolateral prefrontal cortex (dlPFC) and the anterior cingulate cortex (ACC), for all three cues. Switch-related activation in these prefrontral executive control areas was also observed by Abutalebi et al. (2007), and are referred to as prefrontal control areas for language switching in Abutalebi and Green's (2008) cortical-subcortical model of bilingual language switching. The natural speech context, in contrast, elicited a switch-related activity increase in the right auditory cortex (which was not sensitive to the direction of the switch), but no switching effects were observed in the dlPFC and the ACC. These findings indicate that the comprehension of natural codeswitches is fundamentally different from processing artificial switches (that do engage prefrontal control areas). Blanco-Elorrieta and Pylkkänen (2017) propose that bilinguals' comprehension of natural switches is governed by language-driven predictability effects, and that the auditory cortex switch effect is caused by a reduced prediction for the language switch ('surprisal') compared with the prediction of continuing in the same language. More generally, the finding that processing more artificial switches recruits executive control areas, but the comprehension of more natural codeswitches does not (and engages the auditory cortex) further validates the notion that listening to natural codeswitched sentences is a more ecologically valid task than processing switches between unrelated items.

Two ERP studies examined code-switching in the auditory modality (Liao & Chan, 2016; Ruigendijk et al., 2015). Ruigendijk, Hentschel, and Zeller (2015) examined Russian learners of L2 German with intermediate or advanced L2 proficiency as well as German native speakers, who listened to sentences in German in which the final word was the semantically expected word in German (non-switch), its translation in Russian (switch), or a semantically incongruent word in German. In the 200–550 ms time window, remarkably, the German native speakers showed an increased negativity (N400) for the switched relative to the non-switched word. No switch-related N400 was observed in the intermediate L2 learners, but the advanced L2 learners showed a small switch-related N400 that was left-lateralized. In the 550–1000 ms window, both the proficient and the intermediate L2 speakers showed an enhanced positivity for code-switched compared to non-switched words (LPC effect); also here, the German monolinguals showed a switched-related posterior positivity. A correlational analysis confirmed that, in the L2 learners, the amplitude of the LPC decreased as L2 proficiency increased.

Ruigendijk et al. (2015) studied switching only in one direction, but Liao and Chan (2016) presented code-switched sentences in both switching directions. Mandarin-Taiwanese bilinguals, whose dominant language was Mandarin, listened to sentences that began in either Mandarin or Taiwanese and contained a sentence-final switch or a non-switch. The sentence recordings contained fixed inter-word pauses of 200 ms. In addition to measuring the typical components associated with the processing of code-switched

sentences (N400, LPC), this study also included a cloze probability manipulation and therefore also measured the Phonological Mismatch Negativity (PMN). Results indicated that the PMN was present in both switching directions, but it was more pronounced for the unexpected low-cloze target words relative to the high-cloze target words in switched words. A PMN was also found in an auditory single-item switching study by Phillips, Klein Mercier, and Boysson (2006), which was interpreted as being representative of violations of expectancy regarding the sound of a particular word. Furthermore, switching from the dominant to the weaker language (i.e., from Mandarin to Taiwanese) yielded an N400 effect and a sustained negativity in the 600–900 ms time window. In contrast, switching from the weaker to the dominant language induced only an LPC effect in the 600–900 ms window.

Taken together, even though the specific pattern of results of Liao and Chan (2016) and Ruigendijk et al. (2015) diverge, the switch-related N400 and LPC components observed in these two auditory code-switching studies are similar to the components observed in ERP studies that presented code-switched sentences visually. The N400 observed by Liao and Chan (2016) had an earlier onset and a later offset compared to the typical N400 in visual code-switching studies (Beatty-Martínez & Dussias, 2017; Litcofsky & Van Hell, 2017; Moreno et al., 2002; Ng, Gonzalez, & Wicha, 2014; Proverbio et al., 2004; Van Der Meij et al., 2011), but this is a common characteristic of auditory ERPs and has been also been observed in other auditory ERP sentence studies (e.g., Grey & Van Hell, 2017; Holcomb & Neville, 1991; Kutas & Federmeier, 2011). An auditory-modality specific ERP component is the PMN that was observed by Liao and Chan (2016), which indexes a violation of expectancy regarding the sound of a particular word. Rather than a switch related effect, the PMN is more likely to have emerged as a consequence of the specific cloze manipulation in their materials (for studies that have found PMN effects, see Connolly, Service, D'Arcy, Kujala, & Alho, 2001; Desroches, Newman, & Joanisse, 2009).

As noted earlier, code-switching occurs more frequently in spoken discourse than in writing, so listening to code-switched sentences is more reflective of naturalistic code-switching discourse than reading code-switched sentences. The two published EEG/ERP studies (Liao & Chan, 2016; Ruigendijk et al., 2015) that examined the auditory comprehension of code-switched sentences both presented sentences that contained a one-word (insertional) switch in the sentence-final position. The exclusive use of this type of switches limits the generalizability of these findings, as such switches are not very common in naturalistic code-switching. Rather, alternational switches, switches that occur mid-sentence and entail multiple-word phrases (e.g., a full noun phrase or a prepositional phrase) or a full switch for the remainder of the sentence, are more common (e.g., Deuchar et al., 2014; Milroy & Muysken, 1995; Poplack, 1980). Moreover, Liao and Chan (2016) and Ruigendijk et al. (2015) both studied bilinguals who are non-habitual code-switchers, and these studies thus remain silent on the cognitive and neural mechanisms associated with code-switching in habitual code-switchers for whom intra-sentential code-switches are a defining feature of natural discourse, such as Spanish-English bilinguals in Hispanic communities in the United States (e.g., Guzzardo, Mazak, & Parafito Couto, 2016; Litcofsky & Van Hell, 2017; Poplack, 1980; Torres Cacoullos & Travis, 2016).

2. The present study

To examine the neurocognitive mechanisms underlying the comprehension of code-switched sentences in the auditory modality, we examined intra-sentential code-switching in Spanish-English bilinguals who were habitual code-switchers using sentence materials that more closely reflect code-switches in natural discourse. We maximized ecological validity by making use of naturally produced sentences. Participants listened to sentences that started in one language and then fully switched to the other language, and both switching directions (from the dominant to the weaker language and vice versa) were examined. If the comprehension of code-switched sentences is similar in the auditory and written modalities, building on Litcofsky and Van Hell (2017) who studied two switching directions in Spanish-English bilinguals who read sentences with a full switch to the other language, we expect to find a switch-related LPC only for sentences that switch from the dominant to the weaker language, but not for sentences that switch from the weaker to the dominant language. In contrast, if listening to code-switched sentences differs from reading code-switched sentences, because listening requires stronger inhibition of the non-target language, as argued above, we expect to find an N400 effect and an LPC effect in the dominant-to-weaker switching direction, and a substantial N400 effect in the weaker-to-dominant switching direction given that in this direction, inhibiting the dominant language may be more challenging and pose additional difficulties in terms of lexical integration when the inhibition must be released upon hearing the switch to the weaker language.

In addition to analyzing the pertinent ERP components associated with the comprehension of code-switched sentences, we also analyzed the EEG data in the time-frequency domain in order to examine the oscillatory dynamics of the signal. We consider analyses of neural oscillations to complement ERP analyses, potentially providing additional insights into the neural underpinnings of the comprehension of code-switched speech. Oscillatory neural dynamics have received increased attention in language research as a temporally precise signature of network activity related to language processing (e.g., Bastiaansen & Hagoort, 2006, 2015; Giraud & Poeppel, 2012; Peña & Melloni, 2012; Weiss & Mueller, 2012). Time frequency representations (TFRs) of these neural oscillations represent the level of synchronized activity of the underlying neuronal network in both frequency and time. There are two distinct manifestations of these representations: power increases, which are thought to reflect increasing synchronization of neuronal firing patterns, and power decreases, which are thought to reflect desynchronization of neural firing patterns in functional neural networks (Bastiaansen & Hagoort, 2006). These oscillations are measured as power modulations in different frequency bands (delta: 0.5–2 Hz; theta: 4–7 Hz; alpha: 8–12 Hz; lower beta: 15–18Hz; upper beta: 20–30 Hz; gamma: 30–50 Hz). The use of TFR, in addition to the ERP methodology, can provide a more in-depth understanding of the event-related changes in neural oscillations related to the auditory processing of code-switched sentences.

Language comprehension entails the construction of a hierarchy of linguistic structures of different sizes (e.g., words, phrases, and sentences), associated with different neural processing timescales (e.g., Ding, Melloni, Zhang, Tian, & Poeppel, 2016; Giraud & Poeppel, 2012). Research on oscillatory neural dynamics associated with sentence comprehension builds on incremental models of

sentence processing, postulating two main operations that continuously interact and overlap in time: 1) accessing and retrieving lexical information, and 2) incrementally integrating this information with the preceding context in order to build up a message level interpretation; the latter process is also referred to as unification (e.g., Bastiaansen & Hagoort, 2015; Peña & Melloni, 2012); for a model on the neuro-anatomical and neurophysiological basis of connected speech, see Ding et al. (2016) and Giraud and Poeppel (2012); cf. Obleser, Herrmann, & Henry (2012). Oscillatory neural activities in the theta frequency band during language comprehension, in particular theta power increase, have been related to the retrieval of lexical semantic information (e.g., Bakker, Takashima, & McQueen, 2015; Bastiaansen & Hagoort, 2015; Bastiaansen, Oostenveld, Jensen, & Hagoort, 2008). Oscillatory neural activities in the beta frequency range during sentence comprehension have been related to the active maintenance or change in the construction of sentence-level representations, requiring sentence-level reanalysis mechanisms. More specifically, a power decrease in the beta frequency band has been associated with how incoming information (e.g., words in a sentence) cues the language system to adapt processing in order to accommodate the new information (e.g., Engel & Fries, 2010; Lewis et al., 2015; Weiss & Mueller, 2012). Other models make a more explicit distinction between the incremental building of a syntactic structure and a semantic structure that represents the incoming sentence, and propose that beta-band neuronal synchronization is related to syntactic unification operations and that gamma-band neuronal synchronization is related to sentence-level semantic unification (e.g., Bastiaansen & Hagoort, 2015).

To our knowledge, Litcofsky and Van Hell (2017) is the first study that applied TFR analyses to the comprehension of code-switched sentences. Studying both code-switching directions (in the visual modality), they found a decrease in power in the lower beta band (in combination with an LPC effect) when sentences switched from the dominant to the weaker language, and a power increase in the theta frequency band when sentences switched from the weaker to the dominant language. Relating these switching asymmetries to differences in the activation of the bilinguals' languages, Litcofsky and Van Hell (2017) propose that the beta power decrease when sentences switch from the dominant to the weaker language signifies that encountering the weaker language at the codeswitch requires sentence-level reanalysis and reconfiguration in order to comprehend the full codeswitched sentence. In the other direction, reading sentences that switch from the weaker to the dominant language, bilinguals need to suppress the stronger language when reading the first part of the sentence in their weaker language. Upon encountering a codeswitch, the switch-related theta power increase (typically related to lexical retrieval) possibly signifies a release of inhibition from the suppression of the dominant language during weaker language processing.

The comprehension of code-switched sentences increases as the sentence unfolds over time, and this will be true for both visually and auditorily presented sentences. However, listening to code-switched sentences potentially engages auditory-modality specific neurocognitive mechanisms (different from reading code-switched sentences), related to the comprehension of speech. Specifically, attentive listening to sentences as they unfold over time has been associated with an increase in oscillatory power in the alpha frequency band (Peña & Melloni, 2012), possibly related to the involvement of attentional resources and working memory during spoken sentence comprehension (Meyer, Obleser, & Friederici, 2013; Vassileiou, Meyer, Beese, & Friederici, 2018). Moreover, an increase in power in the alpha band has been linked to increased listening effort associated with the processing of degraded speech (Obleser & Weisz, 2012) and has also been found to be sensitive to attentional control mechanisms used by listeners to ignore irrelevant speech (Wöstmann, Lim, & Obleser, 2017) or stimuli (for a review, see Jensen & Mazaheri, 2010). Alpha power increase has also been linked to increased cognitive load in response to the processing of reduced word forms (Drijvers, Mulder, & Ernestus, 2016) which suggests that increases in alpha power may be indicative of increased cognitive load in the auditory domain and may reflect difficulties in semantic activation and retrieval. Taken together, the available literature suggests that alpha power increases may be indicative of enhanced cognitive efforts associated with auditory language processing.

The analysis of TFRs is an emerging approach in the study of language processing, and to our knowledge no other study has used this type of analysis to study intra-sentential code-switching in the auditory modality. Based on the emergent literature that employed TFR analyses to study word and sentence processing, and visually-presented intra-sentential code-switching, discussed above we can expect to observe one of the following patterns in listening to code-switched sentences. If there are no differences between modalities (written versus auditory), we expected to see a power decrease in the beta band in the dominant-to-weaker switching direction and a power increase in the theta band in the weaker-to-dominant switching direction, in line with Litcofsky and Van Hell's (2017) findings. However, if listening to code-switched sentences induces higher cognitive demands, we expected to find increased power in the alpha band, in addition to the beta power decrease signaling a disruption in sentence-level reanalysis mechanisms related to the creation of sentence-level meaning representation. Particularly when listening to sentences that switch from the weaker to the dominant language, a strong inhibition of the dominant language must be lifted in order to integrate a switched word into the sentence structure, which would be reflected in power modulations in the alpha frequency band.

3. Methods

3.1. Participants

36 Spanish-English bilinguals were tested for this study. Data from 2 participants were discarded due to insufficient accuracy on the comprehension questions during the code-switching task and data from 3 additional participants were discarded due to excessive blink artifact in the EEG signal. 31 participants (17 females) remained (Age: $M = 21.37$, $SD = 3.08$). All bilinguals were native speakers of Spanish, with the large majority of individuals speaking Central or South American Spanish, and had acquired L2 English at a young age (Age of L2 acquisition (AoA L2): $M = 4.91$, $SD = 2.42$). Participants were recruited from the Penn State community

Table 1
Language proficiency outcomes and cognitive measurements for the bilingual participants.

Language Proficiency Measures	Dominant	Weaker
Self-rated production (out of 10)	9.1(0.9)	8.6(1.1)
Self-rated comprehension (out of 10)	9.5(0.7)	9.1(0.9)
LDT Accuracy (%)	86.3(15.9)	85.6 (14.9)
LDT Overall RT (ms)	794 (213)	965(469)
BNT Accuracy (%)	65.6(14.1)	54.6(21.1)
BNT RT (ms)	1133(200)	1279(309)
Cognitive measurements	Accuracy	
O-span (accuracy percentage)	69.2% (5.6)	
Flanker effect (ms)	83.0 (5.5)	

Note: Means are reported; standard deviations are in parentheses.

Table 2
Example of experimental conditions.

Condition	Language	CS	Example
1	English	No	Greg put some pencils on his desk as soon as he got to class.
2	English	Yes	Greg put some pencils on his *escritorio en cuanto llegó a clase*.
3	Spanish	No	Gabriel puso algunos lápices en su escritorio en cuanto llegó a clase.
4	Spanish	Yes	Gabriel puso algunos lápices en su *desk as soon as he got to class.*

via flyers and word-of-mouth and were paid $10/hour for their participation. All participants provided written informed consent before participating.

All participants reported using English and Spanish on a daily basis, and to code-switch between English and Spanish daily. They were highly proficient in both English and Spanish, as assessed by language proficiency tests and self-rated proficiency in a language history questionnaire (to be described below; See Table 1). In order to analyze the effects of switching in each direction based on relative dominance we determined each participant's relative dominant and weaker language. As in Litcofsky and Van Hell (2017), relative dominance was determined by a composite measure of the language proficiency tasks and self-rated proficiency levels. In this experiment, 16 participants were English dominant and 15 were Spanish dominant, but it should be noted that the bilinguals were highly proficient in both languages.

3.2. Materials

The stimuli consisted of 160 semantically and grammatically correct sentences, which were the same as in Litcofsky and Van Hell (2017; a full listing of the materials is presented in the Appendix to this paper and also to the present paper). Each sentence appeared in four different conditions: all English, English switching into Spanish, all Spanish, and Spanish switching into English. (See Table 2).

The critical sentences varied between 10 and 22 words (M = 14.35, SD = 2.32) and the position of the code-switch within the sentence varied between word 7 and word 16 (M = 9.36, SD = 1.61). All sentences contained a minimum of three words following the code-switched word and they all remain in the switched language (i.e., were alternational switches; Muysken, 2000). All code-switched words were nouns and were not repeated in other sentences. Given that previous studies have shown that when switching from Spanish to English, bilinguals are more likely to use the masculine determiner *'el'* in determiner-noun code-switches, regardless of whether the Spanish noun is feminine (e.g., Pfaff, 1979; Valdés Kroff, Dussias, Gerfen, Perrotti, & Bajo, 2016), masculine Spanish determiners were used before all code-switched English nouns.

A simultaneous and balanced bilingual speaker of English and Spanish recorded the sentences. All sentences were recorded at 44100 Hz and flanked by a 50 ms buffer at the beginning and end. The speaker's accent was rated by a total of 9 proficient Spanish-English bilinguals (5 female) of ages 21–34 (M = 27.6, SD = 3.9), of which 5 were native English speakers (M AoA L2 = 10.8, SD = 4.1) and 4 were native Spanish speakers (M AoA L2 = 4.9, SD = 1.0). They were asked to rate the speaker's English and Spanish on a 7-point scale, with 1 indicating no accent, and 7 indicating very strong accent. Our speaker received an average rating of 2.1 (SD = 0.5) in English and 2.7 (SD = 0.4) in Spanish. This indicates that the speaker had very little accent in either language.

The total duration (in seconds) of sentences followed natural characteristics of these languages. Overall, unilingual Spanish sentences were somewhat longer than unilingual English sentences. This is a consequence of natural speech that is reflective of the fact that Spanish words are usually longer than English words. For more information regarding the stimuli, see Table 3. The difference in total duration was not significantly different between code-switched sentences (English to Spanish and Spanish to English).

However, the different sentence conditions were balanced for critical word duration (see Table 3). Since in the statistical analyses

Table 3
Mean Duration (in seconds) of Sentences and Critical Words.

Type of Sentence	Sentence Duration	Critical Word Duration
English to Spanish	3.99 (0.76)	0.50 (0.12)
All English	3.75 (0.72)	0.39 (0.11)
Spanish to English	4.11 (0.76)	0.40 (0.10)
All Spanish	4.35 (0.86)	0.50 (0.13)

Note: Means are reported; standard deviations are in parentheses.

the language of the target words will be kept constant, the code-switched word in sentences that switch from English to Spanish ($M = 0.50$ s; $SD = 0.12$) will be compared with its non-switched equivalent in all-Spanish sentences ($M = 0.50$ s; $SD = 0.13$), and the code-switched word in sentences that switch from Spanish to English ($M = 0.40$ s; $SD = 0.10$) will be compared with its non-switched equivalent in all-English sentences ($M = 0.39$ s; $SD = 0.11$); see Table 3). Hence, the natural length difference between the Spanish and English portions of the sentences does not bias our analyses.[1]

Twelve additional sentences were used for practice. These practice sentences reflected materials from all four conditions of the study, but did not contain any of the critical words.

Four stimulus lists were created from the 160 sentences, each of which contained 40 sentences per condition. Following the procedures of Litcofsky and Van Hell (2017), items in the lists were pseudo-randomized such that participants listened to no more than three sentences of the same condition consecutively, no more than six sentences in a row beginning in either English or Spanish, and no more than six code-switched or unilingual sentences in a row.

During the EEG recording procedure, participants were asked to answer “yes/no” to a total of 40 comprehension questions that were evenly spread across the four conditions within each list; half of the questions for sentences within a given condition required a “yes” response and half required a “no” response. This ensured that participants were paying close attention to the sentences being played.

Each sentence was presented auditorily in its entirety using ER_S4 headphones. Trials began with a screen displaying the question ‘Ready?’ at the center of the screen in black text (Arial font, size 18) on a white screen. Participants pressed a button when they were ready to listen to the sentence. A fixation cross appeared on the screen for the total duration of the sentence. A blank screen appeared for 200 ms upon completion of the sentence. Participants were instructed to listen to the sentences carefully so that they could successfully answer the comprehension questions. All questions were preceded by a question mark symbol ‘?’ after which participants were required to press the yes or no button on a button box to advance to the next sentence. There was no time limit for providing a response to the comprehension questions.

The task consisted of four blocks, each containing 40 sentences and 10 comprehension questions. Each block lasted about 6 min. After every block, participants took self-paced breaks.

Before the sentence listening task and recording of EEG data, participants completed a Language History Questionnaire. After completion of the main task, participants completed a battery of language proficiency and executive function tasks.

3.3. Language proficiency tasks

To determine the bilinguals' language dominance, all participants completed a language history questionnaire that included self-ratings of language proficiency in production and comprehension, and three language proficiency tasks: a lexical decision task, the Boston naming task (Kaplan, Goodglass, & Weintraub, 1983), and a unilingual self-paced sentence reading task; we used the same tasks and procedure as Litcofsky and Van Hell (2017). The three language proficiency tasks were all completed in both English and Spanish. Relative dominance was determined by a composite score of the following language measurements: self-rated proficiency in production and in comprehension, accuracy and RT to real words in the lexical decision task, accuracy and RT in the Boston picture naming task, and average RT and comprehension question accuracy in the self-paced sentence reading task. Overall language dominance for a participant was determined to be the language that they were dominant in for the majority of these measures.

3.4. Cognitive tasks

Participants completed an Operation Span task (Turner & Engle, 1989) and the Flanker task (Emmorey, Luk, Pyers, & Bialystok, 2008).

[1] The gaps between the word preceding the critical word and the critical word (switched and non-switched) were measured for each condition. A one-way ANOVA revealed no significant difference between the durations of the pauses before the critical target words ($F(3,636) = 1.39$, $p = .24$). Additionally, the gaps between the critical word and the word following the critical word were measured, for each condition. A one-way ANOVA revealed a main effect ($F(3,636) = 8.88$, $p < .001$), but a post-hoc Tukey test revealed no significant differences in the means between the critical conditions in our analyses: code-switched sentences from English to Spanish versus all Spanish sentences ($p = .99$), nor between the means of code-switched sentences from Spanish to English and all English sentences ($p = .450$).

3.5. Procedure and EEG recording

Participants were instructed to listen to all the sentences while EEG was recorded. They were seated 3 feet from the computer in a sound-attenuated chamber. An elastic cap (Brain Products ActiCap, Germany) with 31 active Ag/AgCl electrodes was placed on the participants' head. Electrode locations consisted of five sites along the midline (Fz, FCz, Cz, Pz, Oz), 13 left lateral electrodes (FP1, F7, F3, FC5, FC1, T7, C3, CP5, CP1, P7, P3, O1, PO9), and 13 right lateral electrodes (FP2, F7, F4, FC6, FC2, T8, C4, CP6, CP2, P8, P4, O2, PO10). To monitor for eye vertical movements and blinks, bipolar recordings were made above and below the left eye. Bipolar recordings of the outer canthus of the right and left eyes were made to monitor for horizontal eye movements. Electrodes were referenced to a vertex reference (FCz electrode) and re-referenced offline to the average of the left and right mastoids. The electroencephalogram (EEG) was amplified by a NeuroScan SynampsRT amplifier using a 0.05hz-100hz bandpass filter and continuously sampled at a rate of 500hz. Electrode impedances were kept below 10 kΩ. An off-line 30Hz low-pass filter was applied later. For each participant, separate ERPs were averaged off-line at each electrode site for each experimental condition, relative to a 200 ms pre-stimulus baseline. Trials containing any type of artifact were excluded from all analyses. Percentages of excluded trials for each condition were: 13.2% for non-switched words in the dominant language, 13.7% for words that switched from the dominant-to-weaker language, 13.5% for non-switched words in the weaker language, and 11.9% for words that switched from the weaker-to-dominant language.

3.6. ERP analyses

For ERP analyses, the EEG signal was time-locked to the onset of the critical word (code-switched or non-switched word). Analyses were conducted on mean amplitudes between two latencies with a baseline of 200 ms pre-stimulus activity. In accordance with previous studies and visual inspection of the waveforms, two time windows were analyzed, corresponding to the epochs of the N400: 300–500 ms and LPC: 500–900 ms post word onset. Preprocessing and measurement of the ERP data were done using ERPlab (Lopez-Calderon & Luck, 2014).

For all comparisons of interest, two repeated measures analyses of variance (ANOVA) were performed to examine the scalp distribution of the ERP effects. The first ANOVA focused on midline electrodes based on specific location as a factor (Fz, Cz, Pz). The second ANOVA included factors of anteriority (anterior, posterior) and of laterality (right, left hemisphere). For these factors, following the procedures employed by Litcofsky and Van Hell (2017), electrodes were grouped into four regions of interest: right frontal ("RF": F4, F8, FC2, FC6); left frontal ("LF": F3, F7, FC1, FC5); right posterior ("RP": CP2, CP6, P4, P8), and left posterior ("LP": CP1, CP5, P3, P7). A Greenhouse-Geisser correction was applied to all analyses with more than one degree of freedom in the numerator. Significant interactions were also examined with simple effects tests. All analyses first examined whether there was an overall switch cost, across both directions of language switching. To do this, mean amplitudes were compared between the code-switched words in all switched sentences and the non-switched words in unilingual sentences, for each time window of interest. We then examined switch costs as a function of the direction of the language switch. All analyses were based on participants' relative dominant and weak languages (again, following the procedures of Litcofsky & Van Hell, 2017).

3.7. TFR analyses

For all time frequency analyses, the EEG data was preprocessed and analyzed using the Fieldtrip toolbox (Oostenveld, Maris, Fries, & Schoffelen, 2011). First, the EEG signal was re-referenced offline to the average of the left and right mastoids. A notch filter was then applied at 60, 120, and 180 Hz to remove line noise. Epochs of 400 ms pre-stimulus to 1200 ms post-stimulus were extracted. All trials contaminated by any type of artifact were removed using manual inspection. In total, 12.3% of all critical trials were rejected. Time-frequency representations (TFRs) were then computed for all frequencies between 4 and 50 Hz. This was done by convolving the signal with a 400 ms window Hanning taper that was followed by a discrete fourier transform in steps of 50 ms and 1 Hz. TFRs were first computed for each trial and then averaged across trials for each participant and condition separately. Power changes were quantified as the ratio of increase/decrease of the epoch relative to a 200 ms baseline (again, following Litcofsky & Van Hell, 2017). Finally, we performed cluster-based permutation analyses (for more details, see Maris & Oostenveld, 2007) using the Fieldtrip toolbox. This analysis method can only compare two conditions at a time. Therefore, to examine the interaction between switching direction and language, two difference conditions were created in order to compare all four conditions: dominant-weak code-switch minus weak language non-switch, and weak-dominant code-switch minus dominant language non-switch (see also Litcofsky & Van Hell, 2017), and the difference conditions were compared using cluster-based permutation statistics.

As in Litcofsky and Van Hell (2017), separate analyses were performed for the following frequency bands of interest: Theta 4–7 Hz; Alpha 8–12 Hz; Lower Beta 15–18 Hz; Upper Beta 20–30 Hz; Lower Gamma 30–40 Hz; and Upper Gamma 40–50 Hz. Following our ERP analyses, the language of the target word was kept constant. Language dominance was also handled as in the ERP analyses.

4. Results

Participants had a mean accuracy of 87.3% (SD = 2.3) on comprehension questions during the EEG recording, which indicates that they were engaged in the task at hand.

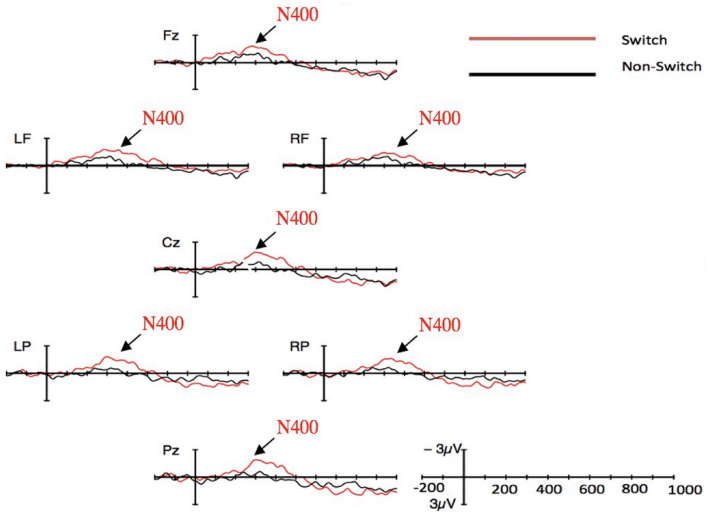

Fig. 1. Grand mean waveforms for code-switched (red) versus non code-switched (black) words. Onset of the code-switched/non-switched word is indicated by the vertical bar (negative is plotted up). Time is plotted on the x-axis; each tick mark indicates 200 ms. LF = left frontal; RF = Right frontal; LP = left posterior; RP = right posterior. (For interpretation of the references to color in this figure legend, the reader is referred to the Web version of this article.)

4.1. ERP results

4.1.1. Analyses on words prior to code-switch

In the first series of analyses, ERP data were analyzed to ensure that sentence comprehension did not differ prior to the code-switched phrase (see also Litcofsky & Van Hell, 2017). To this end, we analyzed the average of the noun and the word following it that occurred prior to the code-switched word and its non-switched control. We did not include analysis of the word directly preceding the code-switch, because in nearly all cases this was an article (e.g., 'el' or 'the') or a pronoun (e.g., 'su' or 'his'), and its very short duration prohibited reliable analysis. The noun analyzed occurred three to six words prior the code-switched or non-switched target words (M = 3.77, SD = 0.92), whereas the word following the noun occurred two to five words (M = 2.77, SD = 0.82) prior to the codes-switched word and its matched non-switched control. To keep the language of these two critical words constant across conditions, we compared sentences that switched from English to Spanish to non-switched all-English sentences, and compared sentences that switched from Spanish to English to non-switched all-Spanish sentences. There were no significant differences in either of the time windows of interests (300–500 and 500–900 ms), for sentences that switched from English to Spanish and their all-English equivalents (all ps > .1) nor for sentences that switched from Spanish to English and their all-Spanish equivalents (all ps > .1).

4.1.2. ERP: overall switched versus non-switched sentences

The subsequent analyses focus on the first switched word in the sentence (and its non-switched control). For the overall analysis, all switches were collapsed and compared to the non-switching condition in the two time windows of interest (300–500 ms and 500–900 ms), irrespective of switching direction. For grand average waveforms, see Fig. 1.

The midline ANOVA in the 300–500 ms time window revealed a significant main effect of switching (F(1,30) = 14.56, p = .001), such that the N400 was more negative-going for switched relative to non-switched words. In the lateral ANOVA there was also a main significant effect of switching (F(1,30) = 18.49, p < .001), confirming that the N400 was more negative-going for switched relative to non-switched words. There were no significant interactions in the midline or lateral ANOVAs in this time window (all ps > .1).

In the 500–900 ms time window, there were no significant main effects or interactions in the midline ANOVA (all ps > .2). In the lateral ANOVA, there was a significant interaction between switching and anteriority (F(1,30) = 5.34 p = .028). Follow-up analyses indicated that there was a simple effect of switching at posterior sites (F(1,30) = 6.29, p = .002), such that there was a larger posterior positivity for switched relative to non-switched words.

4.1.3. ERP: analyses based on switching direction

In order to test hypotheses on processing differences in the two switching directions, ERP data was then analyzed separately for each switching direction. We compared switched sentences from participants' relative dominant-to-weaker language to non-switched sentences in their weaker language, in order to keep the language of the critical target words the same. Likewise, we analyzed switched sentences from participants' weaker-to-dominant language to non-switched sentences in their dominant language.

4.1.3.1. ERP: dominant-to-weaker language switch. For grand-averaged waveforms, see Fig. 2.

In the 300–500 ms time window, there was a significant main effect of switching in the midline ANOVA (F(1,30) = 4.93, p = .034) and also in the lateral ANOVA (F(1,30) = 5.91, p = .021), such that the N400 was more negative ongoing for switched relative to non-switched words. There were no significant interactions found in either ANOVA (all ps > .1).

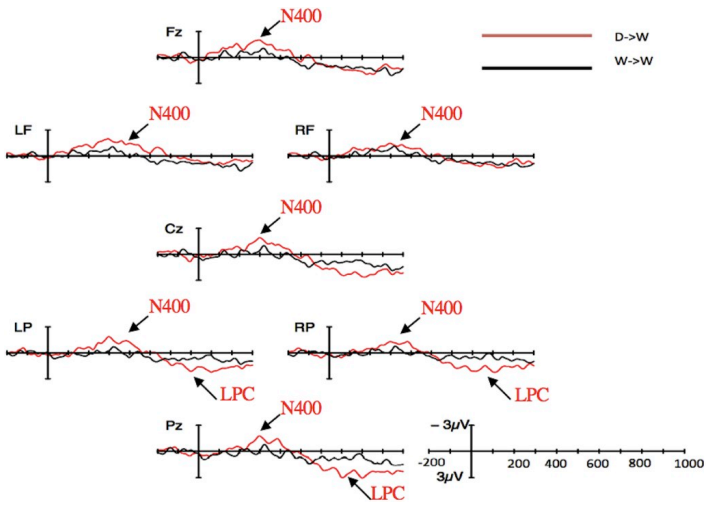

Fig. 2. Grand mean waveforms for code-switched words (red) in the Dominant-to-Weaker switching direction versus non-switched (black) words in Weaker-language sentences. Onset of the code-switched/non-switched word is indicated by the vertical bar (negative is plotted up). Time is plotted on the x-axis; each tick mark indicates 200 ms. LF = left frontal; RF = Right frontal; LP = left posterior; RP = right posterior. (For interpretation of the references to color in this figure legend, the reader is referred to the Web version of this article.)

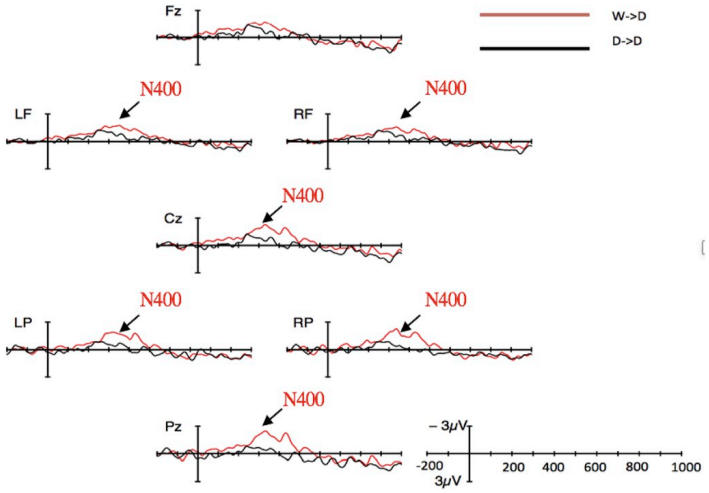

Fig. 3. Grand mean waveforms for code-switched words (red) in the Weaker-to-Dominant switching direction versus non code-switched (black) words in Dominant-language sentences. Onset of the code-switched/non-switched word is indicated by the vertical bar (negative is plotted up). Time is plotted on the x-axis; each tick mark indicates 200 ms. LF = left frontal; RF = Right frontal; LP = left posterior; RP = right posterior. (For interpretation of the references to color in this figure legend, the reader is referred to the Web version of this article.)

In the 500–900 ms time window, there were no significant main effects in the midline ANOVA (all *p*s > .1), but there was a significant interaction between switching and electrode ($F(2,60) = 8.55$, $p = .003$). Follow-up analyses revealed a significant simple effect of switch on the Pz electrode ($F(1,30) = 5.93$, $p = .021$), but not on the Fz or Cz electrodes (all *p*s > .1). This indicates the presence of an LPC at the midline Pz electrode such that there was a larger positivity for switched relative to non-switched words. There was also a significant interaction in the lateral ANOVA between switching and anteriority ($F(1,30) = 13.73$, $p = .001$). Follow-up analyses revealed a simple effect of switch on posterior sites ($F(1,30) = 4.26$, $p = .040$), but not on anterior sites ($p > .5$). This again confirms the presence of an enhanced LPC in posterior locations for switched words.

4.1.3.2. ERP: weaker-to-dominant language switch. For grand-averaged waveforms, see Fig. 3.

There was a significant main effect of switching in the midline ANOVA in the 300–500 ms time window ($F(1,30) = 9.57$, $p = .004$), such that the N400 was more negative ongoing for switched relative to non-switched words. The interaction between switching and electrode in this time window was also significant ($F(2,60) = 4.75$, $p = .012$). Follow up analyses indicated that there was a significant effect of switching on the Cz ($F(1,30) = 9.66$, $p = .004$) and Pz ($F(1,30) = 15.06$, $p = .001$) electrodes, but not on the Fz electrode ($p > .1$). This indicates that the magnitude of the switch-related N400 effect was most pronounced in the midline Cz and Pz electrodes. There was also a significant main effect of switching in the lateral ANOVA ($F(1,30) = 11.93$, $p = .002$), confirming that the N400 was more negative ongoing for switched relative to non-switched words. There were no significant interactions found

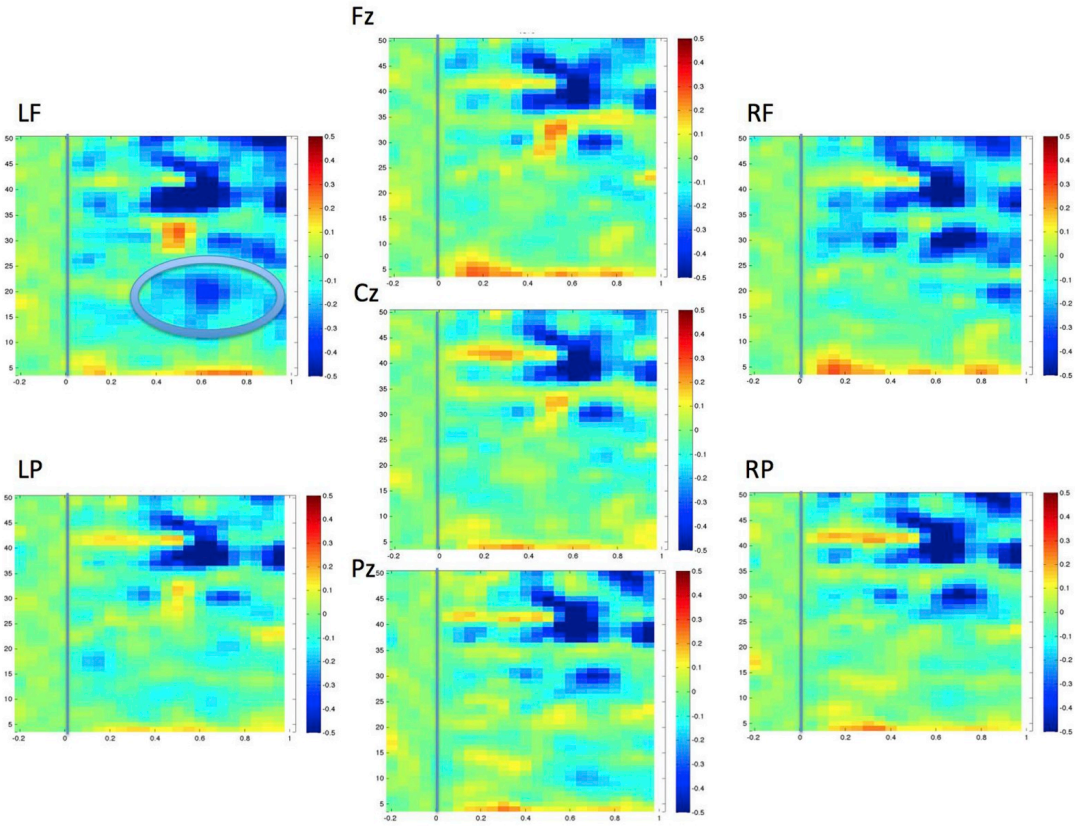

Fig. 4. TFR plots for the differences between dominant to weaker code-switched words and weaker language non-switched words. LF = left frontal; RF = Right frontal; LP = left posterior; RP = right posterior. The y-axis represents frequency (4–50 Hz), the x-axis represents time; -0.2 s to 1 s after the onset of the critical trials. The grey bar represents the onset of the target words at t = 0s. The color bar represents power from −0.5 (blue) to 0.5 (red). (For interpretation of the references to color in this figure legend, the reader is referred to the Web version of this article.)

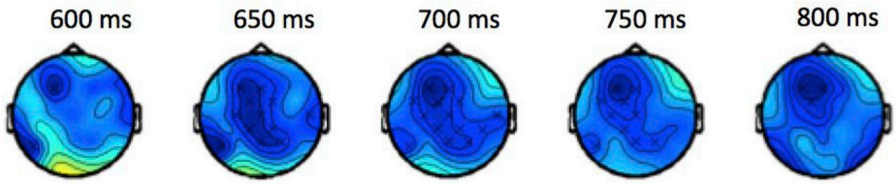

Fig. 5. Significant clusters for switches from the dominant into the weaker language. Power decrease in the upper beta band between 600 and 800 ms for code-switched words relative to non-switched words. Xs mark indicates electrodes contributing to the significant cluster.

in the lateral ANOVA (all *ps* > .1).

In the 500–900 ms time window, there were no significant main effects or interactions in the midline and lateral ANOVAs (all *ps* > .1).

4.2. TFR results

4.2.1. TFR: overall switched versus non-switched sentences

For the overall comparison of the difference conditions (dominant-to-weak code-switch minus weaker language non-switch; weak-to-dominant code-switch minus dominant language non-switch), there were no significant clusters in any of the frequency bands.

4.2.2. TFR: analyses based on switching direction

4.2.2.1. TFR: dominant-to-weaker language switch. TFR plots of the difference between the dominant-to-weaker code-switches and the weaker language non-switches can be seen in Fig. 4. This comparison revealed one significant cluster in the upper beta band (p = .023), which indicated the presence of a significant decrease in power in this frequency band from 600 to 800 ms that begins in the left frontal sites and expands to left centro-frontal (see Fig. 5). There were no significant clusters in theta, alpha, lower beta, lower gamma or upper gamma frequency bands.

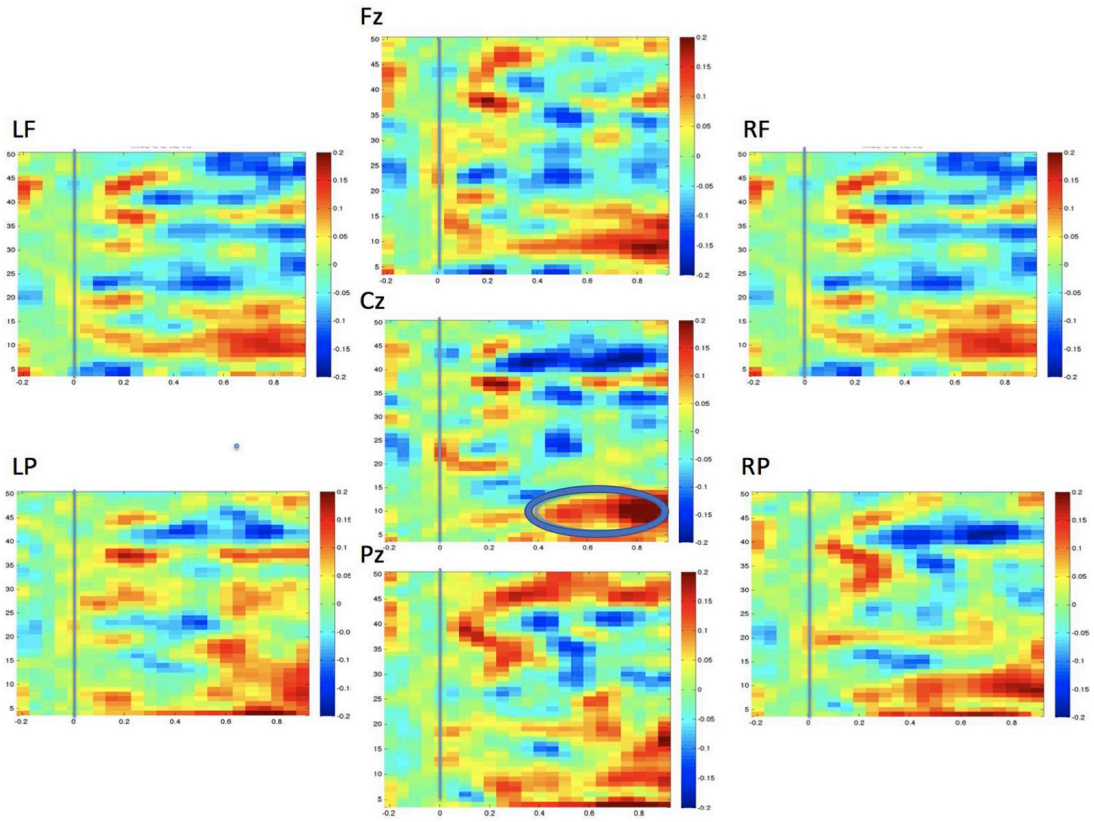

Fig. 6. TFR plots for the differences between weaker to dominant code-switched words and dominant language non-switched words. LF = left frontal; RF = Right frontal; LP = left posterior; RP = right posterior. The y-axis represents frequency (4–50 Hz), the x-axis represents time; -0.2 s to 1 s after the onset of the critical trials. The grey bar represents the onset of the target words at t = 0s. The color bar represents power from −0.2 (blue) to 0.2 (red). (For interpretation of the references to color in this figure legend, the reader is referred to the Web version of this article.)

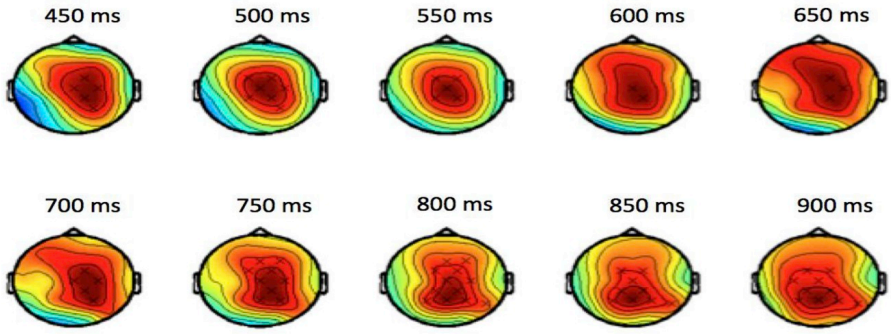

Fig. 7. Significant cluster for switches from the weaker into the dominant language. Power increase in the alpha band between 450 and 900 ms for code-switched words relative to non-switched words. Xs mark indicates electrodes contributing to the significant cluster.

4.2.2.2. TFR: weaker-to-dominant language switch. The comparison between weaker-to-dominant switches and dominant language non-switches revealed one significant cluster in the alpha band (p = .025) (see Fig. 6), which indicated a power increase from 450 to 900 ms over central sites (see Fig. 7). There were no significant clusters in theta, lower beta, upper beta, lower gamma or upper gamma frequency bands.

5. Discussion

The present study was conducted with three main goals: a) to examine intra-sentential code-switching patterns in the auditory domain using ERP and TFR methodologies; b) to examine how switching direction modulates neural patterns associated with listening to code-switched speech, and c) to relate and compare electrophysiological markers of switching costs in the auditory and visual domains.

Our results show that listening to natural sentences that entail a full switch to the other language ('alternational code-switches')

incurs N400 and LPC effects. These ERP components were also elicited when bilinguals read code-switched sentences (for a review, see Van Hell et al., 2018), suggesting that electrophysiological markers of reading and listening to code-switched sentences are similar. We further observed that switching direction (from the dominant to the weaker language, and vice versa) modulated neural patterns associated with intra-sentential code-switching, and this directionality effect was observed in both the ERP and TRF analyses. We will first discuss these switching directions in turn and relate our findings to the outcomes of other switching studies that typically examined only one switching direction, followed by a more integrative discussion of neural mechanisms associated with bilinguals' comprehension of code-switched speech.

Our ERP data show that listening to sentences that switch from one's dominant language to the weaker language incurs N400 and LPC effects relative to non-switched sentences. These results are partially in line with Liao and Chan's (2016) study on code-switching in the auditory modality that also found an N400 and an extended late negativity in this switching direction (but they did not find an LPC effect). It is important to note that Liao and Chan (2016) studied sentences that contained a sentence-final lexical switch (a less frequently occurring switch in natural discourse), and that were presented to non-habitual code-switchers. In contrast, our study examined alternational switches in sentences that fully switched to the other language halfway through the sentence, and we presented these sentences to habitual code-switchers. Taken together these ERP findings indicate that in the auditory modality code-switches in the dominant-to-weaker language switching direction impact the lexical integration of the code-switched word into its preceding context, while the LPC effect indicates that switching in this direction is also accompanied by sentence-level reanalysis.

These ERP analyses were complemented by TFR analyses (which reflect more of the EEG signal, including both phase-locked and non-phase-locked activity in contrast to only the phase-locked information captured by ERPs), and showed that switching from the dominant to the weaker language induces a significant power decrease in the upper beta frequency band. This parallels Litcofsky and Van Hell (2017) who found a lower beta power decrease, in combination with an LPC, in this switching direction when bilinguals read code-switched sentences. This upper beta power decrease also falls in line with (unilingual) sentence processing studies that related oscillatory neural activity in the lower and upper beta frequency bands during sentence comprehension to the active maintenance (associated with power increase) or shift (associated with power decrease) of the underlying neurocognitive network responsible for the construction of the current sentence meaning (Engel & Fries, 2010; Lewis et al., 2015; Weiss & Mueller, 2012), with some arguing that beta-band neuronal synchronization is specifically related to syntactic unification, the incremental building of a synactic structure (e.g., Bastiaansen & Hagoort, 2015).

In the weaker-to-dominant switching direction, our ERP results show that listening to sentences that switch from one's weaker to the dominant language incurs an N400 effect, but no LPC, relative to non-switched sentences. This finding is in line with previous studies in the written modality that found N400 effects when switching from the L2 to the L1 (Ng et al., 2014; Van Der Meij et al., 2011) and in Ruigendijk, Hentschel, and Zeller's (2015) advanced L2 learners in the auditory modality, but stands in contrast to the absence of an N400 in this switching direction in the auditory modality in Chinese-Taiwanese bilingual listeners (Liao & Chan, 2016). The differences between the current study's results and those of Liao and Chan (2016) can be explained by the manner in which sentences were presented. In the current study, participants listened to naturally produced sentences, whereas in the Liao and Chan (2016) study participants listened to sentences that contained unnatural, fixed 200 ms pauses between consecutive words, which could have modulated word-level lexical processes. Specifically, the N400 effect observed in our auditory study suggests that listening to sentences that switch from the weaker to the dominant language poses a challenge in terms of word-level semantic integration (i.e., upon encountering a code-switch into the dominant language, word-level inhibition of the dominant language while listening to the weaker language must be released), but Liao and Chan's fixed pauses in between words may have mitigated this process.

Our TFR results further suggest that processing switches in this direction is particularly cognitively challenging, as evidenced by a significant power increase in the alpha frequency band. Previous studies have interpreted power changes in the alpha frequency band as a neural marker of attential control mechanisms to ignore irrelevant speech (e.g., Wöstmann, Lim, & Obleser, 2017), as well as enhanced listening efforts and increased cognitive load associated with the processing of degraded speech (Obleser & Weisz, 2011) or reduced word forms (Drijvers et al., 2016), possibly reflecting difficulties in semantic activation and retrieval.

What do the current findings tell us about the neurocognitive mechanisms underlying listening to sentences that switch from the dominant to the weaker language, and vice versa? When comprehending or producing language, bilinguals continuously regulate the level of activation of their two languages. The relative activation or inhibition of their two languages is governed by external factors, such as linguistic context, tasks demands, or the socio-contextual situation, and internal factors, such as the bilingual's proficiency in the two languages or language use. The relative activation and inhibition of the bilinguals' two languages, and cognitive efforts to regulate this, are key assumptions in theoretical models of bilingual language processing, including the Bilingual Interactive Activation model (BIA+; Dijkstra & Van Heuven, 2002), the Inhibitory Control (Green, 1998) and Adaptive Control (e.g., Green & Abutalebi, 2013) models, and Grosjean's (1997) notion of a continuum ranging from monolingual to bilingual language modes.

Building on incremental models of sentence comprehension, when listening to code-switched sentences, bilinguals engage in two main operations that interact and overlap in time: accessing and retrieving lexical information and incrementally integrating this information with the preceding context to build up a sentence-level interpretation. At the same time, bilinguals need to regulate and adjust the level of activation of their two languages to optimize their comprehension of the code-switched utterance as it unfolds over time. Our findings suggest that in both switching directions, switching impacts the lexical retrieval and integration of the code-switched word into its preceding context, as exemplified by the N400 effect observed in both switching directions. But each switching direction also appears to engage specific cognitive processes. More specifically, in the dominant-to-weaker switching direction, the N400 and LPC effects in combination with the upper beta power decrease suggest that switching affects the semantic integration of the code-switched word into the preceding context, but also entails a shift in the construction of sentence-level representations. The

fact that an LPC and upper beta power decrease was only observed in the dominant-to-weaker switching direction (which parallels Litcofsky and Van Hell's (2017) findings) suggests that especially encountering the weaker language at the codeswitch, and integrating the weaker language into an emerging sentence structure constructed on the basis of dominant language input, necessitates sentence-level reanalysis in order to comprehend the full code-switched sentence. In the weaker-to-dominant direction the combined N400 effect and alpha power increase suggest that switching impacts the semantic integration of the code-switched word into the preceding context. Assuming that alpha power increase is associated with an increased cognitive load (as observed when listeners ignore irrelevant speech (Wöstmann et al., 2017) or process degraded speech (Obleser & Weisz, 2012) or reduced word forms (Drijvers et al., 2016)), encountering a switch to the dominant language after listening to a sentence that started in the weaker language seems particularly cognitively challenging. Tentatively, when bilinguals listen to a sentence that unfolds in their weaker language they inhibit their dominant language, and this inhibition must be released upon hearing a switch into the dominant language. The alpha power increase thus suggests that the process of lifting inhibition of the dominant language upon encountering a switch into the weaker language requires additional cognitive resources.

Of further note is that the observed neural ERP signatures in the auditory domain are comparable to the ones observed in the visual domain with respect to ERP components that index language comprehension processes (both report N400 and LPC effects). A small quantitative difference is that in the auditory modality, the onset of the N400 occurs earlier and its distribution seems to be more widespread. These differences have also been observed in other auditory sentential studies (Grey, Schubel, McQueen, & Van Hell, in press; Grey & Van Hell, 2017; Holcomb & Neville, 1991; Kutas & Federmeier, 2011; Ruigendijk et al., 2015). However, the present TFR analyses, in particular the alpha power increase, point at an important difference between the auditory and visual modality, and suggest that listening to code-switched sentences is more cognitively effortful than reading code-switched sentences, and that in particular listening to sentences that switch from the weaker to the dominant language engages additional cognitive effort. More specifically, the only study that conducted TFR analyses in intra-sentential code-switching is Litcofsky and Van Hell (2017) who presented sentences in the visual modality. They observed a beta power decrease when reading sentences that switched from the dominant to the weaker language, as in the present auditory study, but unlike the present study did not observe an alpha power increase when switching from the weaker to the dominant language. The differences found in TFR results between the auditory and visual modalities suggest that listening to sentences that switch from the weaker to the dominant language requires additional cognitive resources. It is important to note, however, that the TFR methodology is still being expanded to new areas of language processing, and we are therefore only beginning to comprehend how oscillatory activity reflects underlying neurocognitive mechanisms.

In conclusion, the use of auditory stimuli to study the comprehension of code-switched sentences provides researchers with the opportunity to get a more ecologically valid and in-depth understanding of this bilingual phenomenon. This was also compellingly demonstrated by Blanco-Elorrieta and Pylkkänen (2017) whose MEG study yielded fundamentally different outcomes when bilinguals comprehended switches occurring in natural speech as opposed to a more artificial language switching task. Future studies on the comprehension of code-switched sentences could include additional linguistic cues that may serve to attenuate switching costs, such as speaker identity and accented speech. Moreover, additional studies on the comprehension of code-switched sentences (in both auditory and visual modalities, and in both switching directions) using both ERP and TFR methodologies, but testing other types of bilinguals (e.g., non-habitual codeswitchers) or other types of codeswitches (e.g., sentence-medial lexical switches or sentences that switch multiple times between languages) would help to further elucidate the neural mechanisms involved in processing code-switched sentences.

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Appendix. Conditions: 1) English → Spanish Code-switch; 2) English No Code-switch; 3) Spanish → English Code-switch; 4) Spanish No Code-switch

Condition	Sentence
1	This morning, a wild vulture bit a conejo que pasaba corriendo muy rápido.
2	This morning, a wild vulture bit a rabbit who ran past very quickly.
3	Esta mañana, un buitre salvaje mordió a un rabbit who ran past very quickly.
4	Esta mañana, un buitre salvaje mordió a un conejo que pasaba corriendo muy rápido.
1	After the felony, a harsh punishment was given to the ladrones por el juez.
2	After the felony, a harsh punishment was given to the thieves by the judge.
3	Después del delito, un duro castigo les fue dado a los thieves by the judge.
4	Después del delito, un duro castigo les fue dado a los ladrones por el juez.
1	The girl saw some nice shirts in the tienda frente a su escuela.
2	The girl saw some nice shirts in the shop across the street from her school.
3	La niña vio unas camisas bonitas en el shop across the street from her school.
4	La niña vio unas camisas bonitas en la tienda frente a su escuela.

1 Every Sunday, she reads a short book related to ajedrez para mejorar sus habilidades.
2 Every Sunday, she reads a short book related to chess to improve her skills.
3 Todos los domingos, ella lee un libro corto sobre el chess to improve her skills.
4 Todos los domingos, ella lee un libro corto sobre el ajedrez para mejorar sus habilidades.
1 A lot of brochures were handed out by the manifestantes antes de su protesta.
2 A lot of brochures were handed out by the protesters before their rally.
3 Un montón de folletos fueron repartidos por los protesters before their rally.
4 Un montón de folletos fueron repartidos por los manifestantes antes de su protesta.
1 Next week, the young waiter will begin his trabajo con gran entusiasmo.
2 Next week, the young waiter will begin his job with great excitement.
3 La semana próxima, el camarero joven comenzará su job with great excitement.
4 La semana próxima, el camarero joven comenzará su trabajo con gran entusiasmo.
1 The old men got together to watch a movie about the pandillas en su ciudad.
2 The old men got together to watch a movie about the gangs in their city.
3 Los ancianos se reunieron para ver una película sobre los gangs in their city.
4 Los ancianos se reunieron para ver una película sobre las pandillas en su ciudad.
1 In its basement, the building collects hundreds of maletas perdidas de diversos visitantes.
2 In its basement, the building collects hundreds of suitcases lost by the various visitors.
3 En su sótano, el edificio guarda cientos de suitcases lost by the various visitors.
4 En su sótano, el edificio guarda cientos de maletas perdidas de diversos visitantes.
1 The other night, the neighbors watched the lucha pero no trataron de detenerla.
2 The other night, the neighbors watched the fight but did not try to stop it.
3 La otra noche, los vecinos miraron el fight but did not try to stop it.
4 La otra noche, los vecinos miraron la lucha pero no trataron de detenerla.
1 Tomorrow, Aaron and his friends will build some escudos para usar en un juego de rol.
2 Tomorrow, Aaron and his friends will build some shields to use in a fantasy game.
3 Mañana, Aarón y sus amigos construirán unos shields to use in a fantasy game.
4 Mañana, Aarón y sus amigos construirán unos escudos para usar en un juego de rol.
1 Very angrily, the businessman pounded on his teclado para quitarse el estrés.
2 Very angrily, the businessman pounded on his keyboard to get rid of stress.
3 Muy enojado, el empresario golpeó su keyboard to get rid of stress.
4 Muy enojado, el empresario golpeó su teclado para quitarse el estrés.
1 He is best known as a writer of an assortment of cuentos y poesía hermosa.
2 He is best known as a writer of an assortment of stories and beautiful poetry.
3 Él es más conocido como escritor de un surtido de stories and beautiful poetry.
4 Él es más conocido como escritor de un surtido de cuentos y poesía hermosa.
1 While running her errands, the consultant stopped at the quiosco a recoger el periódico de hoy.
2 While running her errands, the consultant stopped at the newsstand to pick up today's paper.
3 Mientras hacía sus mandados, la asesora se detuvo en el newsstand to pick up today's paper.
4 Mientras hacía sus mandados, la asesora se detuvo en el quiosco a recoger el periódico de hoy.
1 She was on her way to a parade with a cantante a quien había admirado durante mucho tiempo.
2 She was on her way to a parade with a singer whom she had admired for a long time.
3 Ella se dirigía a un desfile con un singer whom she had admired for a long time.
4 Ella se dirigía a un desfile con un cantante a quien había admirado durante mucho tiempo.
1 Even though it was a dreary day, Ann's friendly parrot ensured a sonrisa en el público.
2 Even though it was a dreary day, Ann's friendly parrot ensured a smile with the audience.
3 A pesar de que era un día gris, el amigable loro de Ana aseguró un smile with the audience.
4 A pesar de que era un día gris, el amigable loro de Ana aseguró una sonrisa en el público.
1 Christina was uneasy because of the dogs spotted around the vecindario a principios de esta semana.
2 Christina was uneasy because of the dogs spotted around the neighborhood earlier this week.
3 Cristina estaba inquieta a causa de los perros encontrados en el neighborhood earlier this week.
4 Cristina estaba inquieta a causa de los perros encontrados en el vecindario a principios de esta semana.
1 Everyone at the party whispered about the cintas que decoraban toda la habitación.
2 Everyone at the party whispered about the ribbons that decorated the entire room.
3 Todos en la fiesta susurraban sobre los ribbons that decorated the entire room.
4 Todos en la fiesta susurraban sobre las cintas que decoraban toda la habitación.
1 Arthur hoped that the gift would not be filled with calcetines y corbatas feas.
2 Arthur hoped that the gift would not be filled with socks and ugly ties.
3 Arthur esperaba que el regalo no estuviera lleno de socks and ugly ties.
4 Arthur esperaba que el regalo no estuviera lleno de calcetines y corbatas feas.
1 Please put the extra meat in the congelador cuando termines de comer.
2 Please put the extra meat in the freezer when you are done eating.
3 Por favor, pon la carne sobrante en el freezer when you are done eating.
4 Por favor, pon la carne sobrante en el congelador cuando termines de comer.
1 Yesterday, George found out that a jail will replace the bodega que fue demolida el año pasado.
2 Yesterday, George found out that a jail will replace the warehouse that was demolished last year.
3 Ayer, Jorge descubrió que una cárcel reemplazará al warehouse that was demolished last year.
4 Ayer, Jorge descubrió que una cárcel reemplazará a la bodega que fue demolida el año pasado.
1 Every morning, Sarah gets her gloves caught in the cremallera de su chaqueta.
2 Every morning, Sarah gets her gloves caught in the zipper of her jacket.
3 Cada mañana, a Sara se le enganchan los guantes en el zipper of her jacket.
4 Cada mañana, a Sara se le enganchan los guantes en la cremallera de su chaqueta.
1 Suddenly, I remembered that the woman had warned us about the tempestad que se avecinaba.
2 Suddenly, I remembered that the woman had warned us about the storm that was coming.

3 De repente, me acordé de que la mujer nos había advertido sobre el storm that was coming.
4 De repente, me acordé de que la mujer nos había advertido sobre la tempestad que se avecinaba.
1 Sadly, the young winner sprained his tobillo y no pudo competir en la ronda final.
2 Sadly, the young winner sprained his ankle and could no longer compete in the final round.
3 Tristamente, el joven ganador se torció el ankle and could no longer compete in the final round.
4 Tristamente, el joven ganador se torció el tobillo y no pudo competir en la ronda final.
1 Last week, a truck overturned in the carretera y derramó muchos litros de combustible.
2 Last week, a truck overturned in the road and spilled many gallons of fuel.
3 La semana pasada, un camión volcó en el road and spilled many gallons of fuel.
4 La semana pasada, un camión volcó en la carretera y derramó muchos litros de combustible.
1 Staring into the sky, the dreamer thought about his esperanzas y sueños para el futuro.
2 Staring into the sky, the dreamer thought about his hopes and dreams for the future.
3 Mirando al cielo, el soñador pensaba en sus hopes and dreams for the future.
4 Mirando al cielo, el soñador pensaba en sus esperanzas y sueños para el futuro.
1 For the winter, Angela's scarf was made out of lana para mantenerla caliente.
2 For the winter, Angela's scarf was made out of wool to keep her warm.
3 Para el invierno, la bufanda de Angela fue hecha de wool to keep her warm.
4 Para el invierno, la bufanda de Angela fue hecha de lana para mantenerla caliente.
1 This morning, the orderly brought the muletas a Ana y le mostró cómo usarlas.
2 This morning, the orderly brought the crutches to Anne and showed her how to use them.
3 Esta mañana, el camillero le trajo los crutches to Anne and showed her how to use them.
4 Esta mañana, el camillero le trajo las muletas a Ana y le mostró cómo usarlas.
1 Last year, the earthquake destroyed all of the aldea y sus alrededores.
2 Last year, the earthquake destroyed all of the village and the surrounding areas.
3 El año pasado, el terremoto destruyó todo el village and the surrounding areas.
4 El año pasado, el terremoto destruyó toda la aldea y sus alrededores.
1 For tomorrow, bring an eraser for the prueba de física y astronomía.
2 For tomorrow, bring an eraser for the quiz on physics and astronomy.
3 Para mañana, trae una goma para el quiz on physics and astronomy.
4 Para mañana, trae una goma para la prueba de física y astronomía.
1 The other night, the rooster wandered into a prado que era muy peligroso.
2 The other night, the rooster wandered into a meadow that was very dangerous.
3 La otra noche, el gallo vagó en un meadow that was very dangerous.
4 La otra noche, el gallo vagó en un prado que era muy peligroso.
1 Looking over the crowd, the supporter stood atop of the escaleras y gritó su oposición.
2 Looking over the crowd, the supporter stood atop of the stairs and shouted his opposition.
3 Mirando sobre la gente, el partidario se paró encima de los stairs and shouted his opposition.
4 Mirando sobre la gente, el partidario se paró encima de las escaleras y gritó su oposición.
1 Adam wanted to pick peaches and lots of ciruelas en la granja cercana.
2 Adam wanted to pick peaches and lots of plums at the nearby farm.
3 Adán quería recoger melocotones y un montón de plums at the nearby farm.
4 Adán quería recoger melocotones y un montón de ciruelas en la granja cercana.
1 Being lazy, the boys threw stones into the estanque para pasar el tiempo.
2 Being lazy, the boys threw stones into the pond to pass the time.
3 Con pereza, los chicos tiraron piedras en el pond to pass the time.
4 Con pereza, los chicos tiraron piedras en el estanque para pasar el tiempo.
1 Some people at the beach watch all the peces nadando entre los corales.
2 Some people at the beach watch all the fish swimming amongst the coral.
3 Alguna gente en la playa ve todos los fish swimming amongst the coral.
4 Alguna gente en la playa ve todos los peces nadando entre los corales.
1 Once a month, referees mingle with the jugadores antes de que empiece el juego.
2 Once a month, referees mingle with the players before the game starts.
3 Una vez al mes, los árbitros se entremezclan con los playes before the game starts.
4 Una vez al mes, los árbitros se entremezclan con los jugadores antes de que empiece el juego.
1 Sometimes, young people enjoy eating grapes during a descanso de sus clases.
2 Sometimes, young people enjoy eating grapes during a break from their classes.
3 A veces, los jóvenes disfrutan comiendo uvas durante el break from their classes.
4 A veces, los jóvenes disfrutan comiendo uvas durante el descanso de sus clases.
1 Elizabeth brought her granddaughter on a caminata a lo largo del río.
2 Elizabeth brought her granddaughter on a walk along the river.
3 Elena llevó a su nieta en un walk along the river.
4 Elena llevó a su nieta en una caminata a lo largo del río.
1 In the fall, some people put skulls in the ventanas de sus casas.
2 In the fall, some people put skulls in the windows of their houses.
3 En el otoño, la gente pone calaveras en los windows of their houses.
4 En el otoño, la gente pone calaveras en las ventanas de sus casas.
1 After the couple's wedding, their church was covered in carteles, guirnaldas y globos.
2 After the couple's wedding, their church was covered in posters, streamers, and balloons.
3 Después de la boda de la pareja, su iglesia estaba cubierta de posters, streamers, and balloons.
4 Después de la boda de la pareja, su iglesia estaba cubierta de carteles, guirnaldas y globos.
1 Since Danielle was homesick, her boyfriend bought her a boleto para volver de visita.
2 Since Danielle was homesick, her boyfriend bought her a ticket to come visit.
3 Dado que Daniela añoraba su casa, su novio le compró un ticket to come visit.
4 Dado que Daniela añoraba su casa, su novio le compró un boleto para volver de visita.

1 Charlie will soon be a lawyer with his own velero como su padre.
2 Charlie will soon be a lawyer with his own sailboat just like his father.
3 Carlos pronto será un abogado con su propio sailboat just like his father.
4 Carlos pronto será un abogado con su propio velero como su padre.
1 At last, the squad saw the preso cuando salía de su casa.
2 At last, the squad saw the inmate as he left his house.
3 Por fin, la cuadrilla vio al inmate as he left his house.
4 Por fin, la cuadrilla vio al preso cuando salía de su casa.
1 Thankfully, the ignited skyscraper was saved by the bomberos que fueron muy valientes.
2 Thankfully, the ignited skyscraper was saved by the firemen who are very brave.
3 Con agradecimiento, el rascacielos incendiado se salvó por los firemen who are very brave.
4 Con agradecimiento, el rascacielos incendiado se salvó por los bomberos que fueron muy valientes.
1 People say that childhood brings some of the best recuerdos de la vida.
2 People say that childhood brings some of the best memories of your life.
3 La gente dice que la niñez trae algunos de los mejores memories of your life.
4 La gente dice que la niñez trae algunos de los mejores recuerdos de la vida.
1 The woman at the tombstone bowed her cabeza para rezar en silencio.
2 The woman at the tombstone bowed her head to pray in silence.
3 La mujer en la lápida bajó su head to pray in silence.
4 La mujer en la lápida bajó su cabeza para rezar en silencio.
1 She likes to watch the sparrows rather than the patos que viven cerca del embalse.
2 She likes to watch the sparrows rather than the ducks that live near the reservoir.
3 Le gusta ver los gorriones en vez de los ducks that live near the reservoir.
4 Le gusta ver los gorriones en vez de los patos que viven cerca del embalse.
1 The stove was leaking smoke into the entire cocina y se incendió.
2 The stove was leaking smoke into the entire kitchen and caught on fire.
3 La estufa emanaba humo en todo el kitchen and caught on fire.
4 La estufa emanaba humo en toda la cocina y se incendió.
1 The dust rose off of the sidewalk in lots of remolinos de calor y suciedad.
2 The dust rose off of the sidewalk in lots of swirls of heat and dirt.
3 El polvo se levantó fuera de la acera en un montón de swirls of heat and dirt.
4 El polvo se levantó fuera de la acera en un montón de remolinos de calor y suciedad.
1 Emilie and her aunt love apple dumplings served with nueces en el lado.
2 Emilie and her aunt love apple dumplings served with walnuts on the side.
3 Carolina y su tía aman los bollos de manzana servidos con walnuts on the side.
4 Carolina y su tía aman los bollos de manzana servidos con nueces en el lado.
1 Her expansive and beautiful lawn was covered with faroles y gnomos de jardín.
2 Her expansive and beautiful lawn was covered with lanterns and garden gnomes.
3 Su amplio y hermoso césped estaba cubierto con lanterns and garden gnomes.
4 Su amplio y hermoso césped estaba cubierto con faroles y gnomos de jardín.
1 The king instructed that his blade be made of oro y de bronce solamente.
2 The king instructed that his blade be made of gold and bronze only.
3 El rey ordenó que su hoja fuera de gold and bronze only.
4 El rey ordenó que su hoja fuera de oro y de bronce solamente.
1 He decided to become a clergyman after the muerte de su abuelo.
2 He decided to become a clergyman after the death of his grandfather.
3 Él eligió ser sacerdote después del death of his grandfather.
4 Él eligió ser sacerdote después de la muerte de su abuelo.
1 Even though her review was turned down by the revista, ella la publicó independientemente.
2 Even though her review was turned down by the journal, she published it independently.
3 A pesar de que su reseña fue rechazada por el journal, she published it independently.
4 A pesar de que su reseña fue rechazada por la revista, ella la publicó independientemente.
1 Brittney cleaned up the counter with a trapo después del enorme derrame.
2 Brittney cleaned up the counter with a rag after the huge spill.
3 Bibiana limpió el mostrador con un rag after the huge spill.
4 Bibiana limpió el mostrador con un trapo después del enorme derrame.
1 She brought her umbrella along with her gabardina para mantenerse seca de la fuerte lluvia.
2 She brought her umbrella along with her raincoat to keep her dry from the heavy rain.
3 Ella trajo su paraguas junto con su raincoat to keep her dry from the heavy rain.
4 Ella trajo su paraguas junto con su gabardina para mantenerse seca de la fuerte lluvia.
1 Sophia lounged around in her slippers with a resfriado mientras estaba encerrada en su casa.
2 Sophia lounged around in her slippers with a cold while she was stuck at her house.
3 Sofía holgazaneó en sus pantuflas con un cold while she was stuck at her house.
4 Sofía holgazaneó en sus pantuflas con un resfriado mientras estaba encerrada en su casa.
1 Paul asked to see the ring in the vitrina de la joyería.
2 Paul asked to see the ring in the showcase at the jewelry store.
3 Pablo pidió ver el anillo en el showcase at the jewelry store.
4 Pablo pidió ver el anillo en la vitrina de la joyería.
1 Roger took the overcoat to his sastre para hacer alteraciones.
2 Roger took the overcoat to his tailor to get alterations.
3 Rodrigo llevó el abrigo a su tailor to get alterations.
4 Rodrigo llevó el abrigo a su sastre para hacer alteraciones.
1 Nicholas bought some ointment for the ampolla en su mano.
2 Nicholas bought some ointment for the blister on his hand.

3 Nicolás compró una pomada para el blister on his hand.
4 Nicolás compró una pomada para la ampolla en su mano.
1 Luckily, Victoria had no wounds except a sarpullido que preocupó a los paramédicos.
2 Luckily, Victoria had no wounds except a rash that worried the paramedics.
3 Por suerte, Victoria no tuvo heridas salvo un rash that worried the paramedics.
4 Por suerte, Victoria no tuvo heridas salvo un sarpullido que preocupó a los paramédicos.
1 Jessica will learn more about her midwife during a cita la próxima semana.
2 Jessica will learn more about her midwife during an appointment in the next few weeks.
3 Jessenia va a saber más sobre su comadrona durante un appointment in the next few weeks.
4 Jessenia va a saber más sobre su comadrona durante una cita la próxima semana.
1 She did her homework on the birth of the estrellas según como se ven en varios países.
2 She did her homework on the birth of the stars as seen from various countries.
3 Ella hizo su tarea sobre el nacimiento de los stars as seen from various countries.
4 Ella hizo su tarea sobre el nacimiento de las estrellas según como se ven en varios países.
1 Filled with anger, the knight slayed the bruja en la torre.
2 Filled with anger, the knight slayed the witch in the high tower.
3 Lleno de enojo, el caballero mató al witch in the high tower.
4 Lleno de enojo, el caballero mató a la bruja en la torre.
1 Out of sympathy, the traveler told the mendigo dónde encontrar ayuda.
2 Out of sympathy, the traveler told the beggar where to find some help.
3 Por lástima, el viajero le dijo al beggar where to find some help.
4 Por lástima, el viajero le dijo al mendigo dónde encontrar ayuda.
1 They found out that the nurse liked her jefe por su generosidad.
2 They found out that the nurse liked her boss because of his generosity.
3 Ellos se enteraron de que a la enfermera le gustaba su boss because of his generosity.
4 Ellos se enteraron de que a la enfermera le gustaba su jefe por su generosidad.
1 I think that puppies are scared of aspiradoras porque hacen mucho ruido.
2 I think that puppies are scared of vacuums because they are loud.
3 Creo que los cachorros tienen miedo de los vacuums because they are loud.
4 Creo que los cachorros tienen miedo de las aspiradoras porque hacen mucho ruido.
1 From what I've noticed, wasps often hate abejas con una pasión violenta.
2 From what I've noticed, wasps often hate bees with a violent passion.
3 Por lo que he notado, las avispas a menudo odian a los bees with a violent passion.
4 Por lo que he notado, las avispas a menudo odian a las abejas con una pasión violenta.
1 In the old days, planes had fewer asientos, pero había más lujos.
2 In the old days, planes had fewer seats, but had more luxuries.
3 En los viejos tiempos, los aviones tenían menos seats, but had more luxuries.
4 En los viejos tiempos, los aviones tenían menos asientos, pero había más lujos.
1 Eleanor could not believe the wickedness and sadness of the hambruna que ocurría por todo el lugar.
2 Eleanor could not believe the wickedness and sadness of the famine occurring all over the place.
3 Eleanor no podía creer la maldad y tristeza del famine occurring all over the place.
4 Eleanor no podía creer la maldad y tristeza de la hambruna que ocurría por todo el lugar.
1 The girl set the notebook on the mesa con la intención de finalmente comenzar su investigación.
2 The girl set the notebook on the table with the intent of finally starting her research.
3 La niña dejó el cuaderno sobre el table with the intent of finally starting her research.
4 La niña dejó el cuaderno sobre la mesa con la intención de finalmente comenzar su investigación.
1 After seeing Molly's distress from the broma, Franco se arrepintió de haberla planeado.
2 After seeing Molly's distress from the prank, Frank regretted planning it.
3 Después de ver la angustia de Amelia por el prank, Frank regretted planning it.
4 Después de ver la angustia de Amelia por la broma, Franco se arrepintió de haberla planeado.
1 When Nathan is sick, he pours some honey into his leche para sentirse mejor.
2 When Nathan is sick, he pours some honey into his milk to feel better.
3 Cuando Alberto está enfermo, él echa un poco de miel en su milk para to feel better.
4 Cuando Alberto está enfermo, él echa un poco de miel en su leche para sentirse mejor.
1 Scott likes playing basketball instead of esgrima para mantenerse en forma.
2 Scott likes playing basketball instead of fencing in order to stay in shape.
3 A Sergio le gusta jugar al baloncesto en lugar de hacer fencing in order to stay in shape.
4 A Sergio le gusta jugar al baloncesto en lugar de hacer esgrima para mantenerse en forma.
1 This morning, the manager received the impresora de la oficina principal.
2 This morning, the manager received the printer from the main office.
3 Esta mañana, el gerente recibió el printer from the main office.
4 Esta mañana, el gerente recibió la impresora de la oficina principal.
1 Soon after arriving, the stewardess found her equipaje y se dirigió al coche.
2 Soon after arriving, the stewardess found her luggage and headed to the car.
3 A poco de llegar, la azafata encontró su luggage and headed to the car.
4 A poco de llegar, la azafata encontró su equipaje y se dirigió al coche.
1 That morning, the lifeguards watched the ola cuando llegaba a la costa.
2 That morning, the lifeguards watched the wave as it hit the shore.
3 Essa mañana, los salvavidas vieron el wave as it hit the shore.
4 Essa mañana, los salvavidas vieron la ola cuando llegaba a la costa.
1 Last week, Marcus hung a clock next to the espejo en su habitación.
2 Last week, Marcus hung a clock next to the mirror in his room.
3 La semana pasada, Manuel colgó un reloj al lado del mirror in his room.
4 La semana pasada, Manuel colgó un reloj al lado del espejo en su habitación.

1 Yesterday we agreed that the striped pillows match the alfombra en la sala de estar.
2 Yesterday we agreed that the striped pillows match the rug in the living room.
3 Ayer acordamos que las almohadas de rayas coinciden con el rug in the living room.
4 Ayer acordamos que las almohadas de rayas coinciden con la alfombra en la sala de estar.
1 Bryan will spend a week at the wharf as part of a viaje con su compañía.
2 Bryan will spend a week at the wharf as part of a trip with his company.
3 Armando pasará una semana en el embarcadero como parte de un trip with his company.
4 Armando pasará una semana en el embarcadero como parte de un viaje con su compañía.
1 All summer long, Chris collected spiders and other muestras para examinar en su microscopio nuevo.
2 All summer long, Chris collected spiders and other specimens to view under his new microscope.
3 Todo el verano, Lucas recogió arañas y otros specimens para to view under his new microscope.
4 Todo el verano, Lucas recogió arañas y otros muestras para examinar en su microscopio nuevo.
1 Luckily for me, the hairdresser can cut any cabello en los últimos estilos.
2 Luckily for me, the hairdresser can cut any hair in the latest styles.
3 Por suerte para mí, el peluquero puede cortar cualquier hair in the latest styles.
4 Por suerte para mí, el peluquero puede cortar cualquier cabello en los últimos estilos.
1 Feeling very tired, the baker took a siesta para recuperar su energía.
2 Feeling very tired, the baker took a nap to boost his energy.
3 Sintiéndose muy cansado, el panadero tomó un nap to boost his energy.
4 Sintiéndose muy cansado, el panadero tomó una siesta para recuperar su energía.
1 When night fell, the wolf howled at the luna lo más fuerte que pudo.
2 When night fell, the wolf howled at the moon as loudly as he could.
3 Al caer la noche, el lobo aulló al moon as loudly as he could.
4 Al caer la noche, el lobo aulló a la luna lo más fuerte que pudo.
1 I enjoy eating cinnamon with my desayuno porque es saludable.
2 I enjoy eating cinnamon with my breakfast because it is healthy.
3 Me gusta comer canela con el breakfast because it is healthy.
4 Me gusta comer canela con el desayuno porque es saludable.
1 Having learned that beetles have so many patas y pueden morder, Gloria les tiene miedo.
2 Having learned that beetles have so many legs and can bite, Gloria is now very scared of them.
3 Al enterarse de que los escarabajos tienen tantos legs and can bite, Gloria is now very scared of them.
4 Al enterarse de que los escarabajos tienen tantas patas y pueden morder, Gloria les tiene miedo.
1 They could not carry the mattress through the small puerta de la casa de la pareja.
2 They could not carry the mattress through the small door of the couple's house.
3 Ellos no podían llevar el colchón a través del pequeño door of the couple's house.
4 Ellos no podían llevar el colchón a través de la pequeña puerta de la casa de la pareja.
1 She hung her dresses on the tendedero y se le volaron todos.
2 She hung her dresses on the clothesline and they all blew away.
3 Ella colgó sus vestidos en el clothesline and they all blew away.
4 Ella colgó sus vestidos en el tendedero y se le volaron todos.
1 The cat chased the squirrel through the entire alcantarilla hasta que finalmente la atrapó.
2 The cat chased the squirrel through the entire sewer until he finally caught it.
3 El gato persiguió a la ardilla por toda el sewer until he finally caught it.
4 El gato persiguió a la ardilla por toda la alcantarilla hasta que finalmente la atrapó.
1 He hoped that the pills could cure his sick caballo enfermo antes del concurso la semana siguiente.
2 He hoped that the pills could cure his sick horse before the show the following week.
3 Él esperaba que las pastillas pudieran curar a su horse before the show the following week.
4 Él esperaba que las pastillas pudieran curar a su caballo enfermo antes del concurso la semana siguiente.
1 Madeline wrote some folktales about two palomas, los símbolos de la paz y el amor.
2 Madeline wrote some folktales about two doves, the symbols of peace and love.
3 Marcela escribió algunas leyendas sobre dos doves, the symbols of peace and love.
4 Marcela escribió algunas leyendas sobre dos palomas, los símbolos de la paz y el amor.
1 Tyler will only eat noodles with butter and repollo desde que él concoció la comida polaca.
2 Tyler will only eat noodles with butter and cabbage ever since he was introduced to Polish cuisine.
3 Tito sólo come fideos con mantequilla y cabbage ever since he was introduced to Polish cuisine.
4 Tito sólo come fideos con mantequilla y repollo desde que él concoció la comida polaca.
1 After the blizzard, helpers provided some alivio a las víctimas.
2 After the blizzard, helpers provided some relief for the victims.
3 Después de la ventisca, ayudantes proporcionaron algo de relief for the victims.
4 Después de la ventisca, ayudantes proporcionaron algo de alivio a las víctimas.
1 Kristy loves to have ferns in her hogar porque traen buena suerte.
2 Kristy loves to have ferns in her home because they bring her good luck.
3 A Celia le encanta tener helechos en su home because they bring her good luck.
4 A Celia le encanta tener helechos en su hogar porque traen buena suerte.
1 Very repulsed, the shopper removed all the anacardos de su ensalada.
2 Very repulsed, the shopper removed all the cashews from his salad.
3 Muy asqueado, el parroquiano quitó todos los cashews from his salad.
4 Muy asqueado, el parroquiano quitó todos los anacardos de su ensalada.
1 On the hill there is a nursery where the monjas honran su virtud.
2 On the hill there is a nursery where the nuns honor their virtue.
3 En la colina hay una guardería donde los nuns honor their virtue.
4 En la colina hay una guardería donde las monjas honran su virtud.
1 I like eating chicken with a side of papitas y un batido.
2 I like eating chicken with a side of fries and a milkshake.

3	Me gusta comer pollo con una guarnición de fries and a milkshake.
4	Me gusta comer pollo con una guarnición de papitas y un batido.
1	Tori and Jess went to a dance for the becarios que vienen de Europa.
2	Tori and Jess went to a dance for the scholars visiting from Europe.
3	Tonya y Josefina fueron a un baile para los scholars visiting from Europe.
4	Tonya y Josefina fueron a un baile para los becarios que vienen de Europa.
1	Alexa stuffed a bunch of coins into her bolsillo antes de ir al supermercado.
2	Alexa stuffed a bunch of coins into her pocket before heading to the supermarket.
3	Alejandra metió un montón de monedas en su pocket before heading to the supermarket.
4	Alejandra metió un montón de monedas en su bolsillo antes de ir al supermercado.
1	According to Peter, no brewery will provide a cena tan tarde por la noche.
2	According to Peter, no brewery will provide a meal so late at night.
3	Según Pedro, ninguna cervecería servirá un meal so late at night.
4	Según Pedro, ninguna cervecería servirá una cena tan tarde por la noche.
1	This morning, they approved the budget for this primavera después de muchas reuniones.
2	This morning, they approved the budget for this spring after many meetings.
3	Esta mañana, ellos aprobaron el presupuesto para este spring after many meetings.
4	Esta mañana, ellos aprobaron el presupuesto para esta primavera después de muchas reuniones.
1	Early this morning, the board acknowledged their elogios por el comportamiento de los aficionados durante el partido del campeonato.
2	Early this morning, the board acknowledged their praise for the behavior of the fans during the championship game.
3	Temprano esta mañana, la junta reconoció su praise for the behavior of the fans during the championship game.
4	Temprano esta mañana, la junta reconoció sus elogios por el comportamiento de los aficionados durante el partido del campeonato.
1	Because we were not tired, we ordered cupcakes for our postre y hablamos un poco más.
2	Because we were not tired, we ordered cupcakes for our dessert and talked some more.
3	Debido a que no estabamos cansados, pedimos magdalenas para el dessert and talked some more.
4	Debido a que no estabamos cansados, pedimos magdalenas para el postre y hablamos un poco más.
1	Naively, Doug gave his stepbrother a bunch of dulce que lo hizo caer gravemente enfermo.
2	Naively, Doug gave his stepbrother a bunch of candy that made him get very sick.
3	Ingenuamente, Alfredo le dio a su hermanastro un montón de candy that made him get very sick.
4	Ingenuamente, Alfredo le dio a su hermanastro un montón de dulce que lo hizo caer gravemente enfermo.
1	Carol was very proud that her stuffing fit so well with the pavo y otros platillos este Acción de Gracias.
2	Carol was very proud that her stuffing fit so well with the turkey and other entrees this Thankgiving.
3	Camila estaba muy orgullosa de que su relleno quedara tan bien con el turkey and other entrees this Thankgiving.
4	Camila estaba muy orgullosa de que su relleno quedara tan bien con el pavo y otros platillos este Acción de Gracias.
1	The Bradleys like to buy onions and garlic from the granjero cada semana en el mercado local.
2	The Bradleys like to buy onions and garlic from the farmer each week at the local market.
3	A los García les gusta comprar cebollas y ajo del farmer each week at the local market.
4	A los García les gusta comprar cebollas y ajo del granjero cada semana en el mercado local.
1	Jack and Amanda handed out flyers for the venta muy temprano esta mañana.
2	Jack and Amanda handed out flyers for the sale very early this morning.
3	Alma y Alejo repartieron volantes para el sale very early this morning.
4	Alma y Alejo repartieron volantes para la venta muy temprano esta mañana.
1	Sadly, Cheryl forgot the basket for her hija y tuvo que encontrarse con ella con las manos vacías.
2	Sadly, Cheryl forgot the basket for her daughter and had to meet her empty handed.
3	Tristemente, Cheryl olvidó la canasta para su daughter and had to meet her empty handed.
4	Tristemente, Cheryl olvidó la canasta para su hija y tuvo que encontrarse con ella con las manos vacías.
1	The young parents bought a lot of pacifiers and enough ropa para durar hasta el tercer cumpleaños de su bebé.
2	The young parents bought a lot of pacifiers and enough clothes to last until their baby's third birthday.
3	Los jóvenes padres compraron un mónton de chupetes y bastante clothes to last until their baby's third birthday.
4	Los jóvenes padres compraron un mónton de chupetes y bastante ropa para durar hasta el tercer cumpleaños de su bebé.
1	Thomas, look at the ditch next to the columpios en el extremo este del campo de juego.
2	Thomas, look at the ditch next to the swings on the east end of the playground.
3	Tomás, mira la zanja al lado de los swings on the east end of the playground.
4	Tomás, mira la zanja al lado de los columpios en el extremo este del campo de juego.
1	Corey didn't realize he left his cooler on the muelle hasta que fue demasiado tarde.
2	Corey didn't realize he left his cooler on the pier until it was too late.
3	César no se dio cuenta de que dejó su hielera en el pier until it was too late.
4	César no se dio cuenta de que dejó su hielera en el muelle hasta que fue demasiado tarde.
1	Valerie left her wet canvas next to the caballete mientras sus niños pequeños corrían alrededor.
2	Valerie left her wet canvas next to the easel while her young kids were running around.
3	Valentina dejó su lienzo mojado al lado del easel while her young kids were running around.
4	Valentina dejó su lienzo mojado al lado del caballete mientras sus niños pequeños corrían alrededor.
1	Greg put some pencils on his escritorio en cuanto llegó a clase.
2	Greg put some pencils on his desk as soon as he got to class.
3	Gabriel puso algunos lápices en su desk as soon as he got to class.
4	Gabriel puso algunos lápices en su escritorio en cuanto llegó a clase.
1	He was angry because the plug for his plancha no estaba funcionando correctamente.
2	He was angry because the plug for his iron was not working properly.
3	Él estaba enojado porque el enchufe de su iron was not working properly.
4	Él estaba enojado porque el enchufe de su plancha no estaba funcionando correctamente.
1	She thoroughly enjoyed the snow and the paisaje de la cordillera.
2	She thoroughly enjoyed the snow and the landscape of the mountain range.
3	Ella disfrutó plenamente de la nieve y del landscape of the mountain range.
4	Ella disfrutó plenamente de la nieve y del paisaje de la cordillera.

1 The men always choose to drink water with the guiso en lugar de vino.
2 The men always choose to drink water with the stew rather than wine.
3 El hombre siempre elige beber agua con el stew rather than wine.
4 El hombre siempre elige beber agua con el guiso en lugar de vino.
1 The coach emphasized that fearlessness, ruthlessness, and fuerza eran las claves para ganar.
2 The coach emphasized that fearlessness, ruthlessness, and strength were the keys to winning.
3 El entrenador subrayó que la valentía, la misericodia y el strength were the keys to winning.
4 El entrenador subrayó que la valentía, la misericodia y la fuerza eran las claves para ganar.
1 Tiffany wanted for herself the jewels of the kings and reinas de toda Europa.
2 Tiffany wanted for herself the jewels of the kings and queens of all of Europe.
3 Teresa quería para ella las alhajas de los reyes y queens of all of Europe.
4 Teresa quería para ella las alhajas de los reyes y reinas de toda Europa.
1 He had been a locksmith in the condado durante los últimos cinco años.
2 He had been a locksmith in the county for the last five years.
3 Él había sido un cerrajero en el county for the last five years.
4 Él había sido un cerrajero en el condado durante los últimos cinco años.
1 Karina learned about moles, bones, and dientes en su clase de biología.
2 Karina learned about moles, bones, and teeth in her biology class.
3 Carmen aprendió sobre los lunares, los huesos y los teeth in her biology class.
4 Carmen aprendió sobre los lunares, los huesos y los dientes en su clase de biología.
1 For ten years, the old lizard lived in my cobertizo, comiendo ratones y espantando a otras criaturas del pantano.
2 For ten years, the old lizard lived in my shed, eating mice and scaring away the other swamp creatures.
3 Por diez años, el lagarto viejo vivió en mi shed, eating mice and scaring away the other swamp creatures.
4 Por diez años, el lagarto viejo vivió en mi cobertizo, comiendo ratones y espantando a otras criaturas del pantano.
1 She was taken aback by the ugliness of all the grabados de la exposición de arte.
2 She was taken aback by the ugliness of all the engravings in the art exhibit.
3 Ella se sorprendió de la fealdad de todos los engravings in the art exhibit.
4 Ella se sorprendió de la fealdad de todos los grabados de la exposición de arte.
1 Every year, the shopkeeper makes his own juguetes para los niños pequeños.
2 Every year, the shopkeeper makes his own toys for the young children.
3 Cada año, el tendero hace sus propios toys for the young children.
4 Cada año, el tendero hace sus propios juguetes para los niños pequeños.
1 One of the clowns broke through the muro mientras cantaba y bailaba.
2 One of the clowns broke through the wall while singing and dancing.
3 Uno de los payasos rompió el wall while singing and dancing.
4 Uno de los payasos rompió el muro mientras cantaba y bailaba.
1 The teachers take the kids to the libraries and the piscinas para darles a concocer la cultura local.
2 The teachers take the kids to the libraries and the pools to acquaint them with the local culture.
3 Los maestros llevan a los niños a las bibliotecas y los pools to acquaint them with the local culture.
4 Los maestros llevan a los niños a las bibliotecas y las piscinas para darles a concocer la cultura local.
1 Very little remained of the path and all the setos después de las Fuertes lluvias.
2 Very little remained of the path and all the hedges after the heavy rain.
3 Muy poco quedaba del sendero y todos los hedges after the heavy rain.
4 Muy poco quedaba del sendero y todos los setos después de las fuertes lluvias.
1 Olivia tried to find her lost earring in the pasillo de aquel hotel tan grande.
2 Olivia tried to find her lost earring in the hallway of the very large hotel.
3 Olivia trató de encontrar su arete perdido en el hallway of the very large hotel.
4 Olivia trató de encontrar su arete perdido en el pasillo de aquel hotel tan grande.
1 They raced from the fence to the gradas diez veces antes de decidir quién era más rápido.
2 They raced from the fence to the bleachers ten times before deciding who was faster.
3 Ellos corrieron de la cerca a los bleachers ten times before deciding who was faster.
4 Ellos corrieron de la cerca a las gradas diez veces antes de decidir quién era más rápido.
1 She looked at the screen next to the pizarra y alzó la mano para contestar la pregunta.
2 She looked at the screen next to the chalkboard and raised her hand to answer the question.
3 Ella miró la pantalla junto al chalkboard and raised her hand to answer the question.
4 Ella miró la pantalla junto a la pizarra y alzó la mano para contestar la pregunta.
1 This morning, Joel was craving eggs with some tocino o salchichas al lado.
2 This morning, Joel was craving eggs with some bacon or sausage on the side.
3 Esta mañana, a Joel se le antojaban huevos con un poco de bacon or sausage on the side.
4 Esta mañana, a Joel se le antojaban huevos con un poco de tocino o salchichas al lado.
1 He won't eat anything but mushrooms with those costillas y se niega a pedir algo diferente.
2 He won't eat anything but mushrooms with those ribs and refuses to order something different.
3 Él no quiere comer nada sino champiñones con esos ribs and refuses to order something different.
4 Él no quiere comer nada sino champiñones con esas costillas y se niega a pedir algo diferente.
1 Heather only dares to make pork on the parrilla cuando su marido está alrededor para venir al rescate.
2 Heather only dares to make pork on the grill when her husband is around for damage control.
3 Guadalupe sólo se atreve a hacer cerdo en el grill when her husband is around for damage control.
4 Guadalupe sólo se atreve a hacer cerdo en la parrilla cuando su marido está alrededor para venir al rescate.
1 They were not expecting the lightning or the granizada y tuvieron que correr rápidamente por seguridad.
2 They were not expecting the lightning or the hailstorm and had to quickly run to safety.
3 Ellos no esperaban los relámpagos o el hailstorm and had to quickly run to safety.
4 Ellos no esperaban los relámpagos o la granizada y tuvieron que corer rápidamente por seguridad.
1 By learning from wars and performance in siglos pasados, hemos mejorado nuestras estrategias militares de manera exponencial.
2 By learning from wars and performance in centuries past, we have improved our military strategies exponentially.

3 Al aprender de las guerras y del desempeño en centuries past, we have improved our military strategies exponentially.
4 Al aprender de las guerras y del desempeño en siglos pasados, hemos mejorado nuestras estrategias militares de manera exponencial.
1 In the fall, Michael harvests wheat and other siembras para vender en el mercado.
2 In the fall, Michael harvests wheat and other crops to sell in the market.
3 En el otoño, Miguel cosecha trigo y otros crops to sell in the market.
4 En el otoño, Miguel cosecha trigo y otras siembras para vender en el mercado.
1 After the noise complaint, the landlord spoke to the inquilino en privado y le dio una severa advertencia.
2 After the noise complaint, the landlord spoke to the tenant privately and gave him a severe warning.
3 Después de la queja por ruidos, el dueño habló con el tenant privately and gave him a severe warning.
4 Después de la queja por ruidos, el dueño habló con el inquilino en privado y le dio una severa advertencia.
1 He likes having his livestock next to the huerta porque facilita mantener un ojo en todo.
2 He likes having his livestock next to the orchard because it makes it easier to keep an eye on everything.
3 A él le gusta tener su granado al lado del orchard because it makes it easier to keep an eye on everything.
4 A él le gusta tener su granado al lado de la huerta porque facilita mantener un ojo en todo.
1 She always stores the wheelbarrow under a estante en su granero enorme.
2 She always stores the wheelbarrow under a shelf in her enormous barn.
3 Ella siempre pone la carretilla abajo de un shelf in her enormous barn.
4 Ella siempre pone la carretilla abajo de un estante en su granero enorme.
1 Sammy was displeased that the loudspeaker next to the buzones aún estaba roto a pesar de muchas llamadas al encargado.
2 Sammy was displeased that the loudspeaker next to the mailboxes was still broken despite many calls to the superintendent.
3 Salvador estaba molesto porque el altavoz al lado de los mailboxes was still broken despite many calls to the superintendent.
4 Salvador estaba molesto porque el altavoz al lado de los buzones aún estaba roto a pesar de muchas llamadas al encargado.
1 The Greeks felt a great surge of achievement and orgullo después de que derrotaran a los persas.
2 The Greeks felt a great surge of achievement and pride after they defeated the Persians.
3 Los griegos sintieron una gran oleada de logro y pride after they defeated the Persians.
4 Los griegos sintieron una gran oleada de logro y orgullo después de que derrotaran a los persas.
1 She bought these paintbrushes for the retrato que se volvió muy famoso.
2 She bought these paintbrushes for the portrait that became very famous.
3 Ella compró estos pinceles para el portrait that became very famous.
4 Ella compró estos pinceles para el retrato que se volvió muy famoso.
1 The left lane of the highway is closed due to inundaciones por el resto de la semana.
2 The left lane of the highway is closed due to flooding for the rest of the week.
3 El carril izquierdo de la autopista está cerrado debido al flooding for the rest of the week.
4 El carril izquierdo de la autopista está cerrado debido a las inundaciones por el resto de la semana.
1 Even though he was in pain, the handyman climbed to the techo para trabajar desde un ángulo mejor.
2 Even though he was in pain, the handyman climbed to the roof to work from a better angle.
3 A pesar de que estaba dolorido, el manitas se subió al roof to work from a better angle.
4 A pesar de que estaba dolorido, el manitas se subió al techo para trabajar desde un ángulo mejor.
1 Yesterday, Jennifer purchased soaps for the ducha del baño de arriba.
2 Yesterday, Jennifer purchased soaps for the shower in the upstairs bathroom.
3 Ayer, Jenifer compró jabones para el shower in the upstairs bathroom.
4 Ayer, Jenifer compró jabones para la ducha del baño de arriba.
1 They carefully lifted the bookcase onto the montacargas y se alejaron lentamente.
2 They carefully lifted the bookcase onto the forklift and slowly drove away.
3 Ellos levantaron cuidadosamente la estantería en el forklift and slowly drove away.
4 Ellos levantaron cuidadosamente la estantería en el montacargas y se alejaron lentamente.
1 The king rode an ostrich across the puente hacia las tierras adyacentes.
2 The king rode an ostrich across the bridge into the adjacent lands.
3 El rey montó un avestruz a través del bridge into the adjacent lands.
4 El rey montó un avestruz a través del puente hacia las tierras adyacentes.
1 The loose sheets fell out of her briefcase into the charco mientras caminaba por la calle.
2 The loose sheets fell out of her briefcase into the puddle while walking down the street.
3 Las hojas sueltas se cayeron de su maletín en el puddle while walking down the street.
4 Las hojas sueltas se cayeron de su maletín en el charco mientras caminaba por la calle.
1 This year, his niece wants a helmet and patines para su cumpleaños.
2 This year, his niece wants a helmet and skates for her birthday.
3 Este año, su sobrina quiere un casco y skates for her birthday.
4 Este año, su sobrina quiere un casco y patines para su cumpleaños.
1 He turned on the heater in the lavadero y continuó con su proyecto.
2 He turned on the heater in the washroom and continued his project.
3 Él prendió el calentador en el washroom and continued his project.
4 Él prendió el calentador en el lavadero y continuó con su proyecto.
1 To make matters worse, he found bedbugs in addition to the hormigas que ya estaban causando problemas a los propietarios.
2 To make matters worse, he found bedbugs in addition to the ants that were already causing problems for the homeowners.
3 Para empeorar las cosas, él encontró chinches además de los ants that were already causing problems for the homeowners.
4 Para empeorar las cosas, él encontró chinches además de las hormigas que ya estaban causando problemas a los propietarios.
1 Phil and Jamie played with their puzzles on the colcha hasta que fue hora de ver la televisión.
2 Phil and Jamie played with their puzzles on the quilt until it was time to watch television.
3 Adriana y Liliana jugaron con su rompecabezas en el quilt until it was time to watch television.
4 Adriana y Liliana jugaron con su rompecabezas en la colcha hasta que fue hora de ver la televisión.
1 She didn't want to leave the snacks with the gemelos por miedo a que hubiera un gran lío cuando regresara.
2 She didn't want to leave the snacks with the twins for fear that there would be a huge mess when she returned.
3 Ella no quería dejar las meriendas con los twins for fear that there would be a huge mess when she returned.
4 Ella no quería dejar las meriendas con los gemelos por miedo a que hubiera un gran lío cuando regresara.

1	Anne was overwhelmed by the loan on her hipoteca pero no había nada que pudiera hacer al respecto.
2	Anne was overwhelmed by the loan on her mortgage but there was nothing she could do about it.
3	Ana estaba abrumada por el préstamo de su mortgage but there was nothing she could do about it.
4	Ana estaba abrumada por el préstamo de su hipoteca pero no había nada que pudiera hacer al respecto.
1	He walked outside to find drenched furniture near the rociadores y su ánimo al instante se volvió agrio.
2	He walked outside to find drenched furniture near the sprinklers and his mood instantly turned sour.
3	Él salió y encontró los muebles empapados cerca de los sprinklers and his mood instantly turned sour.
4	Él salió y encontró los muebles empapados cerca de los rociadores y su ánimo al instante se volvió agrio.
1	With the help of a crane, he moved boxes full of herramientas y materiales de construcción.
2	With the help of a crane, he moved boxes full of tools and building supplies.
3	Con la ayuda de una grúa, él trasladó cajas llenas de tools and building supplies.
4	Con la ayuda de una grúa, él trasladó cajas llenas de herramientas y materiales de construcción.
1	She bought more hairspray as well as afeitadoras ya que estaba a punto de quedarse sin los dos.
2	She bought more hairspray as well as razors since she was close to running out of both.
3	Ella compró más laca además de razors since she was close to running out of both.
4	Ella compró más laca además de afeitadoras ya que estaba a punto de quedarse sin los dos.
1	Whether it's the dishwasher or the secadora, Consuelo odia todo lo que tiene que ver con la limpieza.
2	Whether it's the dishwasher or the dryer, Kathy hates everything to do with cleaning.
3	Ya sea el lavaplatos o el dryer, Kathy hates everything to do with cleaning.
4	Ya sea el lavaplatos o la secadora, Consuelo odia todo lo que tiene que ver con la limpieza.
1	She fixed the ripped sleeve of the sudadera porque no pudo soportar desprenderse de ella.
2	She fixed the ripped sleeve of the sweatshirt because she couldn't bear to part with it.
3	Ella arregló la manga rasgada del sweatshirt because she couldn't bear to part with it.
4	Ella arregló la manga rasgada de la sudadera porque no pudo soportar desprenderse de ella.
1	Gabriella ended up with a bruise on her espalda después de una noche escandalosa.
2	Gabriella ended up with a bruise on her back after a rowdy night out.
3	Gabriella acabó con un moretón en su back after a rowdy night out.
4	Gabriella acabó con un moretón en su espalda después de una noche escandalosa.
1	They rushed to the courthouse after the tiroteo que causó estragos en muchas personas.
2	They rushed to the courthouse after the shooting that caused havoc for many people.
3	Ellos corrieron al juzgado después del shooting that caused havoc for many people.
4	Ellos corrieron al juzgado después del tiroteo que causó estragos en muchas personas.
1	He was given an award for his deportividad durante el torneo.
2	He was given an award for his sportsmanship during the tournament.
3	A él le dieron un premio por su sportsmanship during the tournament.
4	A él le dieron un premio por su deportividad durante el torneo.

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