Cross-linguistic influence from Catalan and Yucatec Maya on judgments and processing of Spanish focus

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Abstract

Although a bilingual's knowledge of one language can affect the other, cross-linguistic influence (CLI) is constrained: certain domains, such as the syntax-discourse interface, are more likely to be affected. Linguists have debated CLI's nature and cause: the Structural Overlap Hypothesis identifies surface overlap between the languages as the key factor determining CLI, while the Interface Hypothesis highlights the role of processing overloads. Our study presents evidence from processing and judgments of a syntax-discourse interface property—information focus—in the Spanish of Yucatecan Spanish monolinguals, Yucatec Maya-Spanish bilinguals, and Catalan-Spanish bilinguals. The comparison across language dyads that realize information focus in different ways allows us to test predictions for language-specific effects of CLI. Using a forced-choice task to measure offline sentence preferences and a self-paced reading task to measure real-time processing, we find (i) language-specific CLI for Yucatec Maya bilinguals but (ii) no CLI for Catalan bilinguals and (iii) no significant differences in real-time processing. We conclude that these results provide partial support for the Structural Overlap Hypothesis but do not align with the Interface Hypothesis. We also examine the role of language dominance on CLI but find no such effects.

Keywords: cross-linguistic influence, Structural Overlap Hypothesis, Interface Hypothesis, focus, information structure, Yucatec Maya, Catalan, Spanish

1. Introduction

A central question of bilingualism research asks how simultaneous bilinguals organize their two languages, including whether they start as a single system or develop autonomously (de Houwer, 1990; Meisel, 1989). Because research has largely sided with accounts proposing separate geneses (see Kupisch, 2007), a natural segue is to ask whether—and if so, how—the two languages influence each other throughout the bilingual lifespan—the question of **crosslinguistic influence (CLI)**. Within research on late sequential L2 acquisition, CLI has typically been framed via the construct of 'transfer,' and it is generally accepted that the initial states for first- and second-language acquisition are distinct, with studies showing that the first language's linguistic properties are transferred into the second (Schwartz & Sprouse, 1996; Slabakova, 2008). Recent evidence has also shown that CLI is not unidirectional, such that the L2 can influence L1 processing (Dussias, 2004), and that relative dominance can play a role (Kupisch, 2007). Additionally, CLI can occur in real time: bilinguals activate their languages in parallel, with data showing between- and within-language competition as well as simultaneous activation when bilinguals process and produce language (e.g., Marian & Spivey, 2003).

In this landscape, we examine the locus of CLI in bilinguals: whether this influence is intensified when a structure requires the integration of linguistic and nonlinguistic knowledge, as proposed by the Interface Hypothesis (Sorace, 2011), or whether structural overlap between the two languages at the surface level also plays a particularly important role (Müller & Hulk, 2001). The structure we use to answer these research questions is the expression of *information focus* in Spanish in contact with Catalan and Yucatec Maya, languages that express focus differently from each other and from Spanish, providing the potential opportunity to observe CLI. Because information focus involves syntactic operations that respond to discourse constraints, the realization of information focus constitutes a suitable structure to test the claims of the Interface Hypothesis and to explore the role of structural overlap.

2. Crosslinguistic Influence in Bilingualism

While there is plentiful evidence CLI operates across myriad linguistic domains (Slabakova, 2008; White, 2003), researchers have proposed that CLI transpires in linguistically constrained ways. One constraint concerns the linguistic modules involved: researchers have proposed that the acquisition of structures at the syntax-discourse interface is particularly effortful. On one hand, there exists independent *experimental* evidence of protracted acquisition by monolingual children when constructions integrate syntax and discourse constraints (e.g., topicalization or object drop; see Müller & Hulk, 2001). On the other hand, a modular view of grammar makes a *theoretical* distinction between internal interfaces (e.g., syntax-semantics) and those involving grammar-external modules (e.g., syntax-discourse; Fodor, 1983; Jackendoff, 2002).

Sorace (2011) uses this theoretical distinction to formulate the **Interface Hypothesis** (henceforth IH**),** which predicts that bilinguals will display variable rule application ("optionality") at the syntax-discourse interface but not when internal interfaces or 'core syntax' are involved. Crucially for our purposes, Sorace excludes CLI as the main source of difficulties, reasoning that even languages that could evince positive transfer show evidence of optionality when external interfaces are involved. She highlights studies where speakers of two null-subject languages, which express null and overt subjects in analogous ways, cannot resolve anaphora in a native-like fashion (Bini, 1993; Sorace et al., 2009). Based on data from Sorace and Serratrice's (2009) study, Sorace (2012, p. 212) proposed that CLI "applie[d] only to the syntax-semantics interface but not to the syntax-pragmatics interfaces," while highlighting that this does not mean the syntax-semantics interface is wholly "immune to problems."

Sorace identifies, instead, *taxed resources* as the source of protracted acquisition at external interfaces; optionality is thus a biproduct of bilingualism, so to speak. Bilinguals must use additional resources to inhibit one of their languages due to parallel activation, which, by hypothesis, leads to variable/optional application of language rules when information is integrated across external modules.

Recently, Kubota et al. investigated, in the context of Japanese-English returnees, whether CLI could explain their choice of genitive forms (*Mary's book* vs. *the book of Mary*) and ultimately concluded that "processing difficulties in resolving such conflicts provide a better explanation for the observed behavior than does CLI from L1 to L2, as the Interface Hypothesis would predict" (Kubota et al., 2020, p. 19). An important corollary of the Interface Hypothesis, then, is that bilinguals will *not* show language-specific effects.

However, the proverbial jury is still out, since other evidence shows that syntax-discourse interface properties are not always destined for optionality (Gupton & Sánchez Calderón, 2021; Hopp, 2009; Ivanov, 2009; Leal et al., 2017; Smeets, 2019; a.o.). The studies that have found evidence against the IH differ in two important dimensions: the property/construction under study and whether the study used online methods. While studies of anaphora resolution typically show difficulties with the syntax-discourse interface (e.g., Belletti et al., 2007), those testing other constructions do not always show optionality. For instance, experiments testing clitic left dislocation (CLLD), which marks topics, have generally found that bilinguals show no special difficulty with the interface either with offline methods (Ivanov, 2009; Leal, 2016, 2018; Slabakova et al., 2011; Smeets, 2020) or with methods that are online (Leal et al., 2017) or tax the processor via time pressure (Sequeros-Valle et al., 2020). Similarly, studies testing information focus have provided mixed results (e.g., Leal et al., 2019; Lozano, 2006), although only one study provides online evidence against the hypothesis (Leal & Hoot, submitted).[1] Our current aim is to contribute to this literature with a battery of tasks including an online measure.

Other researchers propose L1/L2 surface similarity plays a role in the acquisition of external interface structures (Müller & Hulk, 2001). In their seminal study, Müller and Hulk suggested CLI transpires when a bilingual's languages "overlap" in their surface realizations of syntax-pragmatics structures. (We call this proposal the Structural Overlap Hypothesis, following Kupisch, 2012.) This is

[1] Additionally, Cuza (2012) has also provided evidence that even purely syntactic phenomena (viz., SV inversion in interrogatives) appear to give rise to optionality, which is not predicted by the IH.

because the bilingual child could potentially misanalyze structures showing surface-level overlap in the two languages. If language X has a structure that can be analyzed in multiple ways, but language Y provides evidence for only one analysis, the child could misinterpret language X's input. Under this operationalization, CLI comes about when one language has two options and the other only one. Crucially, the overlapping option will be extended to inappropriate contexts in the language with two options (see Figure 1).

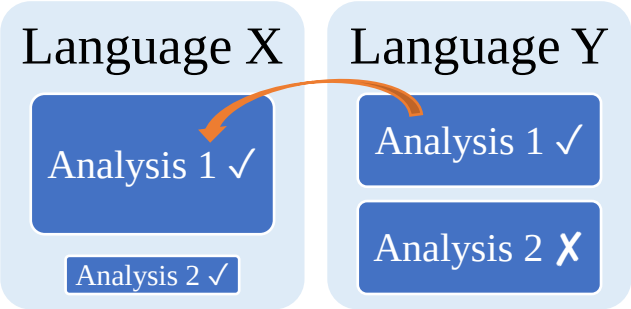

Figure 1. Structural Overlap Hypothesis (Müller & Hulk 2001).

Müller and Hulk formulated this hypothesis to explain apparent delays in acquisition among bilingual children, but scholars have extended Müller and Hulk's insight to adult bilingual grammars. For instance, Kupisch (2012) examined L2 acquisition of Italian generic and specific reference by L1 German adults. Under Kupisch's definition, two structures overlap if they occur in the same context. In this context, German has two options: DPs that mark the subject as specific, and bare NPs marking subjects as generic. Italian has only one option—DPs mark both specific and generic subjects. Kupisch predicts that structural overlap entails influence from Italian into German, such that DPs could be infelicitously used in German to mark both generic and specific subjects. In this formulation, Kupisch's operationalization incorporates insights from the field of language contact, which has conceptualized CLI at the syntax/pragmatics interface as the application of pragmatic rules from one language on the syntactic structures of the other (Prince,

1988, 1998; Silva-Corvalán, 1993, 1994, 2008). In this view, pragmatic rules from Italian—DPs mark specificity and genericity—are applied to the overlapping syntactic structures in German.

However, Kupisch's operationalization is not without alternatives. For instance, Italian allows bare NPs in "very restricted contexts" (Kupisch, 2012, p. 741). Thus, *within* generic contexts, German has one option—bare NPs—while Italian has two—a very limited set of bare NPs and (more commonly used) DPs. Under these assumptions, Müller and Hulk's prediction would be the opposite: influence from German into Italian. Our point is not to criticize Kupisch's operationalization, but rather to highlight that what counts as structural overlap is not necessarily straightforward and must be made explicit. We operationalize structural overlap for the languages under study in §4.

Other factors may also be important, including language dominance. Although the construct of language dominance means different things in different contexts, there is overall agreement that it "involves the relationship between competencies in two languages" (Gertken et al., 2014, p. 211), and, as such, it constitutes a relative measurement. Based on child longitudinal data, Kupisch (2007) concluded that both language-internal factors (structural similarity) and language-external factors (dominance) predict CLI. Kupisch (2014) refines this view, taking dominance to be a quantitative factor modulating the *degree* of CLI, while language-internal factors determine *which structures* are vulnerable to it. In short, structural overlap determines the linguistic features affected by CLI, while dominance predicts the degree of influence, with more balanced bilinguals showing less CLI.

Both hypotheses we consider take the syntax-discourse interface to be a locus of special difficulty, albeit for different reasons. We turn now to the linguistic structure we use to test them.

3. Focus

A sentence conveying a particular proposition can take different forms depending on its context. Parts of the sentence may present *given* or *background* information, belonging to the common ground, while others present new or non-presupposed information: the *focus* of that sentence, which can be expressed in

one constituent (*narrow focus*) or a whole sentence (*broad focus*). Focus is thus determined by the discourse context. We use *information focus* as our test case because it minimally involves syntax, phonology, and discourse/pragmatics: precisely the sort of structure vulnerable to CLI.

Focal constituents are associated with prominence, realized via syntactic, prosodic, or morphological means that vary crosslinguistically. Typologies of focus identify these according to their pragmatic meaning (Büring, 2009; Krifka, 2007). Here we only consider *information* or *presentational focus*, excluding others (e.g., contrastive), which have different syntactic and prosodic properties. Information focus, which represents the information the speaker assumes is not shared by their hearer (Jackendoff, 1972), is commonly identified using the *wh*-question diagnostic—the constituent answering a *wh*-question is the focus. In (1), the *wh*-question creates a context for subject focus, while in (2), the direct object is in focus.

(1) Who hugged the wildebeest? Subject focus

[Zac]$_F$ hugged the wildebeest.

(2) What did Kalyani put in the bathtub? Object focus

Kalyani put [the platypus]$_F$ in the bathtub.

Throughout this paper, when we say "focus" for brevity's sake, we mean *narrow information focus*.

We examine focus in Spanish in contact with Yucatec Maya and Catalan, two typologically distinct languages that realize focus differently from each other and from Spanish. Comparing speakers of languages with different properties provides an ideal context to determine whether we observe language-specific CLI or non-specific effects of bilingualism. To understand this phenomenon in Spanish, and how the other two languages might affect it, we present the properties of focus realization for each in turn.

3.1. Focus in Spanish

In Spanish, speakers often order their sentences by placing given information first, followed by new information (Bolinger, 1954), making Spanish an example of a language that primarily uses syntactic reordering to mark information structure.[2] Most research in syntactic theory has examined the causes and types of focus movement, under the assumption that Spanish focus appears obligatorily rightmost (see, inter alia, Büring & Gutiérrez-Bravo, 2001; Contreras, 1978; Escandell Vidal & Leonetti, 2019; Zubizarreta, 1998). Such approaches often explore the mechanism of the syntactic movement that produces rightmost focus, e.g. by tying prosodic stress to the sentence's right edge and requiring that the focus be stressed, resulting in rightmost focus alignment (Büring & Gutiérrez-Bravo, 2001; Zubizarreta, 1998). However, most experimental/quantitative work on Spanish focus provides a different view (see Hoot et al., 2020, p. 22 for a comprehensive summary). While there is an association between rightmost position and focus interpretation (e.g., Domínguez, 2013; Feldhausen & Vanrell, 2014; Heidinger, 2015; Hertel, 2003; Hoot et al., 2020; Hoot & Leal, 2020; Lozano, 2006), canonical word orders can be used to realize focus on a constituent *in situ*, requiring no syntactic movement (e.g., Gabriel, 2010; Hoot, 2016; Hoot et al., 2020; Leal et al., 2018; Muntendam, 2013).

Subject and object focus have minimally two possible realizations, shown in (3) and (4). However, in most experiments (production/judgments), speakers prefer to mark focus in situ when canonical order is available (e.g., Gabriel, 2010; Hoot, 2016; Hoot et al., 2020).

(3) Who hugged the wildebeest? — Subject focus

a. $[Zac]_F$ abrazó a-l ñu. — In situ (canonical): S_FVO

Z hugged ACC-the wildebeest

b. Abrazó a-l ñu $[Zac]_F$. — Movement: VOS_F

hugged ACC-the wildebeest Z

[2] Prosody also plays a key role in focus realization in Spanish (the focal constituent is usually stressed); we concentrate here on word order because it has received the most attention in the literature and our experiment tests it.

'Zac hugged the wildebeest.'

(4) What did Kalyani put in the bathtub? — Object focus

a. Puso [a-l ornitorrinco]$_F$ en la bañera. — In situ (canonical): VO$_F$PP
she.put ACC-the platypus in the bathtub

b. Puso en la bañera [a-l ornitorrinco]$_F$. — Movement: VPPO$_F$
she.put in the bathtub ACC-the platypus
'She put the platypus in the bathtub.'

Non-discourse factors—including which constituent is focalized, what arguments are present, and whether orders are (non)canonical—also affect focus realization (see Hoot et al., 2020; Hoot & Leal, 2020). Non-final realizations of subject focus are less acceptable when the non-final order is not the canonical SVO order (5a). On the other hand, both final and non-final subject focus are more acceptable when the object is cliticized (5b-c).

(5) Who hugged the wildebeest? — Subject focus

a. # Abrazó [Zac]$_F$ a-l ñu. — #VS$_F$O
hugged Z ACC-the wildebeest
'Zac hugged the wildebeest.'

b. Lo abrazó [Zac]$_F$. — clVS$_F$
CL.ACC hugged Z
'Zac hugged it.'

c. [Zac]$_F$ lo abrazó. — S$_F$clV

Because our study concerns Spanish in contact with Yucatec Maya and Catalan, it also involves two distinct Spanish varieties: Yucatecan (Merida) and Catalonian (Barcelona). We thus acknowledge that

there may be differences by dialect. For example, Gutiérrez-Bravo (2020) and Gutiérrez-Bravo et al. (2019) have pointed out some ways Yucatecan Spanish differs from other varieties in Mexico, especially regarding certain fronting constructions. Yet few studies have systematically investigated the effect of dialectal variation on Spanish information structure. We previously reported some comparisons between these dialects and found little difference (Anonymous 2020); the present study builds on our previous work by examining CLI in bilinguals, and it includes control groups within each dialect to help distinguish CLI from regional differences.

With this description of Spanish focus in mind, what would CLI from Yucatec Maya or Catalan look like? To understand the possibilities, we turn to a description of focus in those languages.

3.2. Focus in Yucatec Maya

Unlike Spanish, Yucatec Maya has a dedicated left-periphery focus position; focal constituents generally move to a position immediately left of the verb.[3] Non-focal constituents may be realized in a post-verbal (in-situ) position, although two other options exist. First, given arguments in Yucatec Maya can be elided. Second, non-focal constituents can be the sentence's topic, which has its own dedicated left-peripheral position and a special morphological marking. (See Gutiérrez-Bravo, 2015, Chapter 2; Verhoeven & Skopeteas, 2015 for details.)

Verhoeven and Skopeteas (2015) found, using a production experiment, that subject information focus was invariably realized via SVO order (6a), or SV if the object is elided (6b). Unlike in Spanish, focused subjects in Yucatec Maya *cannot* be left in situ (6c); they must be moved to pre-verbal position.

[3] Some researchers contend fronted foci are actually clefts (e.g., Tonhauser, 2003), and some that they are always contrastive, information focus being realized in situ (e.g., Gutiérrez-Bravo & Monforte, 2011). We adopt Gutiérrez-Bravo's (2017) monoclausal analysis of fronting and follow Verhoeven and Skopeteas (2015) and Kügler et al. (2007) in assuming it can realize all focus types.

(6) Who ate an avocado?[4] Subject focus

a. [Pèedróoh]$_F$ hàant òon. Movement: S_FVO

Pedro eat:TRR(SUBJ)(B.3.SG) avocado

'Pedro ate an avocado.'

b. [Pèedróoh]$_F$ hàant. Movement: S_FV

Pedro eat:TRR(SUBJ)(B.3.SG)

c. # T=u hàant-ah òon [Pèedróoh]$_F$. # In situ: VOS_F

PFV=A.3 eat:TRR-CMP(B.3.SG) avocado Pedro

Verhoeven and Skopeteas (2015) found more variability for object focus in simple transitives, while fronting the object (OVS) was the most common production. More broadly, leftward movement applies to other constituents in focus, including PPs and adverbs (Skopeteas & Verhoeven, 2012). In ditransitive sentences (canonically VOSPP), object focus (7) and PP focus (8) result in focus movement (Skopeteas, p.c.).

(7) What did María give to Pedro? Object focus

Jun-p'éel áanalte' t=u ts'a'-aj Maariáaj ti' Peedróoj. Movement: O_FVSPP

one-CL.IN book PFV=A.3 give-CMPL(B.3) María LOC Pedro

'Maria gave one book to Pedro.'

[4] Examples are from Verhoeven and Skopeteas (2015) and Skopeteas (p.c); spelling and glosses vary slightly by original source. The word *tu* is a perfective auxiliary. A and B on the auxiliary and verb are agreement markers that, by convention, Mayanists call "Set A" and "Set B." Subject fronting is known as Agent Focus which has a special verb form: the auxiliary is dropped and the verb appears without agreement affixes. See Coon (2016) and Gutiérrez-Bravo (2015).

(8) Who did María give one book to? PP focus

Ti' Peedróoj t=u ts'a'-aj jun-p'éel áanalte' Maariáaj. Movement: $PP_F VOS$

LOC Pedro PFV=A.3 give-CMPL(B.3) one-CL.IN book María

'Maria gave one book to Pedro.'

To summarize, focal constituents in Yucatec Maya, unlike in Spanish, generally move immediately left of the verb.

3.3. Focus in Catalan

Catalan also uses syntactic movement for information-structural purposes, but, unlike Yucatec Maya, which moves the focus to a specific position, Catalan dislocates *non-focal* material so that whatever is left behind is interpreted as information focus. Non-focal constituents inside VP must be dislocated to the right or left edge to escape the focal domain and avoid a focus interpretation, producing, for instance, clitic left dislocation (CLLD) or clitic right dislocation (CLRD) (López, 2009; Vallduví, 1992). For example, a direct object cannot be made prominent in situ with canonical word order (9a); rather, its accompanying PP must be dislocated to the left (9b) or right (9c). Similarly, focus on the PP produces object dislocation (10). In each case, the non-focal constituent is dislocated, leaving the VP-internal constituent to receive focus interpretation.

(9) What did you put in the drawer? Object focus

a. # Vaig ficar [el ganivet]$_F$ al calaix. #VO_FPP

PAST.1SG put the knife in-the drawer

b. Al calaix, hi vaig ficar [el ganivet]$_F$. VO_F w/ CLLD

in-the drawer CL.LOC PAST.1SG put the knife

c. Hi vaig ficar [el ganivet]$_F$, al calaix. VO_F w/ CLRD

CL.LOC PAST.1SG put the knife in-the drawer

'I put the knife in the drawer.'

(10) Where did you put the knife? PP Focus

a. # Vaig ficar el ganivet [al calaix]$_F$. #VOPP$_F$

PAST.1SG put the knife in-the drawer

b. El ganivet, el vaig ficar [al calaix]$_F$. VPP$_F$ w/ CLRD

the knife CL.ACC PAST.1SG put in-the drawer

c. El vaig ficar [al calaix]$_F$, el ganivet. VPP$_F$ w/ CLRD

CL.ACC PAST.1SG put in-the drawer the knife

'I put the knife in the drawer.'

Spanish also allows dislocations, but Spanish and Catalan dislocation operations are not equivalent. First, Spanish can plainly make foci prominent within VP without dislocation, unlike Catalan. Second, certain dislocations—CLRD in particular—are more productive strategies in Catalan than Spanish (Villalba, 2011). Third, scrambling arguments *within* the VP is common in Spanish—see (4b)—but ungrammatical in Catalan—see (11a) (López 2009; Vallduví 1992). Fourth, *focus fronting* operations are restricted to contrastive focus in Spanish, whereas it can realize information focus in Catalan (11b; CAPS indicate emphatic stress) (Domínguez, 2002; Feldhausen & Vanrell, 2014; Vallduví, 1992).

(11) What did you put in the drawer? Object focus

a. * Vaig ficar al calaix [el ganivet]. *VPPO$_F$

PAST.1SG put in-the drawer the knife

b. [El GANIVET]$_F$ vaig ficar al calaix. O$_{FF}$VPP

the knife PAST.1SG put in-the drawer

'I put the knife in the drawer.'

For subject focus, Catalan favors dislocation of non-focal constituents resulting in subject-final order, as in (12a-b); in these examples, the non-focal object *els mobles* 'the furniture' is extracted from the clause via CLRD or CLLD and the subject appears clause-finally. Spanish-like patterns are unavailable: SVO (12c) and VOS (12d) are generally (not universally) regarded as infelicitous (López, 2009; Vallduví, 1992), while VSO (12e) is ungrammatical (Gallego, 2013).

(12) Who bought the furniture? Subject focus

a. Els va comprar [en Joan]$_F$, els mobles. VS_F w/ CLRD
CL.ACC PAST.3SG buy the Joan the furniture

b. Els mobles, els va comprar [en Joan]$_F$. VS_F w/ CLLD
the furniture CL.ACC PAST.3SG buy the Joan

c. #[En Joan]$_F$ va comprar els mobles. #S_FVO
the Joan PAST.3SG buy the furniture

d. #Va comprar els mobles [en Joan]$_F$. #VOS_F
PAST.3SG buy the furniture the Joan

e. *Va comprar [en Joan]$_F$ els mobles. *VS_FO
PAST.3SG buy the Joan the furniture
'Joan bought the furniture.'

Table 1 summarizes the facts across languages for the structures we test.

Table 1

Cross-linguistic comparison

	Spanish	**Yucatec Maya**	**Catalan**
Subject Focus			
VSO	#	#	*
VOS	✓	#	#
Notes	VSO for S focus dispreferred in judgments and processed slower (Hoot & Leal, 2020). Both grammatical.	S-initial the only option for S focus (Gutiérrez-Bravo & Monforte, 2011; Kügler et al., 2007; Verhoeven & Skopeteas, 2015).	VSO ungrammatical (Gallego, 2013); non-focal objects must be dislocated (López, 2009; Vallduví, 1992).
Object Focus			
VOPP	✓	#	#
VPPO	Possible but dispreferred	#	*
Other (OVPP)	#	✓	✓
Notes	VOPP overwhelmingly preferred and processed faster (Hoot et al., 2020). VOPP most common in production (Gabriel, 2010; Hoot et al., 2020), but VPPO possible and judged favorably (Feldhausen & Vanrell, 2014; Hoot, 2016). Fronting seldom preferred/attested but grammatical (Hoot et al., 2020).	Focused objects generally fronted (Skopeteas, p.c.; Verhoeven & Skopeteas, 2015)	In-situ focus without dislocating the PP infelicitous; VPPO not grammatical (López, 2009; Vallduví, 1992). Dislocation of PP might be preferred, but fronting attested for information focus (Feldhausen & Vanrell, 2014; Vallduví, 1992).
PP focus			
VOPP	✓	#	#
VPPO	#	#	*
Other (PPVO/CLRD)	Possible but dispreferred	✓ (PPVO)	✓ (CLRD)
Notes	VOPP overwhelmingly preferred and processed faster, while fronting or CLRD are less preferred and rarely produced while being grammatical (Hoot et al., 2020).	Focused PPs fronted (Skopeteas, p.c.; Skopeteas & Verhoeven, 2012; Verhoeven & Skopeteas, 2015).	In-situ focus without dislocating the O is infelicitous, and VPPO is not grammatical; the ideal realization of PP focus involves right-dislocation of O (López, 2009; Vallduví, 1992).

4. The present study: RQs and predictions

We postulate four research questions for CLI on focus in Spanish.

(13) Research questions

a. RQ1: Do we observe language-specific effects from Catalan and Yucatec Maya in speakers' judgments?

b. RQ2: Do we observe language-specific effects from Catalan and Yucatec Maya in speakers' online processing?
c. RQ3: If language-specific effects are observed, do we find evidence that CLI is exacerbated in cases when there is structural overlap?
d. RQ4: Can language dominance explain any observed language-specific differences in judgments or processing?

The hypotheses in §2 make different predictions for our questions. The **Interface Hypothesis** predicts we will observe non-language-specific optionality: variable rule application due to processing overload should apply to both language dyads, so we should not observe differences among groups or linguistic structures. We might, however, observe differences by method: measuring real-time processing may reveal variability that offline tasks mask. Indeed, Sorace (2011) argues that offline tasks cannot test the IH.

The **Structural Overlap Hypothesis**, instead, predicts language-specific CLI. Predictions are directional: influence will be evinced from the language with one option into the language with two. Thus, its predictions differ by language pair *and* by linguistic structure. We operationalize structural overlap as follows. First, we hold the discourse context constant, following Müller and Hulk. Second, we deal with infelicity by considering the potential for misanalysis from the speaker's perspective. If a word order is grammatical but infelicitous in a particular context, the learner could misanalyze the input if there is conflicting evidence from the speaker's other language. Take the case of Catalan object focus. In this context, VOPP is infelicitous but grammatical. Because VOPP word order is exemplified for object focus in the Spanish input, a Spanish/Catalan bilingual may extend the (overlapping) VOPP order in Catalan to inappropriately realize object focus as well. That is, evidence from an overlapping word order in Spanish triggers extension of a grammatical word order in Catalan into a context that would normally be infelicitous.

The reverse would not be true, however. Catalan VOPP's contextual restrictions would not spread to Spanish, because nothing they could hear in Catalan would make them misanalyze their Spanish input.

Under these assumptions, our specific predictions for the Structural Overlap Hypothesis for each group are found in Table 2.

Table 2

Structural overlap predictions

Structure	Spanish	Yucatec Maya	Catalan	Prediction for influence into Spanish
Subject Focus				
VSO	#	#	*	No predicted influence – neither structure is available for misanalysis in Spanish.
VOS	✓	#	#	
Object Focus				
VOPP	✓	#	#	All three structures possible in Spanish but only one possible in other language; **the overlapping structure will be extended to inappropriate contexts**. To wit: • **More Fronting** in Spanish of **Yucatec Maya bilinguals.** • **More Fronting** in Spanish of **Catalan bilinguals**.
VPPO	?	#	*	
Other (OVPP)	#	✓	✓	
PP Focus				
VOPP	✓	#	#	All three structures possible in Spanish, but only one possible in other language; **the overlapping structure will be extended to inappropriate contexts**. To wit: • **More Fronting** in Spanish of **Yucatec Maya bilinguals**. • **More CLRD** in Spanish of **Catalan bilinguals**.
VPPO	#	#	*	
Other (PPVO/CLRD)	?	✓	✓	

In summary, the Structural Overlap Hypothesis predicts (i) no influence of either Yucatec Maya or Catalan on Spanish subject focus for the structures we test, (ii) increased fronting in the Spanish of Yucatec Maya bilinguals under both object and PP focus, and (iii) increased CLRD in the Spanish of Catalan bilinguals under PP focus and increased fronting under object focus. We do not discuss cases of influence in the reverse direction because we only measured their Spanish.

5. Participants and Bilingual Context

We tested four groups of speakers who acquired Spanish naturalistically in infancy in two countries where Spanish is the main societal language: Mexico and Spain. Although all participants fall under the rubric 'native Spanish speaker' (they learned the language naturalistically and in infancy), not all were monolingual (Rothman & Treffers-Daller, 2014). In a previous article, we reported the results of two of these groups, one at each testing site: Monolingual speakers in Merida, Mexico (n = 42), and Spanish-dominant Spanish-Catalan bilinguals in Barcelona (n = 34). For these groups, we include only relevant information here; the reader is referred to Hoot and Leal (2020) for details. Those groups serve to establish a baseline of behavior against which we compare our experimental groups: Spanish-Yucatec Maya bilinguals in Merida (n = 22) and Catalan-dominant Catalan-Spanish bilinguals in Barcelona (n = 39). We present details on these groups in Table 3 (Merida) and Table 4 (Barcelona) but first describe their sociolinguistic contexts and how they were grouped.

Participants completed the Bilingual Language Profile (BLP; Birdsong et al., 2012) as a background questionnaire and measure of language dominance. Operationalizing language dominance is not straightforward; most researchers acknowledge it is gradient and multifaceted, involving psycholinguistic *and* sociolinguistic factors, although there is no widespread agreement on which factors are indispensable. Measures range, focusing on self-reporting of sociolinguistic facts (e.g., Dunn & Fox Tree, 2009), linguistic competence (e.g., Kupisch, 2007), or fluidity of language access (e.g., Dubiel, 2019), among other measures. Because dominance is relative, it can only be measured when both languages are considered (Gertken et al., 2014). Our choice of instrument was influenced by our population of interest (adult bilinguals) and the above considerations. The BLP measures dominance via self-report of sociolinguistic and usage factors in both languages. Solís-Barroso and Stefanich (2019) compared it to three other dominance measures and found it correlated well with others using self-report but not with a repetition task, a fact we consider when interpreting our results by dominance (see §8). The BLP also has the benefit of generating a continuous measure ranging from -218 to +218.

We excluded 37 speakers who reported a different Spanish variety, significant contact with other languages before age 14, or cognitive or language-related impairments. Two participants were excluded

based on self-paced reading task performance: one outlier whose mean reading times were more than 2.5 standard deviations above overall mean, and one who answered the comprehension questions less than 70% correctly. Exclusions are not included in participant counts. We describe each group and bilingual context next.

5.1. Merida

Yucatec Maya has approximately 860,000 speakers, mostly in Yucatán, Quintana Roo, and Campeche (INALI, 2018). While the Yucatan's population speaks mostly Spanish, widespread use is recent: During 300 years of colonial rule, sectors of the peninsula were de facto independent and Maya monolingualism prevailed. Until recently, Mayan speakers outnumbered Spanish speakers (Klee & Lynch, 2009) and its use was not restricted to marginalized groups (Lope Blanch 1987, cited in Klee & Lynch 2009). After World War II, increased immigration entailed a shift away from Maya. Recent government data shows 29% of Yucatán's population speaks indigenous languages, nearly always (98%) Maya (INEGI, 2015). Of these speakers, 4.8% reported being monolingual, while 93% reported also speaking Spanish. Although 71% reports not speaking indigenous languages, 17% reports understanding one. Furthermore, 65% of the state population self-identifies as indigenous. Recent studies using matched guise (Hernández Méndez & Sima Lozano, 2015) and sociolinguistic interviews (Sima Lozano et al., 2014) reveal positive perceptions of Maya speakers despite widespread negative attitudes toward indigenous people (Terborg et al., 2006). Although education in Maya is limited, activism by indigenous communities led to a 2003 law establishing a right to bilingual education for speakers of indigenous languages. Implementation remains uneven, hampered by a dearth of materials and teachers (Terborg et al., 2006), yet advances have been made. Yucatán's Ministry of Education reported "423 indigenous schools … in which 1,464 teachers provide bilingual and bicultural education to 32,463 students" (Yucatan Times, 2019) of the estimated 80,000 speakers of Maya under the age of 18 in the state (INEGI, 2015). Importantly, bilingual education is aimed only at Maya speakers.

Participants were raised and resided in or near Merida. They had completed at least high school and had no significant exposure to languages other than Spanish or Maya before age 14. Bilingual participants reported learning Spanish and Maya before age 7 (except for two who reported learning Spanish at age 12 and 15; both were nonetheless included because they grew up in Yucatán and reported 20+ years of Spanish exposure).[5] Monolingual participants neither grew up in Maya-speaking households nor reported significant experience with Maya.

[5] It is not entirely clear how to understand these participants' answers to the BLP. For instance, much depends on how one interprets the verb *aprender* 'learn' in the question *¿A qué edad empezó a aprender español?* 'At what age did you start to learn Spanish?' It may cause some people to think of a particular type of formal schooling. For example, the same person who reported learning Spanish starting at age 15 reported learning Maya starting at age 7, despite growing up in a Maya-speaking family. On the other hand, several participants who reported always living in Maya-speaking families answered the question *¿A qué edad empezó a aprender maya?* 'At what age did you start to learn Maya?' with ages indicating the start of schooling, between four and seven. Further, the person who reported starting to learn Spanish at age 12 nonetheless reported 20+ years of classes in Spanish, whereas another participant who reported learning Spanish from age two also reported only four years of coursework in Spanish, which is unlikely given that he was in college and Spanish is used at all levels of education in Mexico, even in supposedly bilingual schools (Terborg et al., 2006). These discrepancies point to a limitation of the instrument.

Table 3

Participant characteristics, Merida

	Spanish-Maya bilinguals (n = 22)	Spanish monolinguals (n = 42)*
Age	23.6 (18 – 39)	21.8 (18 – 39)
Gender	12 F / 10 M	25 F / 17 M
BLP Dominance Score (lower = Maya-dominant)	42 (range: -73 – 162)	N/A
Years of education (Spanish)	13.7 (4 – 20+)	15.6 (3 – 20+)
Years of education (Maya)	4.3 (0 – 19)	N/A
% weekly Spanish use: family, friends, self	72% (0 – 100%)†	N/A
% weekly Maya use: family, friends, self	44% (0 – 100%)	N/A
% weekly Spanish use: work/school	87% (30 – 100%)	N/A
% weekly Maya use: work/school	27% (0 – 80%)	N/A
Self-rating, Spanish, speak & understand	5.6/6 (4 – 6)	5.8/6 (5 – 6)
Self-rating, Maya, speak & understand	4.4/6 (0 – 6)	N/A
Self-rating, Spanish, read & write	5.6/6 (4 – 6)	5.6/6 (3 – 6)
Self-rating, Maya, read & write	3.8/6 (0 – 6)	N/A

* We have previously reported on most members of this group in Authors (2020); we repeat the relevant information here for the reader's convenience.
† Usage percentages do not add up to 100% because the instrument does not restrict participants' answers in this section, and some report totals more than 100%.

5.2. Barcelona

Catalan, the autochthonous language of Catalonia, has historically enjoyed high social status (Montrul 2013) and has about nine million speakers (Eberhard et al., 2020). After the Spanish Civil War (1939), Franco's dictatorship systematically repressed Catalan publicly, although it remained widely used in private spheres. Once the 1978 Constitution recognized Catalan's status, the regional government and other groups worked to revitalize and 'normalize' its use (Klee & Lynch, 2009). Catalan is co-official in Catalonia, widely used in public and private life. It is the main language of compulsory education, regardless of students' first language, with Spanish limited to 5-10% of class time in most schools (Garvía & Santana, 2020). Although Catalan is the home language of under half of Catalonia's population, 95% reports understanding it and 75% speaking it (Montrul, 2013).

Nearly all speakers of Catalan speak Spanish but, due to immigration, the rate of bilingualism varies geographically in Catalonia (Montrul, 2013). Accordingly, a monolingual control group is not appropriate because it would include speakers of a different dialect (see Adli 2011:128–131). We examine the degree of Catalan influence in Spanish along a cline of dominance, from Spanish-dominant to Catalan-dominant. Because dominance is a gradient notion, we analyze it as a continuous variable. Nevertheless, to provide a clearer picture of the characteristics of this participant population and to conduct analyses comparing across the four groups, we also distinguish between those classified as classified as Catalan-dominant (scores below 0; *n* = 37) or Spanish-dominant (scores above 0; *n* = 31).

Table 4

Participant characteristics, Barcelona

	Catalan-dominant (n = 37)	**Spanish-dominant (n = 34)‡**
Age	23.4 (18 – 54)	22.5 (18 – 47)
Gender	26 F / 11 M	27 F / 7 M
BLP Dominance Score (lower = Catalan-dominant)	-58 (-131 – -5)	58 (3 – 169)
Years of education in Spanish	12.5 (0 – 20+)	14.8 (0 – 20+)
Years of education in Catalan	15.3 (3 – 20+)	12.7 (0 – 20+)
% weekly Spanish use: family, friends, self	19% (0 – 90%)	79% (0 – 100%)
% weekly Catalan use: family, friends, self	78% (10 – 100%)	17% (0 – 100%)
% weekly Spanish use: work/school	25% (0 – 70%)	60% (10 – 100%)
% weekly Catalan use: work/school	51% (0 – 100%)	30% (0 – 80%)
Self-rating, Spanish, speak & understand	5.8/6 (3 – 6)	5.9/6 (5 – 6)
Self-rating, Catalan, speak & understand	5.9/6 (5 – 6)	5.3/6 (1 – 6)
Self-rating, Spanish, read & write	5.7/6 (3 – 6)	5.9/6 (5 – 6)
Self-rating, Catalan, read & write	5.8/6 (4 – 6)	5.1/6 (0 -6)

‡ We have previously reported on most members of this group in Authors (2020); we repeat the information here for the reader's convenience.

6. Forced-Choice Task

6.1. Procedure

The forced-choice task (FCT) is a preference task: participants chose the most natural word-order option given the context. It was completed under researcher supervision via Qualtrics. After the instructions (in Spanish), participants completed two practice items without feedback. Word-order choices were randomized per question; trial order per participant. Trials were presented in a Latin square (two lists, each including 8 subject-focus trials and 16 object/PP-focus trials, 8 per focus condition).[6] The Barcelona group completed 24 filler trials while the Merida group completed 40. Every trial included a visual context (picture), followed by a *wh*-question. Questions biased responses for focus, e.g., *¿Quién compró el carro?* 'Who bought the car?' for subject focus. Critical items included words from the 5,000 most common Spanish words (Davies, 2006).

6.2. Materials

6.2.1.Subject Focus

The FCT tested *Word Order* (final [VOS] vs. non-final focus [VSO]) under subject focus. These options did not include SVO because, as an unmarked order in Spanish, it can be used in a wide variety of information focus contexts. Importantly, while VOS is available for subject focus, VSO in Spanish can instantiate broad focus but *not* subject focus (Domínguez, 2004, p. 74; Zubizarreta, 1998, p. 125). Thus, by including VSO as our non-final subject order, we have an expected contextual contrast between the two word orders. Because Gutiérrez-Bravo (2020) has argued that in Mexican Spanish VSO/VOS are ungrammatical unless preceded by another constituent, test items were subordinate clauses following a verb of perception or assertion (e.g., *Creo que…* 'I believe that…'). Figure 2 shows a sample trial.

[6] Due to a technical error, on one list one subject focus item was lost, so some participants completed only 7 subject focus trials instead of 8.

¿Quién comió la naranja?

Creo que comió el piloto la naranja.

Creo que comió la naranja el piloto.

Translation

Who ate the orange?

I believe that ate the pilot the orange. (VSO)

I believe that ate the orange the pilot. (VOS)

Figure 2. Sample FCT trial, subject focus.

6.2.2.Object/PP Focus

We also tested *Focus Type* (Object-Focus/PP-focus) and *Word Order* in a 2×3 design. The word-order options were (canonical) VOPP, VPPO, and Other—Fronting (OVPP/PPVO) for Maya and Fronting(OVPP)/CLRD(clVPP,O) for Catalan. To avoid undesired phonological-weight effects, we controlled for number of syllables. Figure 3 presents an object focus trial.

¿Qué compró en el mercado?

Parece que compró en el mercado los caramelos.

Parece que compró los caramelos en el mercado.

Parece que los caramelos compró en el mercado.

Translation

What did she buy at the market?

It seems that she bought at the market the candies. (VPPO)

It seems that she bought the candies at the market. (VOPP)

It seems that the candies she bought at the market. (Other: Fronting)

Figure 3. Sample FCT trial, object focus.

In an object focus trial (Figure 3), both groups saw Fronting (OVPP) as the "Other" word order. To investigate language-specific effects, in PP focus questions, the Yucatan group saw Fronting (PPVO, i.e., *Parece que en el mercado compró los caramelos* 'It seems that at the market she bought the candies'), while the Catalonia groups saw CLRD (i.e., *Parece que los compró en el mercado, los caramelos*).

The FCT materials are available via the Open Science Foundation at osf.io/f6u4c/.

6.3. Results

Because the outcome is categorical, we analyzed it with logistic regression via the GENLINMIXED procedure in SPSS, which runs generalized linear mixed-effects models (GLMM). For each, we compared the groups as a categorical fixed factor with four levels (Merida Monolinguals, Merida Bilinguals, Spanish-dominant Barcelona Bilinguals, Catalan-dominant Barcelona Bilinguals).

GLMMs are flexible tools whose results can be reported variously according to the purpose of the analysis. Although these procedures are regressions, we are interested fundamentally in the question of

whether the groups differ in their response patterns, a question traditionally answered by ANOVA and its nonparametric equivalents. For that reason, we focus our reporting on the results of the omnibus *F* test and its associated *p* value, which tests the null hypothesis that the odds of a given answer are the same across the levels of the fixed factors, then explore those results as needed with follow-up tests. Wherever relevant, post hoc tests used the Bonferroni correction for multiple comparisons, although we recognize that this correction is overly conservative. We report the results for each model in a table. We included random effects by participant and by item to account for the repeated-measures design, using a stepwise, top-down procedure to fit the maximal random-effects structure (RES) that converged for the data. The RES for each model is specified in its output table.

6.3.1.Subject Focus

Figure 4 presents each group's word-order choices in this context.

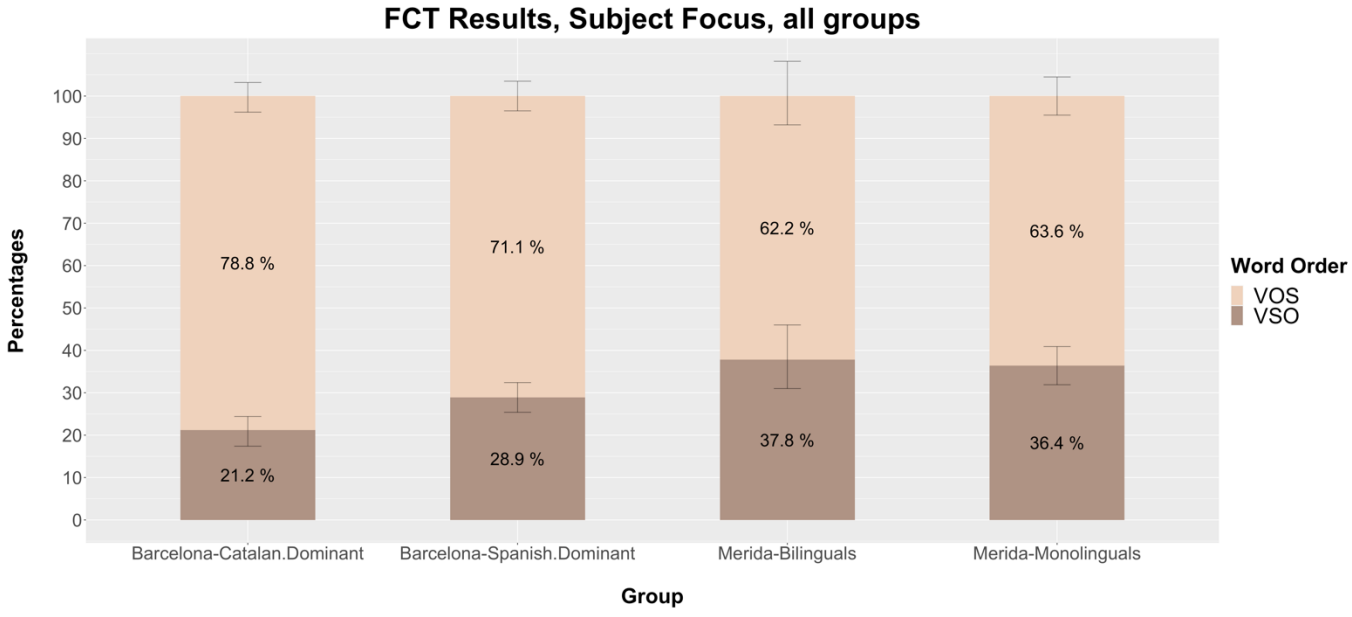

Figure 4. FCT results, subject focus, by group.

Given the binary outcome (VOS/VSO), we used a binomial logistic regression, including *Group* as a between-subjects fixed factor. Because it had no within-subject fixed factors, the maximal RES included only the intercepts. Table 5 shows that the groups differed overall. Post hoc pairwise comparisons confirmed that the Catalan-dominant Barcelona group was more likely to choose VOS than the Merida Monolingual group (p = .014), but otherwise found no group differences, suggesting that the bilingual groups did not differ from their respective control groups.

Table 5

Binomial logistic regression, subject focus

Fixed Effect	***F***	***df***	***p***
Group	3.50	3, 118	.018
Random Effects		**Variance**	**SE**
By-Participant Intercept		0.90	0.21
By-Item Intercept		0.10	0.07

6.3.2.Object/PP Focus

Figure 5 presents each group's word-order choices in the object focus context and Figure 6 their choices in the PP focus context.

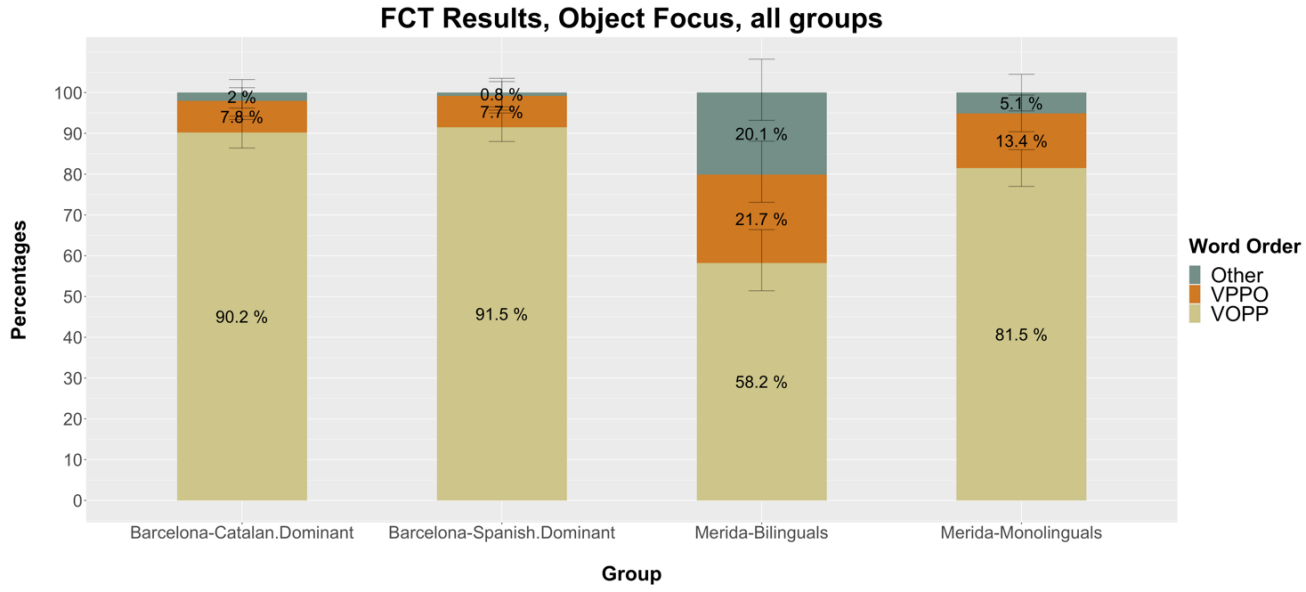

Figure 5. FCT results, object focus, by group.

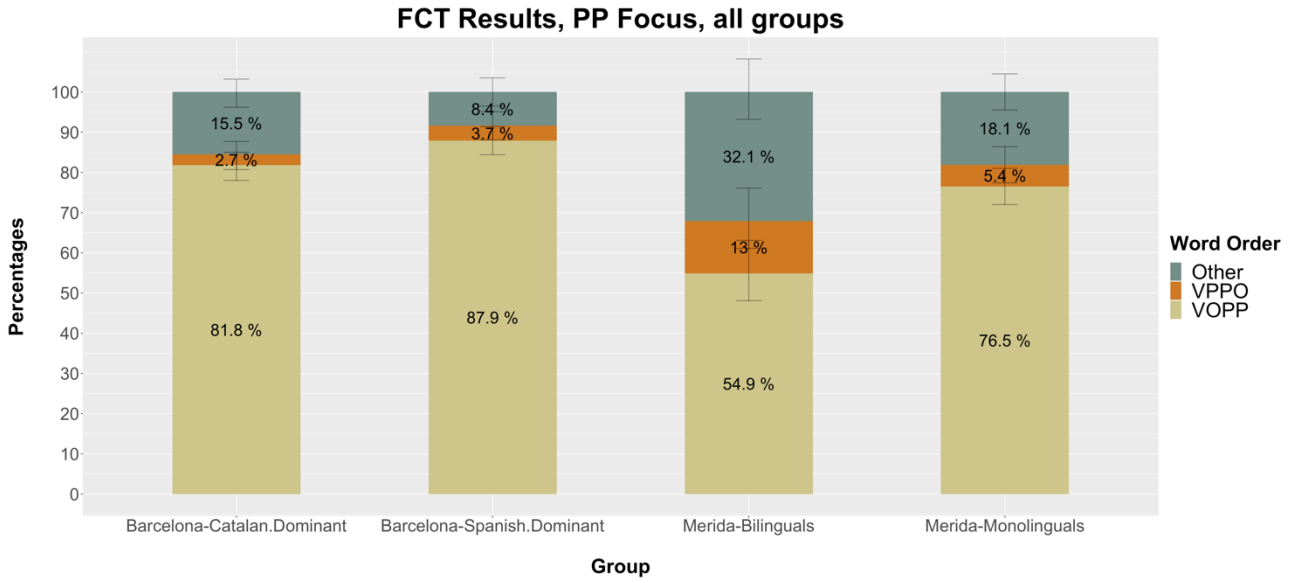

Figure 6. FCT results, PP focus, by group.

We analyzed object/PP focus with a multinomial logistic regression because it had three outcomes (VOPP, VPPO, Other). In addition to *Group*, we included *Focus Type* (Object/PP) as a within-subjects fixed factor, plus their interaction. Table 6 shows that the probability of the three word orders differed by

group and context, but the lack of interaction suggests that the difference by context was the same for each group.

Table 6

Multinomial logistic regression, object/PP focus

Fixed Effects	***F***	***df***	***p***
Type	23.25	2, 209	< .001
Group	11.89	6, 159	< .001
Type*Group	1.26	6, 194	.279
Random Effects		**Variance**	**SE**
By-Participant Intercept		1.01	0.41
By-Participant Slope over Type		0.82	0.35
By-Item Intercept		0.01	0.04

To explore this finding, we followed up with a series of binomial logistic regressions, each targeting one outcome versus the other two. In each case, we found significant main effects but no interaction.

First, we compared VOPP to the other orders (Table 7). Post-hoc pairwise comparisons revealed that the Merida Bilinguals chose VOPP less than any other group ($p \leq .001$ for each comparison). Merida Monolinguals chose it more than Merida Bilinguals ($p = .001$), but less than the two Spain groups ($p = .009$, $p = .045$). The Barcelona groups did not differ ($p = .433$). For Type overall, irrespective of group, participants chose more VOPP in object focus contexts than PP focus contexts, although only slightly (85.9% in O focus vs. 81.1% in PP focus). Again, we observed no interaction, suggesting the groups' patterns did not change across contexts.

Table 7

Binomial logistic regression, object/PP focus: VOPP vs. VPPO/Other

Fixed Effects	***F***	***df***	***p***
Type	4.25	1, 129	.041
Group	16.38	3, 118	< .001
Type*Group	0.55	3, 123	.647
Random Effects		**Variance**	**SE**
By-Participant Intercept		0.71	0.24
By-Participant Slope over Type		0.67	0.21
By-Item Intercept		0.04	0.04

Second, we compared VPPO to the other orders (Table 8). Post-hoc pairwise comparisons revealed that the Merida Bilingual group chose VPPO significantly more than either Barcelona group (Spanish-dominant, p = .011; Catalan-dominant, p = .006), but did not differ from the Merida Monolingual group; no other group differences were found. For *Type* overall, irrespective of group, VPPO was chosen more often under object focus than PP focus, although only slightly (10% vs. 4.4%).

Table 8

Binomial logistic regression, object/PP focus: VPPO vs. VOPP/Other

Fixed Effects	***F***	***df***	***p***
Type	14.33	1, 28	.001
Group	7.22	3, 141	< .001
Type*Group	0.17	3, 150	.919
Random Effects		**Variance**	**SE**
By-Participant Intercept		0.41	0.26
By-Participant Slope over Type		0.56	0.27
By-Item Intercept		0.01	0.08
By-Item Slope over Type		0.08	0.11

Finally, we compared the Other word order to VOPP/VPPO (Table 9). Merida Bilinguals chose Other significantly more often than any other group ($p \leq .012$ for all comparisons). Merida Monolinguals also differed from the Spanish-dominant Barcelona group (p = .010) but not the Catalan-dominant one (p

= .123), although the comparison is not exact. Recall that the "Other" category was always focus fronting for the Merida groups, whereas in one case it is CLRD for the Barcelona groups. Barcelona groups did not differ from each other (p = .171). Overall, Other was chosen more often for PP focus than object focus.

Table 9

Binomial logistic regression, object/PP focus: Other vs. VOPP/VPPO

Fixed Effects	***F***	***df***	***p***
Type	34.86	1, 259	< .001
Group	13.02	3, 155	< .001
Type*Group	2.02	3, 135	.114
Random Effects		**Variance**	**SE**
By-Participant Intercept		0.94	0.40
By-Participant Slope over Type		0.86	0.35
By-Item Intercept		0.01	0.04

6.3.3.Dominance

Although we have treated these groups as separate for expository clarity in the above analyses, the two Barcelona groups display a cline of dominance from more Catalan-dominant to more Spanish-dominant, reflected in the continuous BLP score. Here, we examine only the Barcelona results with *Dominance* as a continuous fixed factor in place of Group. A binomial logistic regression for subject focus (Table 10) and a multinomial regression for object/PP focus (Table 11) revealed no effect by language dominance.

Table 10

Binomial logistic regression by language dominance, subject focus, Barcelona groups

Fixed Effect	***F***	***df***	***p***
Dominance	0.93	1, 63	.339
Random Effects		**Variance**	**SE**
By-Participant Intercept		1.70	0.48
By-Item Intercept		0.17	0.12

Table 11

Multinomial logistic regression by language dominance, object/PP focus, Barcelona groups

Fixed Effects	***F***	***df***	***p***
Type	7.78	2, 104	.001
Dominance	0.50	2, 98	.608
Type*Dominance	0.10	2, 107	.901
Random Effects		**Variance**	**SE**
By-Participant Intercept		0.79	1.23
By-Participant Slope over Type		2.88	1.29

Similarly, although the monolingual group did not generate dominance scores, it is possible to examine whether dominance variations affected the results for Merida Bilinguals. As with the Barcelona groups, dominance had no effect for subject (Table 12) or object/PP focus (Table 13).

Table 12

Binomial logistic regression by language dominance, subject focus, Merida Bilingual group

Fixed Effect	***F***	***df***	***p***
Dominance	0.06	1, 20	.808
Random Effects		**Variance**	**SE**
By-Participant Intercept		0.54	0.38
By-Item Intercept		0.27	0.27

Table 13

Multinomial logistic regression by language dominance, object/PP focus, Merida Bilingual group

Fixed Effects	***F***	***df***	***p***
Type	0.84	2, 24	.445
Dominance	0.13	2, 23	.878
Type*Dominance	1.34	2, 29	.277
Random Effects		**Variance**	**SE**
By-Participant Intercept		0.38	0.25
By-Participant Slope over Type		0.01	0.03

7. Self-Paced Reading Task (SPR)

7.1. Procedure

Participants read sentences in a non-cumulative moving-window display (Just et al., 1982) as presented in the software Linger (Rohde, 2003). At the outset of each trial, participants read a non-moving discourse context and saw a sentence where non-space characters were replaced by dashes. To read the sentence, participants pressed the space bar at their own pace, while the software recorded the duration between space-bar presses. After reading a segment, participants saw the word changed back to dashes such that segments could not be re-read. To verify comprehension, true/false questions followed experimental and filler sentences. Half the answers were true, half false. Half focused on the context and half on the moving-window sentences, but none targeted the critical region. Participants received feedback on their accuracy, which we used to screen subjects for attentiveness. (Data from one participant was discarded for accuracy, as mentioned in §5.) Instructions were presented in Spanish and five practice items preceded filler and experimental trials, which were randomized per participant and presented in a Latin square (i.e., participants saw only one version, out of four conditions, per item).

7.2. Materials

Excluding practice items, participants read 96 sentence/context combinations, of which one third (32) tested subject focus, as in Figure 7, a second third tested object focus, as in Figure 8, and the last third included a combination of unrelated felicitous and infelicitous sentences (none were ungrammatical). Subject- and object-focus sentences thus served as fillers for one another alongside unrelated fillers, which we judged acceptable given that they (i) had entirely unrelated context stories, (ii) used entirely different sets of words, (iii) involved questions targeting different constituents, and (iv) differed in animacy and syntactic features of relevant constituents. Using each experiment as part of the set of fillers for the other was necessary because the SPR task was rather long—most participants completed it in 45 minutes to an

hour (in three blocks of 32 sentences, with breaks between them), although some took even longer. The context included at the outset of each item was essential to foreground the information in the test sentence such that some material was new, while some material was old/easily retrievable.

7.2.1.Subject Focus

The 32 experimental items followed a 2x2 design (8 items per condition) manipulating *Focus Type* (subject-focus/object-focus) and *Word Order* (VOS/VSO) as independent variables. Figure 7 illustrates a sample item, with both contexts and the VSO word order.

Context	Ayer en el hospital hubo un alboroto porque [alguien insultó un paciente] (*Subject focus*)/[un interno insultó a alguien] (*Object focus*). ¿Sabes [quién lo]/[a quién] insultó? 'There was a mess at the hospital yesterday because [somebody insulted a patient]/[an intern insulted a patient]. Do you know [who insulted him]/[whom was insulted]?'				
	Region 1	*Region 2*	*Regions 3-5 (critical)*	*Region 6*	*Region 7*
VSO	Pues yo	siento que	insultó / el interno / al paciente	pero	quién sabe.
example	*Well, I*	*fee that*	*insulted the intern to-the patient*	*but*	*who knows*

Figure 7. Sample SPR trial, subject focus.

We controlled for factors interacting with information structure. Subjects and objects were masculine, animate, definite DPs semantically limited to words for human social or professional roles. To control for phonological weight, subjects and objects had the same number of syllables within a sentence (either three or four). Verbs were three-syllable core transitive verbs in the third-person singular preterit. The critical region (Regions 3-5) was also controlled for overall length (25-32 characters).

We controlled for semantic plausibility via a norming task. First, we constructed 54 items following the above-described controls. We then created two versions of each, swapping the subjects and objects (14), presented in canonical SVO word order, in a Latin square (i.e., participants only viewed one version).

Twenty-six native Spanish speakers[7] judged items for plausibility using a 0-100 scale ("totally impossible"/"completely possible").

(14) Norming Task item
Durante la reunión diplomática…

'During the diplomatic meeting…'

a. …el sultán rechazó al monarca.

'…the sultan rejected the monarch.'

b. …el monarca rechazó al sultán.

'…the monarch rejected the sultan.'

We discarded items with means below the midpoint of the scale. Then, we picked the 32 items whose means for both versions (a/b) were the closest to each other. The norming task, modelled after Hopp (2009), was necessary to ensure that the roles of each participant could not be predicted from the semantic content of the verb or arguments (e.g., teachers are more likely to teach students than the reverse). Given the above restrictions, we did not control for word frequency.

Before testing, a small group of native Spanish speakers (n = 9) completed the test with the express purpose of providing feedback on plausibility and comprehensibility, resulting in small changes to introductory contexts.

7.2.2. Object Focus

[7] These speakers acquired Spanish naturalistically in infancy and reported the following birthplaces: Spain = 14, Mexico = 2, Argentina = 2, Colombia = 2, USA = 2, Honduras = 1, Nicaragua = 1, Puerto Rico = 1, Germany (lives in Spain) = 1.

The 32 object focus items followed a 2x2 design manipulating *Focus Type* (object-focus/PP-focus) and *Word Order* (VOPP[canonical]/VPPO) as independent variables. Figure 8 illustrates a sample item.

Context	Contrataron a un artista para [instalar un mosaico en alguna parte del museo] (*Object focus*) / [instalar una obra en el patio del museo] (*PP focus*) ¿Sabes [qué instaló]/[dónde lo instaló]? 'They hired an artist to install [a work in the patio of the museum] / [a mosaic in some part of the museum]. Do you know [what he installed]/[where he installed it]?'				
	Region 1	*Region 2*	*Regions 3-5 (critical)*	*Region 6*	*Region 7*
VOPP example	Pues yo	creo que	instaló / un mosaico / en el patio	aunque	no estoy seguro
	Well I	*believe that*	*he-installed a mosaic in the patio*	*although*	*I'm not sure*

Figure 8. Sample SPR trial, object/PP focus.

Similar controls were implemented for these items. Phonological weight was controlled (PPs/object DPs were matched for syllables). Objects were always indefinite, non-human and masculine. PPs were locative or temporal adjuncts consisting of a preposition and a definite DP. These items were also tested for plausibility and comprehensibility in the same pilot study session.

The SPR materials are available via the Open Science Foundation at osf.io/f6u4c/.

7.3. Results

Reading times (RTs) were trimmed at 100 and 10,000 milliseconds, then log-transformed to address their positive skew, and finally length-adjusted using Fine et al.'s (2013) procedure. Length-adjusted log-transformed RTs (hereafter, logRTs) for both the critical region (regions 3-5) and the post-critical region (region 6) were analyzed by a linear mixed-effects model (LMM) for each focus type. Each analysis included *Group* as a four-level categorical fixed factor, as for the FCT, and also included two within-

subjects fixed factors: *Focus Type* (Subject/Object or Object/PP) and *Word Order* (VOS/VSO or VOPP/VPPO).

As with the GLMMs reported above, our fundamental question is whether the groups differ across conditions, so our reporting focuses on addressing that question with the omnibus *F* tests and associated *p* values, using post-hoc pairwise comparisons as needed (Bonferroni-corrected). An alternative reporting method focusing on the regression coefficients would be less appropriate for our research questions. Both reporting methods are widely used and are acceptable practice; the important thing is for analysts to be transparent with their choice and the reasoning (Meteyard & Davies, 2020). We report the outcomes of interest in a table for each model.

To account for the repeated-measures design, we included random effects by participant and by item, fitting the maximal random effects structure (RES) that converged for the data using a top-down stepwise method like the one used by Barr et al. (2013): we began with all possible random by-participant and by-item slopes, plus their intercepts, and then simplified models that did not converge by removing the random slope that accounted for the least variation, repeating that procedure until convergence was achieved. We report the RES in each output table.

7.3.1.Subject Focus

Figures 9 and 10 present the reading times per sentence region for all groups by *Focus* and *Word Order*. Table 14 presents the statistical results for the critical region and Table 15 for the post-critical region.

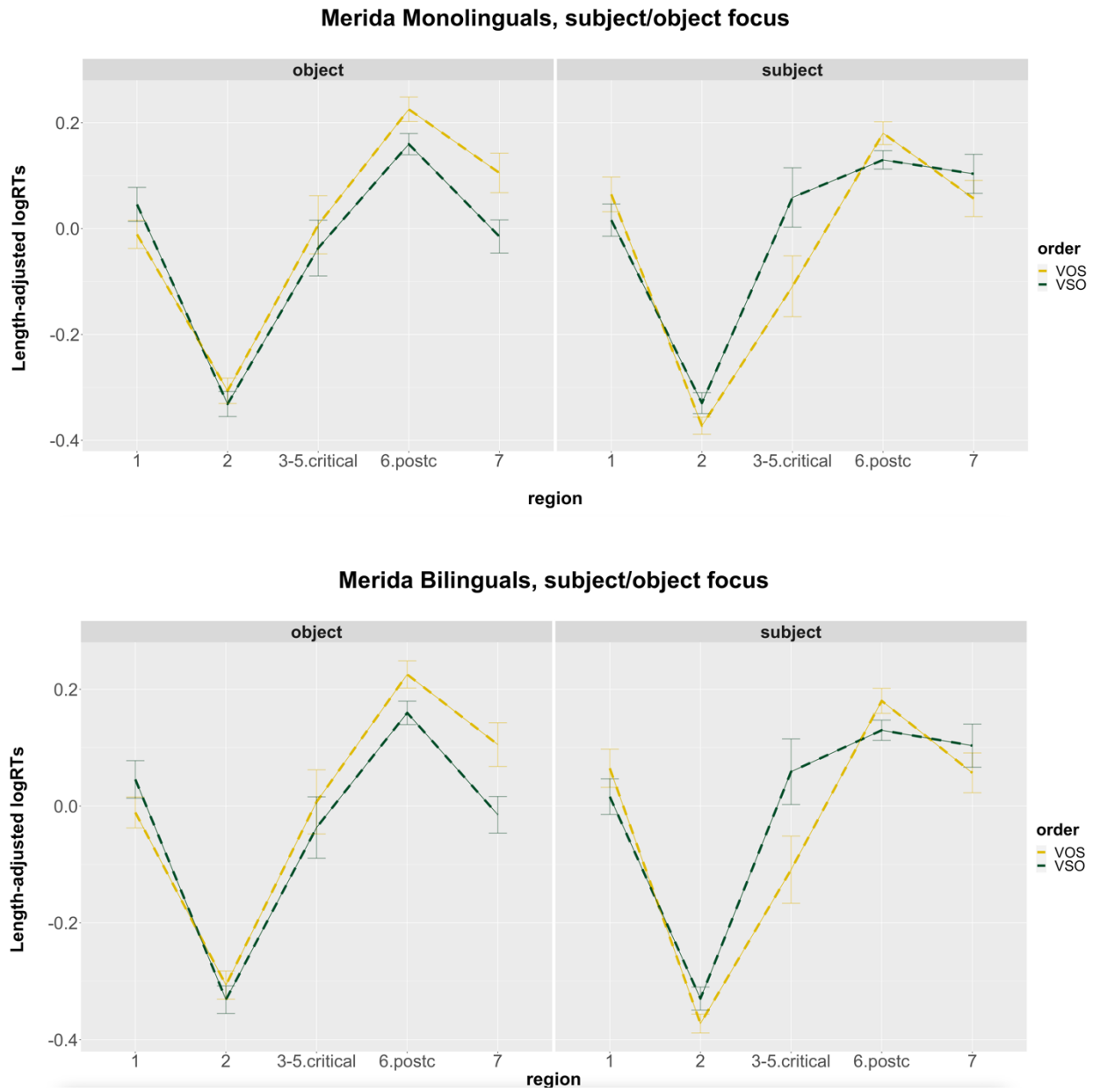

Figure 9. Length-adjusted log-transformed reading times by region, Merida groups, subject focus.

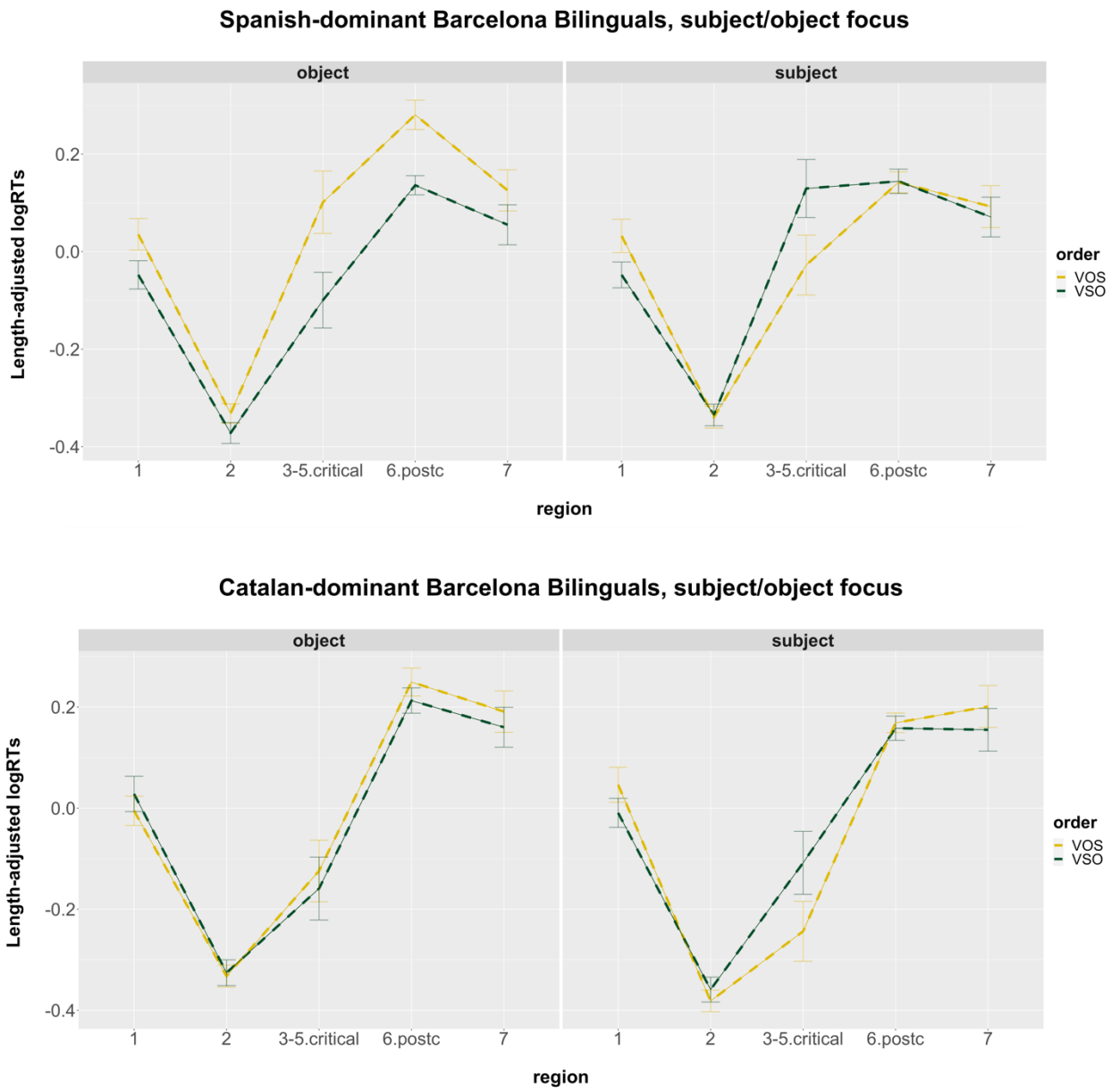

Figure 10. Length-adjusted log-transformed reading times by region, Barcelona groups, subject focus.

Table 14

Linear mixed-effects model, subject focus, critical region

Fixed Effects	***F***	***df***	***p***
Focus	0.36	1, 81	.553
Order	0.93	1, 77	.337
Focus*Order	20.80	1, 68	< .001
Group	1.99	3, 131	.119
Focus*Group	0.59	3, 130	.623
Order*Group	0.41	3, 129	.748
Focus*Order*Group	1.60	3, 131	.193
Random Effects		**Variance**	**SE**
By-Participant Intercept		0.07	0.02
By-Participant Slope over Focus		0.01	0.01
By-Participant Slope over Order		0.01	0.01
By-Participant Slope over Focus*Order		0.01	0.02
By-Item Intercept		0.01	0.01
By-Item Slope over Focus*Order		0.01	0.01

At the critical region, we observe an overall *Focus*Order* interaction, indicating that the differences in RTs between word orders varied according to context. Post-hoc pairwise comparisons confirmed that, for subject focus, VOS was read faster than VSO ($p < .001$), while the reverse held for object focus ($p = .015$). We observe no group differences.

Table 15

Linear mixed-effects model, subject focus, post-critical region

Fixed Effects	***F***	***df***	***p***
Focus	9.55	1, 31	.004
Order	8.00	1, 30	.008
Focus*Order	7.72	1, 3825	.005
Group	0.77	3, 131	.510
Focus*Group	1.29	3, 131	.280
Order*Group	1.39	3, 130	.249
Focus*Order*Group	1.81	3, 3876	.143
Random Effects		**Variance**	**SE**
By-Participant Intercept		0.01	< 0.01
By-Participant Slope over Focus		< 0.01	< 0.01
By-Participant Slope over Order		< 0.01	< 0.01
By-Item Intercept		< 0.01	< 0.01
By-Item Slope over Focus		< 0.01	< 0.01
By-Item Slope over Order		< 0.01	< 0.01

The post-critical region was read faster in subject-focus contexts and when sentences had VSO order, but the important result is the interaction: again we observe effects of context on the logRT difference by word order. In object-focus contexts, the post-critical region was read faster when the sentence had VSO order ($p < .001$), whereas there were no differences in subject focus contexts ($p = .813$). Yet when the sentence was VOS, the post-critical region was read faster under subject focus than object focus ($p < .001$), while VSO sentences did not differ by context ($p = .607$). Again, we observe no group differences.

7.3.2. Object Focus

Figures 11 and 12 show logRTs per region for the Merida and Barcelona groups, respectively, by *Focus Type* and *Word Order*. Table 16 presents the statistical results for the critical region and Table 17 for the post-critical region.

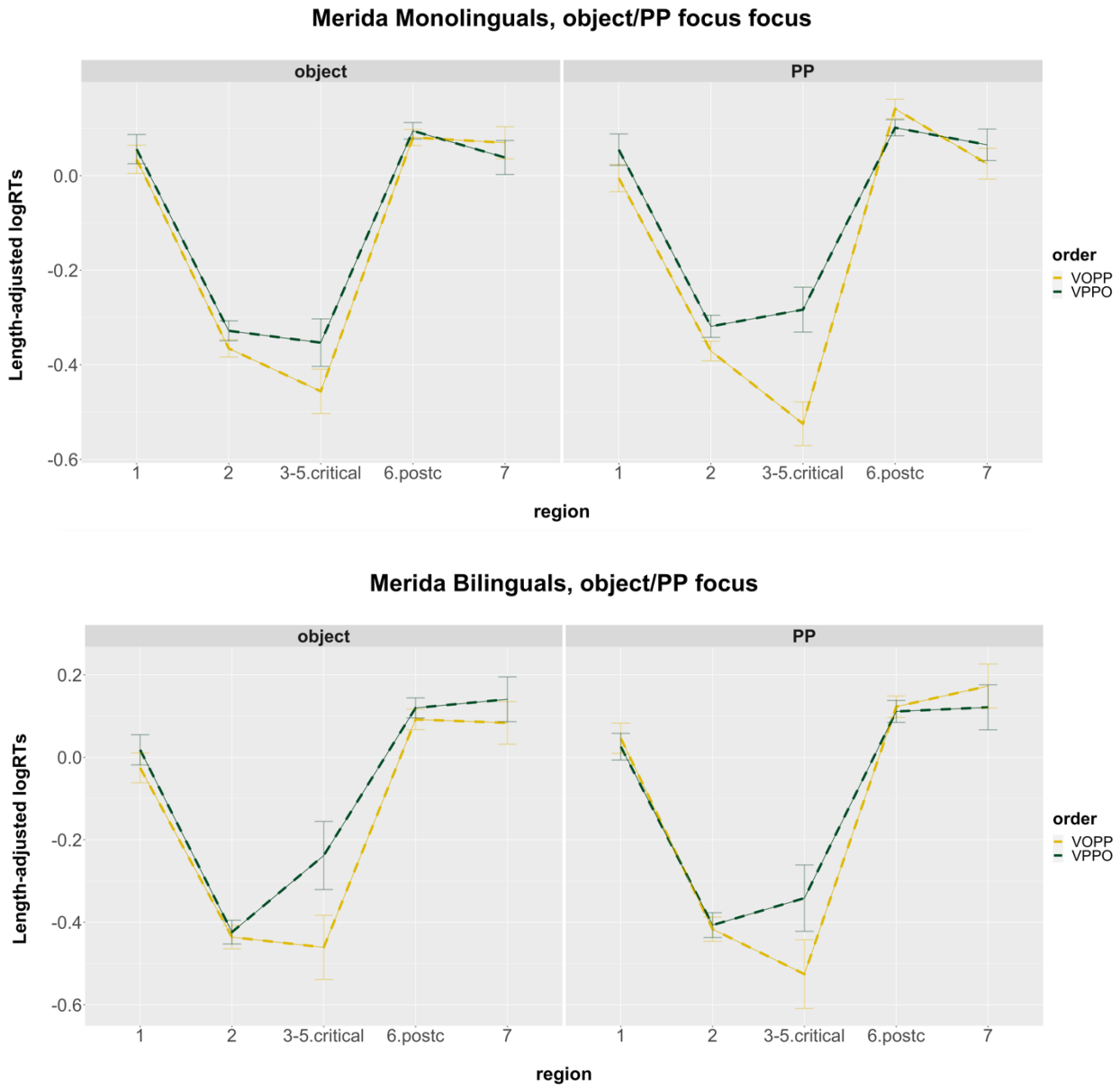

Figure 11. Length-adjusted log-transformed reading times by region, Merida groups, object/PP focus.

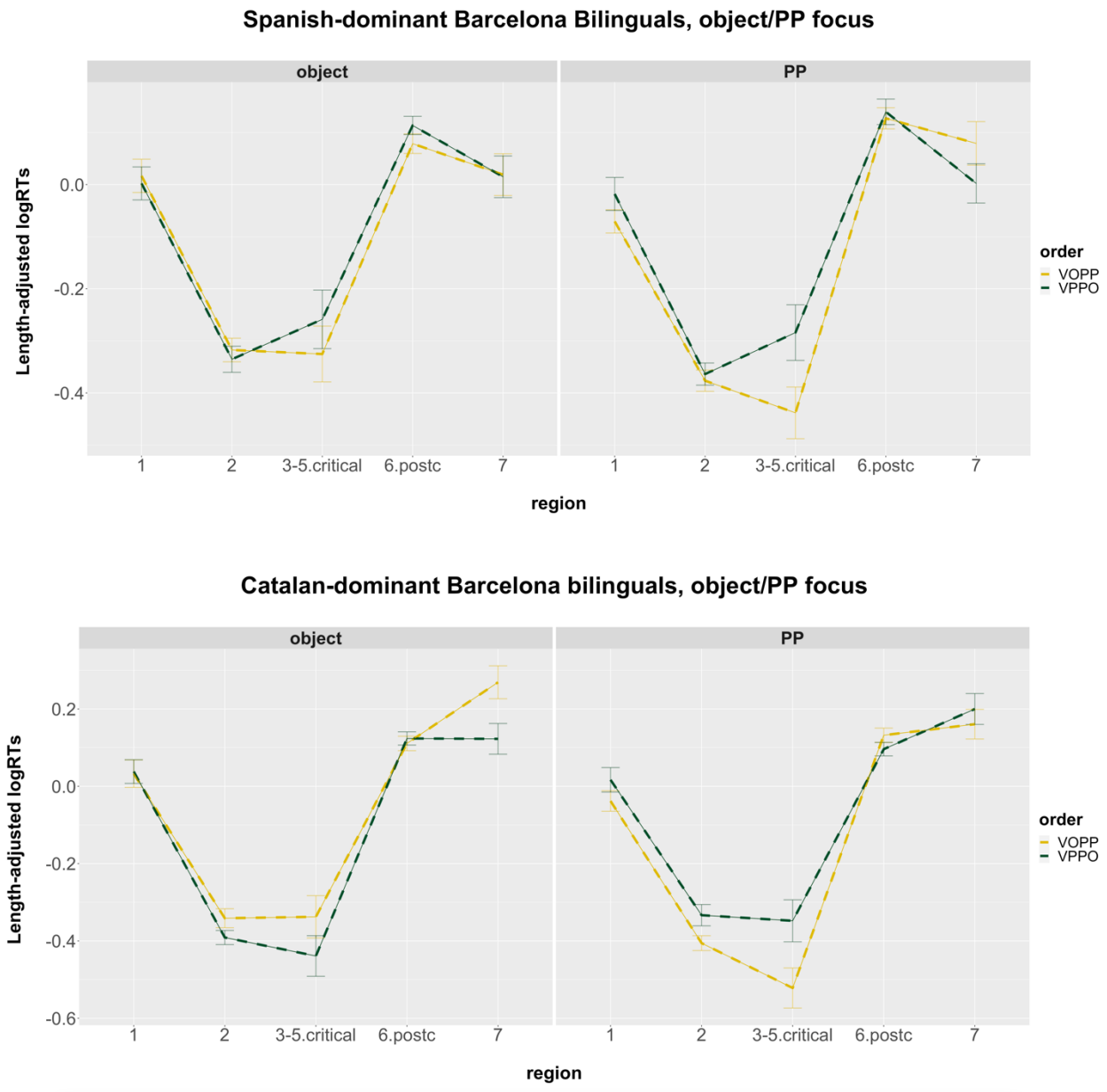

Figure 12. Length-adjusted log-transformed reading times by region, Barcelona groups, object/PP focus.

Table 16

Linear mixed-effects model, object/PP focus, critical region

Fixed Effects	***F***	***df***	***p***
Focus	3.21	1, 4113	.073
Order	18.34	1, 34	< .001
Focus*Order	4.32	1, 4113	.038
Group	0.79	3, 131	.501
Focus*Group	0.49	3, 4139	.689
Order*Group	1.74	3, 4125	.157
Focus*Order*Group	1.14	3, 4139	.332
Random Effects		**Variance**	**SE**
By-Participant Intercept		0.04	0.01
By-Item Intercept		0.01	0.01
By-Item Slope over Order		< 0.01	< 0.01

VOPP was read faster than VPPO regardless of context or group. Yet *Order* and *Focus* also interact. VOPP was read faster in PP-focus contexts than object-focus contexts ($p = .006$); within PP focus, VOPP was read faster than VPPO ($p < .001$). VPPO order did not differ in logRTs between the contexts ($p = .839$), nor did the word orders differ under object focus ($p = .082$). We again observe no differences by group.

Table 17

Linear mixed-effects model, object/PP focus, post-critical region

Fixed Effects	***F***	***df***	***p***
Focus	3.09	1, 67	.083
Order	0.02	1, 35	.887
Focus*Order	3.34	1, 67	.072
Group	0.10	3, 131	.958
Focus*Group	1.09	3, 392	.352
Order*Group	0.80	3, 392	.495
Focus*Order*Group	0.13	3, 392	.944
Random Effects		**Variance**	**SE**
By-Participant Intercept		0.01	< 0.01
By-Participant Slope over Focus*Order		< 0.01	< 0.01
By-Item Intercept		< 0.01	< 0.01
By-Item Slope over Order		< 0.01	< 0.01
By-Item Slope over Focus*Order		< 0.01	< 0.01

Analysis of the post-critical region in the object focus experiment revealed no significant effects.

7.3.3.Dominance

As with the FCT, to ascertain the effect of relative language dominance, we analyzed the critical region for the two Barcelona groups separately with language *Dominance* (BLP score) as a continuous fixed factor. Although overall logRTs varied with dominance for subject focus items (Table 18), we observed no interaction of dominance with any other factor, indicating that the reaction to contextual felicity does not change as dominance does, and we find no dominance effects for object/PP focus (Table 19).

Table 18

Linear mixed-effects model by language dominance, subject focus, Barcelona groups

Fixed Effects	***F***	***df***	***p***
Focus	0.03	1, 67	.864
Order	0.10	1, 61	.750
Focus*Order	7.51	1, 87	.007
Dominance	7.85	1, 69	.007
Focus*Dominance	1.15	1, 68	.288
Order*Dominance	0.33	1, 67	.569
Focus*Order*Dominance	0.83	1, 2017	.364
Random Effects		**Variance**	**SE**
By-Participant Intercept		0.06	0.02
By-Participant Slope over Focus		0.03	0.02
By-Participant Slope over Order		0.01	0.01
By-Item Intercept		0.01	0.01
By-Item Slope over Focus*Order		0.02	0.01

Table 19

Linear mixed-effects model by language dominance, object/PP focus, Barcelona groups

Fixed Effects	***F***	***df***	***p***
Focus	2.48	1, 205	.117
Order	4.07	1, 206	.045
Focus*Order	6.07	1, 205	.015
Dominance	2.44	1, 69	.123
Focus*Dominance	0.37	1, 207	.546
Order*Dominance	0.55	1, 205	.459
Focus*Order*Dominance	2.60	1, 207	.109
Random Effects		**Variance**	**SE**
By-Participant Intercept		.04	.01
By-Participant Slope over Focus*Order		< .01	.01
By-Item Intercept		.01	.01

Turning to the Merida bilingual group, we examined *Dominance* and found no effects for processing subject focus (Table 20) or object focus (Table 21).

Table 20

Linear mixed-effects model by language dominance, subject focus, Merida Bilingual group

Fixed Effects	***F***	***df***	***p***
Focus	1.80	1, 20	.195
Order	0.29	1, 37	.597
Focus*Order	6.10	1, 37	.018
Dominance	0.26	1, 20	.617
Focus*Dominance	0.94	1, 20	.344
Order*Dominance	0.06	1, 38	.814
Focus*Order*Dominance	0.15	1, 38	.698
Random Effects		**Variance**	**SE**
By-Participant Intercept		0.14	0.07
By-Participant Slope over Focus		0.01	0.05
By-Participant Slope over Focus*Order		0.06	0.05
By-Item Intercept		0.02	0.02

Table 21

Linear mixed-effects model by language dominance, object/PP focus, Merida Bilingual group

Fixed Effects	***F***	***df***	***p***
Focus	0.05	1, 650	.817
Order	3.87	1, 664	.049
Focus*Order	0.260	1, 650	.611
Dominance	0.12	1, 20	.732
Focus*Dominance	1.15	1, 673	.285
Order*Dominance	0.03	1, 676	.864
Focus*Order*Dominance	0.26	1, 673	.608
Random Effects		**Variance**	**SE**
By-Participant Intercept		0.06	0.03
By-Item Intercept		0.02	0.02

To visualize the effect of dominance on processing contextual appropriateness, we calculated the difference between felicitous and infelicitous word orders for both types of items and plotted those scores against dominance for all three bilingual groups, as shown in Figure 13. The relatively flat lines in each scatterplot confirm that dominance does not appear to affect processing.

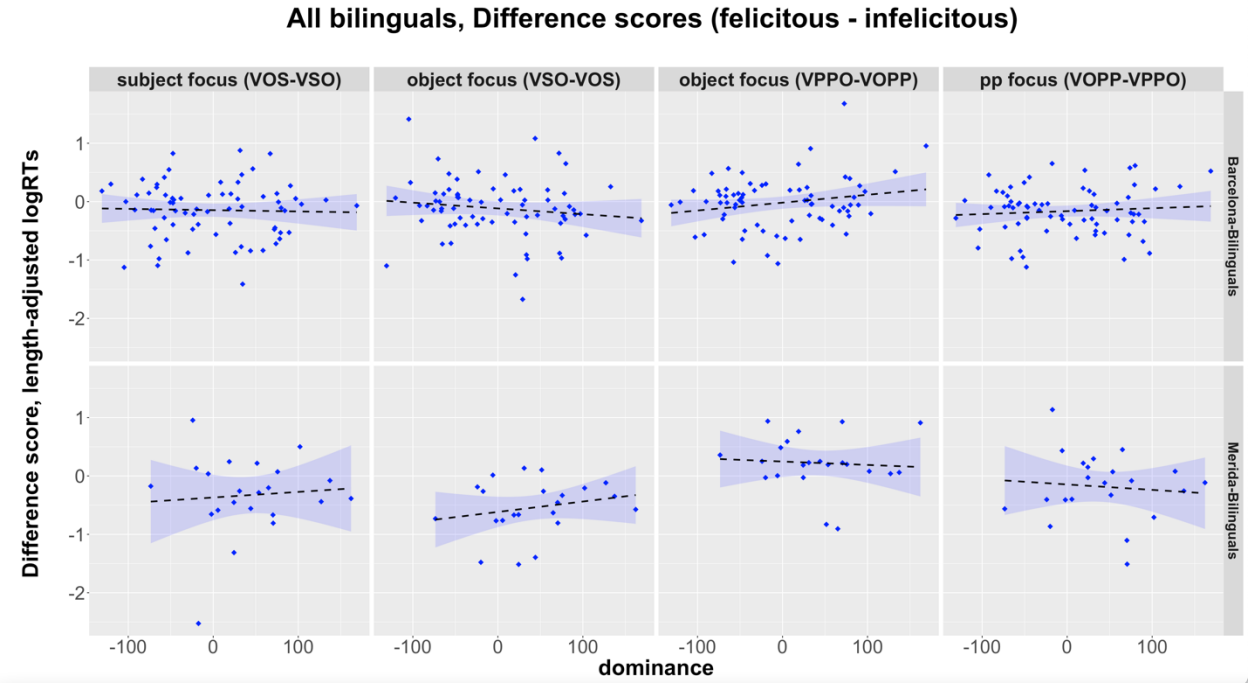

Figure 13. Differences in length-adjusted log-transformed reading times between felicitous and infelicitous sentences by context and group.

8. General discussion

Table 22 summarizes the theoretical predictions and results.

Table 22

Summary of predictions and results by hypothesis

Hypothesis	Prediction	Result
Interface Hypothesis	Non-language-specific optional/variable rule application by bilinguals, especially visible in processing data.	No group differences in processing, thus also no language-specific effects in processing. No evidence of variable rule application during online processing; all speakers process sentence appropriateness in context.
Structural Overlap	No predicted influence for subject focus items we tested. For object/PP focus, language-specific effects: • more fronting for Yucatec Maya group, and • more fronting/CLRD for Catalan-dominant group.	No evidence of influence. Only some language-specific effects: • more fronting for Yucatec Maya group, • no evidence of language-specific effects in processing.

Our first two research questions considered language-specific effects when judging and processing Spanish focus. For judgments, the groups did not differ in language-specific ways, with one exception: Yucatec Maya bilinguals chose more fronting than the others. Although they patterned with the Spanish monolingual group and both Catalonia groups in preferring canonical VOPP for both object and PP focus, their increased use of fronting is indicative of language-specific CLI. For processing, we found no evidence of language-specific effects.

Our third research question asked whether language-specific effects could be attributed to structural overlap. Recall that our operationalization of structural overlap made three predictions (Table 2 and Table 22): (i) no effect on subject focus; (ii) more fronting for both object and PP focus by Yucatec Maya bilinguals; and (iii) more CLRD for PP focus and more fronting for object focus by Catalan bilinguals. Judgment results uphold the first two predictions, but not the third. Although the Catalan-dominant bilinguals chose CLRD for PP focus twice as often as the Spanish-dominant group, the difference failed to reach statistical significance, and the groups did not differ at all in their preferences regarding fronting for object focus. The Structural Overlap Hypothesis did not make predictions for the specific word orders included in the processing data.

Our fourth research question asked whether language dominance would modulate CLI; we did not find any such evidence. In fact, the lack of language dominance effects when examining only the Barcelona groups further supports the conclusion that there was no difference in CLRD use between the groups because it shows that the judgments did not vary along the cline of dominance. This finding was unexpected given evidence that language-external factors can modulate CLI (e.g., Kupisch, 2007, 2014). As one anonymous reviewer points out, however, this could very well be because the assessment is not fine-grained enough to capture small effects. While we cannot discard this possibility, we can note that the range in the dominance scores (Table 3 and Table 4) is wide enough that we don't believe this is due to sampling issues.

What do our results imply for the two hypotheses considered in §2?

The Interface Hypothesis predicts non-language-specific CLI, because optionality should apply to all bilinguals. Moreover, we should observe this optionality in processing. In the judgment task, Yucatec Maya bilinguals provided a wider range of answers than other groups under object focus, which could be interpreted as optionality. Although they, like all the other groups, preferred the canonical order for object/PP focus, they chose each of the two less-preferred orders about one-fifth of the time. Because canonicity can affect judgments, it is possible to understand this wider distribution of answers as variable rule application regarding contextual felicity, potentially indicating support of the IH. However, this optionality does not extend to Spanish/Catalan bilinguals in the same context, nor does it extend to the Yucatec Maya bilinguals' judgments of subject focus, which show a clear preference for VOS over VSO, weakening the case for interpreting the object focus results as optionality. More importantly, we find no evidence of optionality in self-paced reading. We interpret the even reading times between VOPP/VPPO under object focus to be evidence that focus-final contextual appropriateness (VPPO) mitigates the RT penalty for non-canonical orders, because otherwise VOPP is always read faster. Therefore, these cases do not constitute variable rule application. Furthermore, we note that the result is consistent across groups, including monolinguals. Finally, it is worth noting that we do not observe group effects on RTs overall; that is, we do not see evidence of generally effortful processing for bilinguals. We conclude our results do not support the Interface Hypothesis.

Our results, however, partially support the Structural Overlap Hypothesis. The Yucatec Maya bilingual group appears to show language-specific CLI, and we do not observe language-independent effects of bilingualism, consistent with the hypothesis that what matters is structural overlap (i.e., the potential for input misinterpretation). Nonetheless, support is only partial because we do not observe the expected effects for Catalan bilinguals.

It is possible that the lack of effect for Catalan bilinguals could be attributed to sociolinguistic context, even though we did match the populations by education level. As mentioned earlier, the two Barcelona bilingual groups are quite similar, with literacy, high proficiency, and education in both languages. The Yucatec Maya bilinguals, on the other hand, speak a minoritized language that receives

significantly less societal support. However, we must note that we tested their performance in Spanish, rather than Yucatec Maya, so this explanation must be qualified. Differences could also arise from the comparison group. While the Barcelona bilingual group is compared to another bilingual group (given the sociopolitical situation in Catalunya), the Yucatec Maya bilinguals are compared to monolingual controls, whose linguistic competence is arguably more significantly different.

Finally, we should note that this particular comparison is not a direct one: the differences in CLI involve Fronting for the Yucatec Maya groups while the relevant structure for PP focus for the Barcelona groups is CLRD. Thus, differences in the salience of these structures or their distributional properties (i.e., frequency) might have affected the comparison. For instance, while CLRD is relatively frequent in Catalan, it is very infrequent in Spanish (Villalba, 2011) to the point that its existence has been called into question (e.g., Jiménez Juliá, 2000). Thus, the Barcelona bilinguals may be evincing knowledge of these distributional properties in the input in Spanish. Although we are not aware of any study tallying the frequency of Fronting in Yucatec Spanish, researchers on Yucatecan Spanish *have* found increased fronting in other contexts (Gutiérrez-Bravo, 2020; Gutiérrez-Bravo et al., 2019). Thus, it is possible that although our monolingual group did not evince these particular effects, bilinguals are more accepting of these options because they know they are possible in the input.

Although not inherent in the Structural Overlap Hypotheses, we also expected language dominance to modulate the effects of CLI, contrary to our findings. The lack of dominance effects could be due to our chosen measure. As mentioned in §5, language dominance is a complex and multifaceted construct, and the BLP measures only its sociolinguistic aspects. Perhaps an instrument that measured linguistic abilities or psycholinguistic factors of language dominance would reveal something different.

Overall, our results echo other experimental investigations that suggest the syntax-discourse interface is not a site of inexorable optionality (Hopp, 2009; Ivanov, 2009; Leal et al., 2017; Smeets, 2019), while contrasting with those finding difficulty at this particular interface (e.g. Belletti et al., 2007; Sorace & Serratrice, 2009). Independently, other researchers have called into question the explanatory power of the IH because optionality also appears to characterize native speaker grammars (Gupton & Sánchez

Calderón, 2021; Prévost, 2011) and structures involving only narrow syntax, such as S-V inversion in interrogatives, which show evidence of vulnerability (Cuza, 2012). In our view, however, the IH has been valuable in spurring interest in discourse-related factors and has enlarged our database of potential vulnerabilities in bilingualism. Future research should provide additional evidence using online methodologies which focus on other external-interface structures and additional language combinations before the IH can be falsified.

9. Conclusion

Our results make two main contributions to the literature on bilingual language knowledge and CLI. First, we provide evidence of influence (or lack thereof) from typologically dissimilar languages on the same structure using tasks covering different modalities, including measuring real-time processing. Second, we provide direct tests of two of the most prominent hypotheses explaining how a bilingual's languages influence one another. Our main findings are: (i) apparent language-specific CLI for Yucatec Maya bilinguals but (ii) no apparent CLI for Catalan bilinguals and (iii) no significant differences in real-time processing. We did not find support for the Interface Hypothesis but did find partial support for the Structural Overlap Hypothesis, although without any apparent effects by language dominance.

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