

ON RELATIVE CLAUSE ATTACHMENT AMBIGUITY:  
PARSING STRATEGIES OF FRENCH-ENGLISH BILINGUALS

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**Abstract:** Aiming to shed more light on sentence processing in bilinguals, this paper explores the interpretation of relative clauses that temporarily have two potential antecedents. Languages have been found to differ in their default attachment preferences, with French preferring high (NP1) attachment and English possibly preferring low (NP2) attachment of the relative clause. In response to contradictions in past research, I probe whether the amount of L2 exposure has an effect on bilinguals' preferred attachment strategy or whether it is set in stone. I also ask whether the pre- or postverbal position of the relative clause has a bearing on the parse. I investigated two groups of 6 French-English bilinguals: one group that have lived in the UK for an average of 25.7 years, and a second group that have limited experience of Anglophone immersion. I compared them to 6 monolingual English controls. Participants completed a self-paced reading task in concurrence with an AJT. Test items contained a complex NP, as well as a relative clause that could plausibly attach to either the head of the complex NP or to the lower NP. A final phrase disambiguated toward either high or low attachment. On-line (reaction time) and off-line measures (acceptability ratings) were recorded. Results were not conclusive with regard to the L2 exposure hypothesis, but discussion ensues about what may have interfered with the capturing of baseline attachment preferences. Significant results emerged regarding relative clause position, but not in line with the prediction made, hence calling for further investigation into the phenomenon.

**Keywords:** relative clauses, bilingualism, French bilinguals, sentence processing, on-line processing, self-paced reading, AJT, parser, attachment sites, ambiguity resolution, structural ambiguity

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## **1 Introduction**

Pervasive in natural language, structural ambiguities appear in abundance and yet can often go unnoticed by the parser. Research into the interpretation of such ambiguities has been growing, in turn presenting particular challenges for universal parsing models such as Frazier's Late Closure principle (1979). Comparative research into sentence processing was spurred on by Cuetos & Mitchell's (1988) pioneering on- and off-line studies that flagged nonconformity between Spanish and English in the parsing of ambiguous relative clauses. Attempts to reconcile such apparently disparate parsing mechanisms within a single, unified analysis have been numerous (see, e.g., Gibson *et al.* 1996).

When a relative clause (henceforth RC) follows a complex NP, ambiguity can arise as to which NP the RC is intended to modify. Consider (1).

(1) She knows the son of the journalist who is missing.

Structures such as (1) are globally ambiguous; in the absence of context, the ambiguity remains unresolved, even by the end of the sentence. Nonetheless, readers intuitively favour one parse or the other, be it that the journalist is missing or their son. If the RC modifies NP<sub>1</sub> (i.e., in (1), the son is missing), the sentence has been processed with high attachment (HA) of the RC (see Figure 1 below). Conversely, adjoining [<sub>CP</sub> who is missing] to the more recent of the NPs (the journalist) would be a case of low attachment (LA, shown in Figure 2).

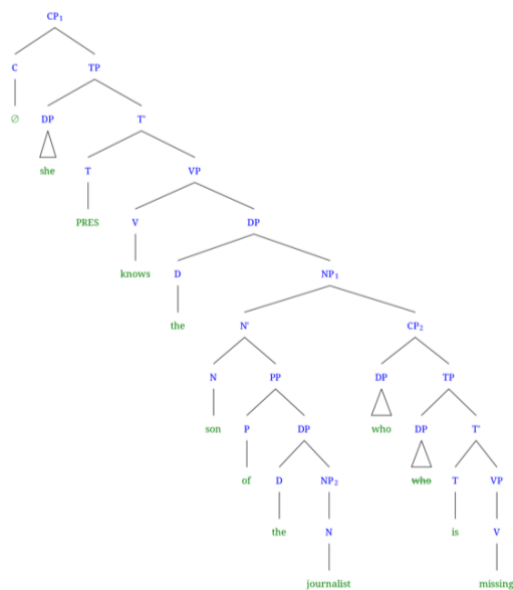


Figure 1. Relative clause attached to NP<sub>1</sub> (HA)

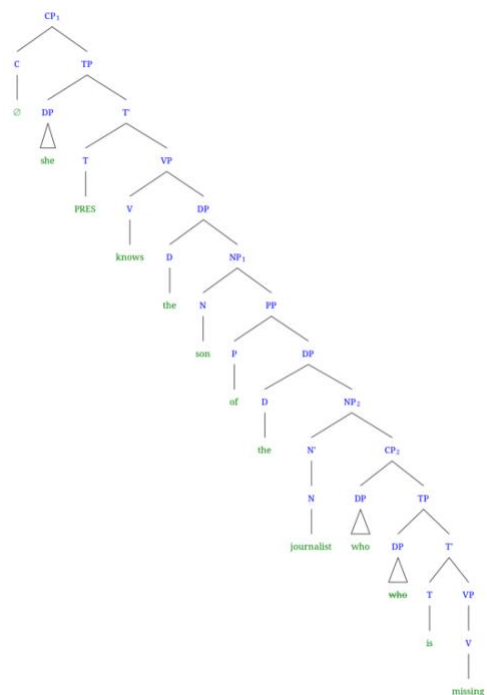


Figure 2. Relative clause attached to NP<sub>2</sub> (LA)

Whether attached low or high, the RC is adjoined as an adjunct to N' (in line with Smits 1989: 105-110), with a determiner scoping over the RC-modified NP. The copy [DP<sub>wh</sub> who] represents what Smits (1989) refers to as the relative gap, i.e. the initial position of the now relativised element that the RC is modifying.

Widely established is the incremental manner in which parsing is done (see, e.g., Williams 2006). If sentences were processed by waiting until the end of the sentence before imposing any structure onto it, we would not experience garden-path effects. These occur when the disambiguating information is revealed later in the sentence and triggers a reanalysis of the initial interpretation, thus increasing the total processing time (see Hoover & Dwivedi 1998). In this paper, such temporarily ambiguous sentences will be used to shed light on the RC attachment preference(s) of French-English bilinguals.

I begin in section 2 with a survey of the existing literature, and then outline the aims of my research in 2.1. The methodology is set out in section 3, and its results constitute section 4. Section 5 follows with a discussion of the results in relation to my research questions and to past studies, finally concluding in section 6 along with suggestions for future research.

## 2 Literature review

Studies have revealed crosslinguistic differences in monolinguals' baseline attachment tendencies when it comes to ambiguous-RC processing. For instance, all things being equal, French speakers appear to join Spanish (Cuetos & Mitchell 1988), Dutch (Brysbaert 1996) and German (Konieczny & Hemforth 2000) in favouring HA (Zagar *et al.* 1997). In contrast, British English (BrE) monolinguals tend either to display an LA bias (Cuetos & Mitchell 1988) as in Mandarin (Shen 2006) and Brazilian Portuguese (Miyamoto 1998), or no preference at all (Carreiras & Clifton 1993).

Bilinguals overwhelmingly converge on a single attachment preference for both languages, even when the biases of monolinguals in their two languages conflict (Leeser & Prieta 2015; Maia & Maia 2019). Which bias they settle on in these cases is of real interest. Since the L1 questions in Maia & Maia's study (2019) directly followed the L2 questions for all participants, order effects may have been induced here. Leeser & Prieta (2015), on the other hand, ensured that half of the participants completed the L1 task first, and half started with the L2 task.

Leeser & Prieta's (2015) on-line study reveals bilinguals (Basque L1, Spanish L2) to converge on an LA bias in both languages (typical of Basque monolinguals), despite the HA bias of Spanish monolinguals (Carreiras & Clifton 1999, *i.a.*). The question remains open as to whether they converged on LA for reasons of economy – whereby, if the more economical bias is available to a parser through one of their languages, they will apply it to both – or of language dominance. To gain further insight into this, they call for investigation into bilinguals that are dominant in a HA, rather than an LA, language.

Frazier (1979) suggests that economy is a key driver of parses, as it minimises computational demand. She posits that many parsing mechanisms are simply “special cases” (1979: 1) of the more generalised Late Closure principle and Minimal Attachment, thus predicting a cross-linguistic LA bias. However, the aforementioned languages that have since been shown to tend towards Early Closure (or HA) present a challenge for this analysis. While LA preference in child language does likely stem from processing efficiency given their more limited working memory (Felser *et al.* 2003), the LA preference among English-speaking adults may not be purely economy-driven; if it were, the LA bias would be expected to be universal.

Among the first to call into question the universal application of Late Closure (Frazier 1979) were the results of Cuetos & Mitchell's (1988) self-paced reading task, which shows significant evidence of a HA parsing preference in Spanish monolinguals. Note, however, that reading times were not normalised across participants, running the risk of particularly slow or fast readers skewing results (Cuetos & Mitchell 1988: 85).

Note also that English – unlike Romance languages – has the so-called Saxon genitive (e.g. *doctor's husband*), which can only take an RC that modifies the head noun (*husband*). Unlike the Norman genitive (*husband of the doctor*), the Saxon circumvents RC attachment ambiguity. Perhaps, then, English speakers' LA bias exists because they implicitly assume that the more common Saxon genitive would have been used if the head noun were intended to be modified. Indeed, this would align with Grice's (1975) maxim of manner (clarity).

Several lines of evidence suggest that the L1 attachment preference may play a significant role in which bias is converged upon. Marefat & Meraji (2007) find that English-Persian (LA-HA) bilinguals apply the attachment bias of their respective L1 to both languages. They infer, then, that a parser's go-to strategy is set early on, being carried into subsequently-learned languages via L1 interference. This is not dissimilar from findings on the age of L2 acquisition onset. For example, Fernández (1999) posits that native-like parsing mechanisms can only be successfully acquired if the L2 acquisition begins before the end of the critical period (around age 10). However, the offline nature of both of these studies prevents any conclusions from being made about the parsing process itself; only the final interpretation is known.

Data from the following on-line studies counter this implication that attachment biases become set in stone. Dekydtspotter *et al.* (2008) finds that fourth-semester students of French (L1 English) amend their interpretations toward HA in truth-value judgment tasks, whereas second-semester students do not. Although participants were tested solely on French items, it indicates a possible effect of L2 exposure on ambiguity resolution. Indeed, Frenck-Mestre (2002) observes that, the more proficient a bilingual becomes, the more similar they become to the monolinguals in their parsing mechanisms (Frenck-Mestre 2002). This is further corroborated by Dussias & Sagarra's (2007) eye-tracking study. They observe that bilinguals (Spanish L1, English L2) who are experiencing daily L2 immersion adapt



- (4) “Focus Attraction Hypothesis: It is more likely that a phrase that is neither a complement nor syntactically obligatory will be taken to modify a phrase P if P is focused than if it is not, grammatical and pragmatic constraints permitting.”

(Schafer *et al.* 1996: 136)

Next, I return to the ‘relative gap’ mentioned in section 1. RC structure differs depending on whether the relative gap occurs in subject or object position. The latter (e.g. ‘*I remember the nurse [who I saw \_\_].*’) are harder to parse than subject RCs (‘*I remember the nurse [who \_\_ saw me].*’). If not universally (cf. Carreiras *et al.* 2010), this holds in at least English (Ford 1983) and French (Cohen & Mehler 1996; Holmes & O’Regan 1981), among others.

Referentiality also influences RC attachment. All else being equal, if one of the NPs in a complex NP is introduced by an overt determiner and the other is not, the former is the more desirable host (Gilboy *et al.* 1995). Choice of relative pronoun can also have an effect on the parse (see Delle Luche *et al.* 2006), as can the type of preposition in the complex NP. Preposition *with*, assigning a theta-role to NP<sub>2</sub>, provokes an LA bias, while the non-theta-assigning *of* has no such effect (Gilboy *et al.* 1995). This is likely due to the costliness of reanalysing the RC as part of a different thematic domain – see De Vincenzi & Job’s (1995: 1309) Thematic Reanalysis Constraint.

## 2.1 Research aims

To follow on from previous research, the current study investigates the RC attachment biases of bilingual speakers of French (L1) and English (L2): languages that have reportedly disparate RC attachment preferences. I ask two main questions:

- Does amount of BrE immersion influence French-English bilinguals’ baseline attachment bias?
- Does the syntactic position of the *NPofNP+RC* structure affect its parse?

To address these research questions, the dependent variables that I will measure and examine are reaction time (specifically, the proportion of time spent reading the 'critical' segment 3, henceforth RT proportion) and acceptability rating. The independent variables, and their levels, are: (a) language (French/English); (b) attachment type post-disambiguation (HA/LA); (c) syntactic position of RC (pre-/post-verbal); (d) participants' BrE exposure (4+ years/<6 months).

Following French-Mestre's (2002) and Dekydtspotter *et al.*'s (2008) indications that attachment biases evolve as L2 exposure builds, I hypothesise that the French-English bilinguals who are long-term UK residents will perform more similarly to English monolinguals, showing more LA preference than those who have less immersive experience.

This next hypothesis follows Schafer *et al.*'s (1996) conclusion that modifiers are preferentially attracted to focussed constituents, coupled with the finding that objects are more often the recipients of focus (Carlson *et al.* 2009). Based on Hemforth *et al.*'s (2015) proposal that focus would scope over the whole complex NP, inducing HA, I hypothesise that RCs will exhibit more high-attachment in postverbal (object) position than in preverbal position.

### **3 Methodology**

#### *3.1 Participants*

In total, 18 participants volunteered to partake. 6 participants constituted a monolingual English control group. The other 12 were L1 French speakers with an advanced level (near-native and/or university-level) of English.

The bilinguals were divided evenly into two groups according to their amount of exposure to BrE. I refer to them as 'extensive-immersion' and 'limited-immersion' bilinguals, following Dussias & Sagarra (2007). The extensive-immersion bilinguals ( $n=6$ ) comprised current, long-term UK residents, ranging from 4 to 42 (mean=25.7) years' residency. The limited-immersion bilinguals ( $n=6$ ) had either never lived in an Anglophone country, or had done so for <6 months but not within the last 10 months, and were residing in France at the time of completing this task. L2 acquisition was initiated at 11-12 years of age in the former group, and age 6-10 in the latter.



### 3.2 *Method*

Using Gorilla, I designed a self-paced reading task which measured RTs, alongside an AJT. All participants were presented with the same English sentences, but the bilinguals were additionally presented with French items. Whether the bilinguals were shown the French or English block first was randomised. The items within the blocks were also randomised to further prevent priming or order effects.

#### 3.2.1 *Methodological revisions following the pilot study*

5 monolingual English speakers participated in a pilot. As their survey response times were longer than expected, I decided to reduce the number of items in the main survey by 25%. This was done in an effort to prevent loss of focus, keeping responses reliable throughout (bearing in mind that the bilingual survey was going to comprise double the number of items).

Furthermore, the pilot results made clear the need to constrain the length of the sentences more strictly. To balance out the phonological weights of sentences, I controlled for number of syllables in the main study (see section 3.3) and requested that participants read the segments aloud. I also decided to control for disambiguation method, replacing the few items that were disambiguated by gender with pragmatically-disambiguated items. This controlled for the possibility of one disambiguation strategy being faster to process than the other.

### 3.3 *Materials*

Each test item contains a structure *NP1-of-NP2-RC*, whereby the complex NP is revealed in segment 1 and the RC in segment 2. Segment 3 follows, of which the purpose is to disambiguate by making only either a HA or LA interpretation plausible. Since the sentences are disambiguated pragmatically, they strongly encourage a high or low attachment, but may not force it (hence the relevance of the AJT).

The test conditions for the bilinguals were as follows. Half of the items in each language block contained preverbal RCs whereby the complex NP was a subject, and half contained postverbal RCs whereby the complex NP was the object of a verb. Half of each of those were disambiguated toward HA, and the other half toward LA (see Table 1).

Table 1. Bilingual experimental conditions.

		HA	LA
French	preverbal RC	$n=3$	$n=3$
	postverbal RC	$n=3$	$n=3$
English	preverbal RC	$n=3$	$n=3$
	postverbal RC	$n=3$	$n=3$

The total number of test items for the bilinguals, then, was 24 (plus 24 fillers). The experimental design for the monolingual group was the same (excluding the French block), resulting in a total of 12 test items and 12 fillers. See below examples of test items that both the bilinguals and monolinguals saw (5–8), and see the full set in the Appendix.

NB: | = segment boundary.

(5) The mother of my classmate| who ended up in hospital| asked to get discharged today.  
Preverbal RC, HA

(6) I advised the sister of my flatmate| who really loves a party| to stop clubbing every night.  
Postverbal RC, HA

(7) The son of the gentleman| who is the local vicar| does not follow a religion.  
Preverbal RC, LA

(8) They shot the servant of the actress| who was on the balcony| filming the opening scene.  
Postverbal RC, LA

It is expected that participants attach the RC in some way during segment 2, re parsing if necessary during segment 3. If their initial parse aligns with the one that is forced by segment 3, no restructuring is necessary, and it is presumed that the reading time in this segment would be shorter (similar to fillers) as a result. As such, the third segment is the critical segment, and it is the proportion of time spent reading this segment that is examined.

I ensured that, during segment 2, HA and LA would be equally plausible, so that the results would capture participants' default attachment bias. The following factors were also controlled for, so that they would not affect the parse.

Firstly, all sentences (including fillers) were composed of 23(±1) syllables. Invariably, segments 2 and 3 each contained 7-8 syllables. Next, given Gilboy *et al's* (1995) reported preposition and referentiality effects outlined in section 2, the only preposition I incorporated was the non-theta-assigning *of*, and all segment 1 NPs were introduced by overt determiners.

Further, to prevent possible pronoun effects, the relative pronoun was consistently *qui* in French and its closest English counterpart, *who*. Object RCs in French require *que*, and were thus avoided in the survey in order to keep the pronouns consistent. Besides, object RCs take longer to process than subject RCs – see section 2 – and may thus have confounded results. In controlling for relative pronoun, I also controlled for animacy, as *who* is incompatible with non-animate NPs.

In each language, 50% of the filler items contained a complex NP but no RC, and the rest contained an RC but a simple NP. As a result, all fillers were unambiguous. Also, half of the fillers contained preverbal NPs and half postverbal, in line with the test items. 25% of the fillers were clearly nonsensical.

### 3.4 Procedure

The bilinguals first answered 3 background questions: the age at which they began to learn English, how long they have lived in an Anglophone country if applicable, and the proportion (on a sliding scale) of time they typically spend using each language.

The instructions stated that part of a sentence would appear on their screen and that they should click anywhere to reveal the subsequent segments (but not before they had finished reading the visible segment). They were told that the sentence would then disappear and they would be asked to rate it. Participants were advised to read the sentences aloud and to go with their intuition, and were assured that they could withdraw at any point.

Then began the practice phase, made up of 4 items that were absent of RCs or complex NPs. As in all items to come, segment 1 would appear, with the rest of the sentence censored until the participants clicked to reveal the next segment. Once all three segments were visible, the participant could click to proceed to the next screen. The AJT consisted of a question (*'Does*

*this make sense?'*) and a 5-point Likert scale with labels at either side (1 = '*Doesn't make sense*'; 5 = '*Makes total sense*'). A response on the Likert scale was required before they could click *Next* or *Suivant* for the next item. This procedure was the same for all items (in both the practice and test phases).

Upon completion of the practice phase, a screen appeared, stating again not to click for the next segment until they have read what's already visible, and that there were no right or wrong answers. They clicked 'Start' to begin the test phase. At the start of each block, a screen would alert them to which language they should expect. For the French items, the AJT question and labels were in French. Exactly halfway through the French block and the English block, there appeared an attention-checker screen. This required participants to type a 2- or 3-character code before continuing. The task ended once the participant had seen all items.

### *3.5 Analysis*

I used RT as a proxy for processing time, under the assumption that a longer processing time is indicative of re-parsing. For each item, I calculated the time between the reveal of segment 3 and the onset of the next (AJT) screen, as a proportion of the participant's total reading time. The raw RTs may not have yielded reliable comparisons; some participants are likely to have had longer or shorter latencies overall. Instead, analysing the segment 3 RT as a proportion of their total sentence reading time normalised this variation.

Turning to the AJT, I assumed that a low rating on a test item would suggest that the participant has an opposing attachment preference so strong that they struggled to re-parse. Alternatively, they did not deliberate for long enough to re-parse, but, either way, I assume that a low acceptability rating may signify that the disambiguation strategy did not match their initial parsing decision made during segment 2.

I calculated mean AJT scores and mean RT proportions for each item and condition, as well as participant means and standard deviations. This allowed me to calculate the mean Z-scores per item and then per condition.

### 3.6 Predictions

Based on my hypotheses in section 2.1, I predict that the acceptability ratings and RT proportions of extensive-immersion bilinguals will be comparable with those of the monolingual controls, whereas limited-immersion bilinguals will display a stronger HA bias, in the form of lower RT proportions and higher AJT scores for items that are disambiguated by HA than by LA. Secondly, I predict that all groups' RT proportions will be lower, along with higher AJT scores, for items containing postverbal HA-disambiguated RCs as compared to preverbal HA-disambiguated RCs.

## 4 Results

### 4.1 Reaction times

The bilinguals' RT proportions, shown in Table 2 below, were often higher when items were disambiguated toward LA than toward HA, however never significantly. The monolinguals patterned comparably. As can also be seen in Table 2, the extensive-immersion bilinguals' and monolinguals' RT proportions were similar (0.57 and 0.55 respectively for HA English items, and 0.56 and 0.57 respectively for LA English items). Limited-immersion bilinguals, on the other hand, displayed reduced RT proportions relative to the other groups ( $p < 0.05$ ), in all conditions shown in Table 2.

Table 2. Effect of disambiguation type and language on mean RT proportions.

	English		French	
	HA	LA	HA	LA
Extensive-immersion bilinguals	0.57 (0.33)	0.56 (0.31)	0.50 (-0.09)	0.52 (0.00)
Limited-immersion bilinguals	0.39 (0.03)	0.41 (0.13)	0.42 (0.19)	0.45 (0.31)
Monolinguals	0.55 (0.16)	0.57 (0.26)		

(Mean Z-scores in parentheses.)

The extensive-immersion bilinguals showed significantly lower ( $p < 0.05$ ) RT proportions when reading HA sentences in French as compared to HA in English. This was the only case where responses to English items significantly diverged from French items in their RT proportion. RT proportions for filler items were significantly lower than for test items ( $p < 0.05$ ) in all participant groups.

As in Table 3 below, the mean RT proportions for high-attaching test items appeared to be higher in cases where the RC was preverbal than when it was postverbal – but not reaching significance – for the monolingual ( $p=0.053$ ) and extensive-immersion ( $p=0.08$ ) groups. Limited-immersion bilinguals performed similarly regardless of RC position in HA sentences.

Table 3. Effect of RC position on mean RT proportions for HA test sentences.

	preverbal HA	postverbal HA
Extensive-immersion bilinguals	0.56	0.51
Limited-immersion bilinguals	0.40	0.42
Monolinguals	0.59	0.51

#### 4.2 Acceptability judgments

As Table 4 shows, in terms of the acceptability of English items, the extensive-immersion bilinguals converged closely to the monolinguals (z-scores of -0.13 and -0.11 respectively for LA items). For high-attaching English items, the limited-immersion bilinguals converged more closely to the monolinguals' responses, however all three groups were comparable.

Table 4. Effect of BrE immersion on mean acceptability ratings.

	English		French	
	HA	LA	HA	LA
Extensive-immersion bilinguals	3.81 (0.12)	3.39 (-0.13)	3.86 (0.19)	3.44 (-0.07)
Limited-immersion bilinguals	3.89 (0.15)	3.72 (0.04)	3.72 (0.03)	3.19 (-0.33)
Monolinguals	3.92 (0.14)	3.47 (-0.11)		

(Mean Z-scores in parentheses.)

The LA English items averaged higher ratings from the limited-immersion bilinguals than from the other groups, but not significantly ( $p=0.20$ ). Significant divergence was observed between the limited-immersion bilinguals' AJT ratings for English LA-disambiguated and French LA-disambiguated items.

The effect of RC position is illustrated in Figure 3 below. The predicted effect (higher-rated HA when RC was postverbal) was shown by the monolingual English participants, though not to a statistically significant degree, thus likely occurring due to chance. As for both bilingual groups, the HA-disambiguated items were rated significantly lower when the RC was in postverbal position than when in preverbal position ( $p<0.05$ ).

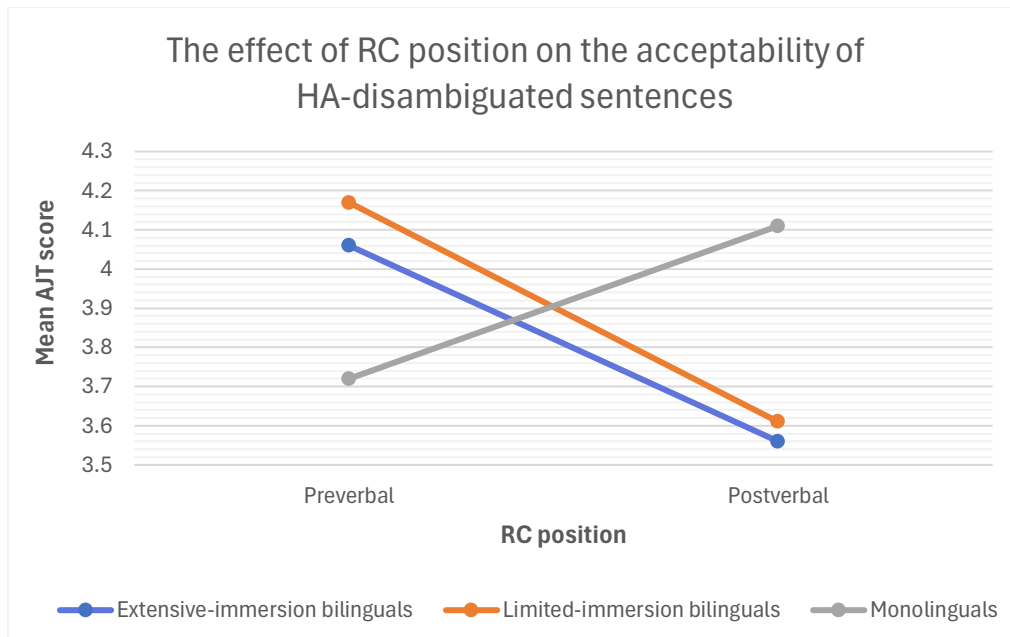


Figure 3. Effect of RC position on AJT responses to HA items.

The limited-immersion bilinguals revealed the same significant position effect when restricted to French test items only ( $p < 0.05$ ), but the extensive-immersion bilinguals did not ( $p = 0.052$ ). English sentence ratings alone had no significant effect.

## 5 Discussion

### 5.1 The immersion effect

Extensive-immersion bilinguals converged particularly closely with the monolinguals in their proportion of time spent reading segment 3 (see Table 2). In contrast, limited-immersion bilinguals significantly diverged from the other groups, regardless of HA/LA disambiguation and regardless of language. The data show, then, that the bilinguals who have more L2 exposure pattern more closely with the monolinguals. This corroborates Frenck-Mestre (2002) and Dekydtspotter *et al.* (2008) and aligns with my hypothesis made in section 2.1.

Nonetheless, it must be noted that other factors might be at play here. According to Fernández's (1999: 224) classification based on the critical period, all the extensive-immersion bilinguals in my study would class as late learners of English (having started learning after the age of 10), and all the limited-immersion bilinguals as early learners.

Technically, then, the two may be conflated: the differences observed between the bilingual groups may be due either to age of L2 acquisition onset, or to the amount of English immersion. It should be taken into account, however, that Fernández's (1999: 224) categorisation was "somewhat arbitrary". Further, Fernández's (1999) account would have predicted that the early learners would be the ones converging more closely with the monolinguals. This did not seem to be the case for this dataset, but future studies may focus in on this question specifically.

Next, the finding that extensive-immersion bilinguals spent proportionately longer on the critical segment in English HA than French HA items may be due to re-reading, although this would need to be verified by eye-tracking. Frenck-Mestre (2002) explains that even highly-proficient L2 speakers re-read sentences much more than L1 speakers do. She posits that it could be a lingering habit from earlier on in their L2 acquisition to ensure correct comprehension. Although, if this is to explain the significant difference between English and French HA reading times, it does not explain why the same pattern was not significant for LA reading times, nor among limited-immersion bilinguals.

## 5.2 *The position effect*

At first glance, the monolingual group performed in concordance with my hypothesis, but results were not statistically significant. In contrast, the bilingual groups contradicted my prediction – and Hemforth *et al.*'s (2015) findings – to a significant extent in their AJT ratings.

After isolating the French test items, the limited-immersion group still favoured high-attaching RCs when they occurred preverbally rather than postverbally. The fact that this was not borne out when isolating the English test items may be suggestive of cross-linguistic variation with regard to the strength of the position effect, which Hemforth *et al.* (2015) also proposed. What's more, the fact that extensive-immersion bilinguals only showed a significant position effect when both languages' ratings were combined could be another signal that RC position does not have a great effect in French or English. This would corroborate Hemforth *et al.* (2015) who found a much more marked position effect in German and Spanish than in French and English, but they found the opposite effect (a preference for postverbal HA over preverbal HA). Further investigation is necessary to reconcile these conflicting results.



### 5.3 General discussion

It may appear that the bilinguals in the present study largely converged on HA for both languages. As HA is the baseline attachment preference among monolinguals of their L1, this would support Marefat & Meraji's (2007) idea that attachment preferences are set early on, with L1 biases then interfering with parses in the L2. It would also suggest that Leeser & Prieta's (2015) observation of LA convergence was a consequence of having an LA-biased L1.

However, it was not only the bilinguals that exhibited an overall HA preference, but also the monolingual BrE speakers. This does not converge with the general consensus in the literature thus far, which would have predicted a mild LA bias among this group. This suggests that another factor may have been causing the push toward HA, in which case, the responses captured may not be representative of the speakers' baseline attachment preferences.

What could have interfered? Upon reflection, in many of the test items, NP<sub>1</sub> was a high-frequency noun relative to NP<sub>2</sub>. In fact, in over half of the cases, NP<sub>1</sub> denoted kinship (*son, mother, etc.*) and NP<sub>2</sub> a profession (*colonel, secretary, etc.*). Pynte & Colonna (2000) expand on Schafer *et al.*'s (1996) account of focussed phrases attracting modifiers, suggesting that a relatively low-frequency NP would appear more salient. It would consequently be more prominent in the discourse and thus a more attractive host for the RC. Yet, this predicts that a higher-frequency NP<sub>2</sub> would promote an LA bias, and the opposite was found in our results.

Perhaps a more plausible cause for the apparent overrepresentation of HA parses – and one that seemingly overpowered the word frequency effect above – lies in the relative lengths of the RCs and complex NPs. Under Fodor's (1998) same-size-sister hypothesis, the modifier seeks a sister that is similar in prosodic weight. Whilst length was controlled for – with each segment bearing a comparable prosodic weight (see section 3.3 and Appendix) – the NP<sub>2</sub> in the complex NP was generally in the 2-4 syllable range. Fodor's (1998) model would predict that, in this case, the RC would be better matched as a sister to the entire complex NP (HA) than to the NP<sub>2</sub> (LA). Indeed, this is what was shown. Had the RC been syllabically similar to the NP<sub>2</sub> rather than the complex NP, though, all results may have been skewed towards LA – or so the same-size-sister model predicts. Overall, the results of the self-paced reading task and AJT provide support for Fodor's (1998) analysis, on the basis that the NP<sub>2</sub> often proved too prosodically light to be a fitting host for a 7- or 8-syllable RC in both English and French.

Next, the sample size in the current study was limited ( $n=12$  bilinguals), especially considering the number of participants in previous studies in the field – 51 bilinguals (Marefat & Meraji 2005), 44 bilinguals (Dussias & Sagarra 2007), etc. Nonetheless, a significantly lower proportion of the reading time was spent on the critical segment in the fillers compared to the test items. This is reflective of expectations. It indicates that, since the filler items were absent of ambiguity, there was no need for reanalysis and, resultingly, the RT (and the net computational demand placed on the parser) was lower. Further, it provides support for the linking hypothesis, which predicts smaller RT proportions for the more easily-processed sentences.

## **6 Conclusion**

The literature does not entirely converge on whether or not L2 exposure has an effect on bilinguals' parsing routines. However, on-line experiments (Dussias & Sagarra 2007; Frenck-Mestre 2002) have put forward a strong case claiming that increased immersion in an L2 can lead to the adoption of its attachment bias. While the data from my task does not lead me to take one stance or the other, it warrants further study, perhaps also integrating the factor of age of L2 acquisition onset as explored in an off-line questionnaire by Fernández (1999). This would allow for an investigation into whether age of acquisition or amount of exposure has the more powerful effect on whether or not the L2 parsing bias is adopted. Additional findings could have significant theoretical implications on the wider field of sentence processing as a whole.

To summarise the RC position effect, there is a dearth of research on how it may influence the choice of attachment site in temporarily ambiguous sentences. However, Schafer *et al.* (1996) predict an effect. When investigated, an effect has been found, and to differing degrees depending on the language (Hemforth *et al.* 2015). This, in tandem with the unexpected results from my AJT, justifies a call for future studies to take a (comparative) look at the potential impact of pre- vs. postverbal RC position.

What is clear from the literature is that many factors can have an effect on whether the RC preferentially adjoins high or low in the structure. Consequently, it can be a challenge to isolate the language's baseline attachment preference and to tease apart potentially influential factors. Whilst much research has emerged from this field since the 1980s, it seems plausible that there remain many more effects to be uncovered. Further research should also represent lesser-known, non-Indo-European languages, to provide necessary challenge and/or support to the existing research base.

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## Appendix

† = Adapted from Cuetos & Mitchell (1988)

### HA, preverbal RC

Le patron du boulanger | qui avait enfreint la loi | s'en est sorti impunément.

The mother of my classmate | who ended up in hospital | asked to get discharged today.

La cousine de la reine | qui a l'air avide de pouvoir | doit juste être jalouse d'elle.

The son of my neighbour | who looks noticeably tired | must have stayed up past his bedtime.

La collègue de mon amie | qui a commencé comme peintre | nous a montré ses chefs-d'œuvre.

The coach of the footballer | who used to be a swimmer | showed us all his swimming techniques.

### HA, postverbal RC

Ils ont parlé aux enfants des parents | qui restent trop souvent chez eux | et sèchent les cours importants.

We told the servant of the king | who really loves playing chess | to teach him how to play it.

Il aime la sœur du producteur | qui allait chez le médecin | afin de voir sa sage-femme.

He knows the mother of the toddler | who is in the hospital | getting ready to give birth.

J'ai dit au frère de ma colocataire | qui a un don pour l'écrit | de publier un roman.

I advised the sister of my flatmate | who really loves a party | to stop clubbing every night.

### LA, preverbal RC

La voisine de mon amie | qui a vendu sa maison | a l'aidée à déménager.

The accomplice of the criminal | who has somehow not been caught | was jailed for helping commit crimes.

Le beau-père de mon ami | qui ne sait pas encore conduire | est moniteur d'auto-école.

The son of the gentleman | who is the local vicar | does not follow a religion.

Le conseiller du président | qui gagne un tas d'argent | devrait gagner plus que le SMIC.

The fiancée of the teacher | who can't stand going shopping | loves to buy new clothes each week.

### LA, postverbal RC

†J'ai vu la fille de l'infirmière | qui venait souvent chez nous | afin de soigner mon grand-père.

I saw the wife of the plumber | who used to come to our house | to fix the heating system.

J'ai contacté l'ami du sportif | qui a subi des blessures | pendant un des entraînements.

†They knew the sister of the colonel | who had had the accident | with soldiers on the front line.

Ils ont imploré la mère du secrétaire | qui ne sait pas cuisiner | de lui apprendre quelques plats.

†They shot the servant of the actress | who was on the balcony | filming the opening scene.

### Fillers (sensical)

NB: [+obj] = NP is object of a verb; RC (if present) is postverbal

[+RC] = RC present; no complex NP

I witnessed the footballer | who inspired me since childhood | score yesterday's winning goal. [+obj], [+RC]

Il a salué le coiffeur | qui lui coupe toujours les cheveux | quand ils deviennent trop longs. [+obj], [+RC]

The talented magician | who makes you believe in magic | was born to entertain others. [-obj], [+RC]

L'artiste de renommée mondiale | qui a eu plein de succès | est fière de ses réussites. [-obj], [+RC]

The Olympic ski jumper | who hopes to win a gold medal | will be competing today. [-obj], [+RC]

Le restaurateur étoilé | qui espère gagner plus de prix | est toujours dans la cuisine. [-obj], [+RC]

I advised the instructor | who works during most vacations | to take some more breaks from work. [+obj], [+RC]

J'ai demandé à mon ami | qui aime les arts du spectacle | de m'apprendre de danser. [+obj], [+RC]

The son of the farmer | never had a doubt in his mind | that he'd become a farmer too. [-obj], [-RC]

La petite-fille de la brodeuse | savait depuis son enfance | qu'elle aimait aussi le textile. [-obj], [-RC]

I heard the friend of the student | perform the song I composed | on my parents' old piano. [+obj], [-RC]

J'ai vu la femme du pianiste | ainsi que tous leurs enfants | dans la foule à son concert. [+obj], [-RC]

A relative of my colleague | called me in the afternoon | to check that he was at work. [-obj], [-RC]

Le mari de la tricoteuse | lui a demandé poliment | de lui tricoter un pull. [-obj], [-RC]

I thanked the friend of the lady | for cleaning my apartment | when I had broken my arm. [+obj], [-RC]

Je connais l'enseignante de mon frère | depuis presque toute ma vie | parce qu'elle est l'amie de ma mère. [+obj], [-RC]

### Fillers (nonsensical)

The music fanatic | who hates all genres of music | could not afford singing lessons.

[-obj], [+RC]

Le dentiste expérimenté | qui travaille huit heures par jour | est au chômage depuis toujours.

[-obj], [+RC]

I'm divorcing the artist | who has still not proposed to me | after eight years of dating.

[+obj], [+RC]

J'aime le plongeur sous-marin | qui n'a jamais osé nager | à cause de sa phobie de l'eau.

[+obj], [+RC]

I greeted the skater of the diver | for a number of decades | before we saw each other.

[+obj], [-RC]

Elle s'est enfuie du fils du prince | après s'être endormie | dans quatre pays à la fois.

[+obj], [-RC]

The builder of the carpenter | wants to try a new career path | such as manual labour.

[-obj], [-RC]

La tante de mon amie galloise | habite en Nouvelle-Zélande | et n'a jamais quitté l'Europe.

[-obj], [-RC]