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***ON THE INTERACTION BETWEEN SYNTAX, SEMANTICS
AND WORKING MEMORY DURING SENTENCE
PROCESSING: AN EYE TRACKING STUDY***

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Abstract

During language processing, we constantly make predictions about the upcoming words (their semantics, syntactic category). Similarly, during agreement processing different features of information of the antecedent have to be predicted/retrieved. But what is the timing at which these prediction processes interact? Previous research has shown evidence supporting either a *syntax-first model* (Friederici, 2002, 2011) which considers each source of information separable from each other at early stages, and integrated at later ones or an *interactive model* (Hagoort, 2003) that considers all types of information processed simultaneously from early points of processing. In the present study, an eye tracking experiment was conducted with 24 Spanish native speakers in order to explore the course of interaction between lexico-semantic predictability effects with gender agreement between full DP object arguments and object-clitics. In addition, the role of *Working Memory Capacity* (WMC) during reading comprehension was also tested. The Spanish sentences used factorially combined grammaticality (grammatical vs ungrammatical object-clitic gender agreement) and verb predictability (high-cloze vs. low-cloze verbs) manipulations.

The results revealed that in First Fixation Duration, considered an early timing measure, no interaction in the computation of verb-cloze probability and gender agreement was found. By contrast, late measures such as Total Fixation Duration showed interaction effects at the critical verb + clitic region. In addition, WMC interacted with predictability at early and late measures, increasing First Fixation Duration and Total Fixation Durations rates for participants with larger WMC. These findings contribute to the understanding of the processing of syntax-semantics interplay in correlation with WM and suggest that semantic and syntactic information interact only at late stages of the linguistic processing, favouring the *syntax first model* (Friederici, 2002; Wicha et al., 2014) and offering counter evidence for the *interactive* theoretical proposal (Hagoort, 2003). Likewise, they also prove that WM interactions constrain reading comprehension and predictability from early phases of processing.

Keywords: prediction, syntactic-semantics interplay, language processing, working memory, eye tracking.

1. INTRODUCTION

Although real-time language comprehension is a task that as humans we effortlessly perform in everyday life, it poses a great challenge for psycholinguistic research when attempting to understand how the human language comprehension system processes and integrates a wide range of linguistic information within milliseconds. One of the major theories for explaining this fast and efficient language processing lies in the idea of *prediction*, considered as one of the main cognitive mechanisms that enables efficient language comprehension (Kuperberg & Jaeger, 2016).

Nevertheless, this perspective strongly contrasts to previous models of comprehension and integration processes from a few decades ago, which essentially ignored this concept. The fundamental goal of those earlier models was to explain how people link incoming linguistic information to previous input and to background knowledge and as so, they were very sceptical about the possibility that linguistic content might be predicted. However, nowadays current evidence allows us to affirm that the human brain is a predictive machine that uses top-down information and previous knowledge in order to predict what comes next. This concept of the brain as a predictive machine fits well with the *top-down* models of comprehension, since it suggests that meaning can get ahead of the input.

Nowadays there are two main models of comprehension, the *top-down* and the *bottom-up* model (Lupyan & Clark, 2015; Ferreira & Chantavarin, 2018) and the core difference between them lies in the order of processing. According to the bottom-up model of comprehension, during comprehension, and more precisely during reading sentences, which is the modality we will focus on from now on in this study, our processing is sequential and so, it depends on phonetic awareness and word decoding strategies. Within this model, the main mechanism supporting language comprehension is *integration*, which is based on the idea of linking new ideas and concepts to what is already known or established (Gernsbacher, 1991; Kintsch & van Dijk, 1978).

By contrast, the *top-down* model assumes that our brain interprets the input in light of our expectations, derived from our background knowledge, and here is where *prediction* takes place, since it is on the basis of this model (Dell & Chang, 2013). Hence, there is a broad discussion regarding *integration* and *prediction*, since it does not exist a clear distinction between both mechanisms. Because of that, some researchers consider that, in fact, *integration* underlies *prediction* (Ferreira & Chantavarin, 2018).

A highly influential approach to expectation-based processing is *surprisal theory* (Hale, 2016; Levy, 2008; Smith & Levy, 2013), which assumes continuous word prediction and varying levels of predictability for all the words of a sentence. Under this approach, “comprehenders use probabilistic knowledge from past experience to generate expectations for the interpretation of the language input so far, as well as predictions about the word likely to come up next” (Ferreira & Lowder, 2016: 226). Indeed, we do not make predictions only about the upcoming words but also about their semantics, syntactic category and morphophonology (Laszlo & Federmeier, 2009). Similarly, during agreement processing different features of information of the antecedent have to be predicted or retrieved (e.g., cue-based retrieval models: Lewis & Vasishth, 2005; Wagers et al. 2009). Nevertheless, how and when these syntactic and semantic sources of information interact remains still one major debate in psycholinguistics. With respect to syntactic parsing and semantic integration processes, two alternative psycholinguistic models have been proposed: *modular or syntax-first models* and *interactive or constraint-satisfaction models*, which are going to be discuss in depth in the following subsection.

Furthermore, when discussing about *prediction*, some researchers point towards *lexical preactivation* as the responsible of the prediction processes (Foertsch & Gernsbacher, 1994; Brothers et al., 2017). According to these models, by means of analogies and associations, lexical preactivation contributes to predict what information comprehenders are likely to encounter in upcoming parts of the linguistic signal (Bar, 2007). For example, when reading the phrase “*I was thirsty and I went to the fountain for drinking...*”, comprehenders will be able to quickly predict that the next word will be “*water*”. Thus, the preactivated representations facilitate the processing of expected information, thus contributing to efficient language comprehension (Farmer, Brown & Tanenhaus, 2013).

Nevertheless, the accuracy of predictions is also mostly influenced by cognitive factors such as working memory and inhibitory control (Mani & Huetting, 2012; Cheimariou, 2016; Huetting & Janse, 2016). During sentence reading, individuals have to hold context or past information in memory while retrieving new information. Accordingly, larger working memory capacity supports stronger predictive processing. At the same time, inhibitory control may affect prediction since competitive representations are being created during processing and the erroneous representations must be discarded.

In support to this approach, the mechanism of *prediction* as a human language faculty has been studied over the years with a variety of different experimental methods, including event-related potentials (ERPs) recording through electroencephalography, as well as eye-tracking measures. Unlike ERPs, studies based on eye movements during reading sentences can determine to what extent a word has been predicted. Thus, a crucial factor influencing eye-tracking measures is how predictable a word is within its context (word's cloze probability). Accordingly, during reading, predictable words are read faster (if they are not skipped) than less predictable ones (Rayner, Ashby, Pollatsek & Reichle, 2004).

In this study I used the eye-tracking technique for investigating the course of lexico-semantic predictability effects with gender agreement during a reading sentence task in order to determine whether semantic and syntactic processes interact or not with each other and, if they do, in what way. To do so, four variations of stimulus sentences were designed: correct sentences, sentences with a morphosyntactic antecedent-verb + clitic gender violation, sentences with a semantic low-cloze probable verb and sentences with combined morphosyntactic and semantic low-cloze verbs. In the first subsection of the introduction I will review the two main classes of psycholinguistic models proposed and the most relevant ERPs and eye-tracking studies supporting each alternative view, and I will outline how these relate to the debate around the processing of syntactic-semantics interplay. Then, some considerations will be done regarding the lack of homogeneity in all these studies. Finally, the impact of working memory on predictive processes and the benefits from the eye-tracking technique in language processing research are going to be addressed.

1.1 Psycholinguistic comprehension models.

With respect to syntactic and semantic processing in sentence comprehension, two main alternative views have been proposed in psycholinguistic comprehension models: *The serial or syntax-first models* and *The interactive or constraint-satisfaction models*. As these models are based on reading data, they ignore prosodic processes.

1.1.1 The independent or syntax-first model

According to the *independent or syntax-first model*, syntax is processed autonomously prior to semantic information and so, syntax and semantics interact only during a late stage of processing.

1.1.1.1 FRAZIER (1987) & FODOR (1990)

In 1987, Lyn Frazier suggested a serial model in which an initial structure is built only on the basis of word category information. Next, thematic roles would be assigned in a second step taking into account other sources of information such as semantics. Thus, this model assumed the autonomy of syntactic processes and consequently, no interaction between syntax and semantics during the initial parse, but strong interaction during reanalysis, that is, in later stages. Then, as properly pointed out by Janet Fodor's model in 1990, this reanalysis process would function as an interface between syntax and semantics.

1.1.1.2 FRIEDERICI (1995, 2002)

In 2002 Angela Friederici published a review of the four relevant language-related components in ERPs. This review was motivated because of the fact that the presence or absence of a particular ERP component allow us to make some conclusions about the source of the component and the linguistic process it reflects. Hence, the technique of ERPs has allowed linguists to achieve a fairly complete description of the neural network underlying language processing, millisecond by millisecond, contributing thus to distinguish early from late processes, which is fundamental for the investigation concerning the processing of the syntax-semantics interplay. Accordingly, when investigating the interaction between syntax and semantics by comparing the ERP responses, Helmholtz's superposition principle applies (see Figure 1):

“a perfect additivity of ERP components to combined syntactic and semantic violations would thus imply that the corresponding language related neurophysiological processes operate independently of each other. Conversely, if any interaction was going on during the processing, a clear non-linear summation should be present during the particular time range.” (Palolathi et al, 2005: 223).

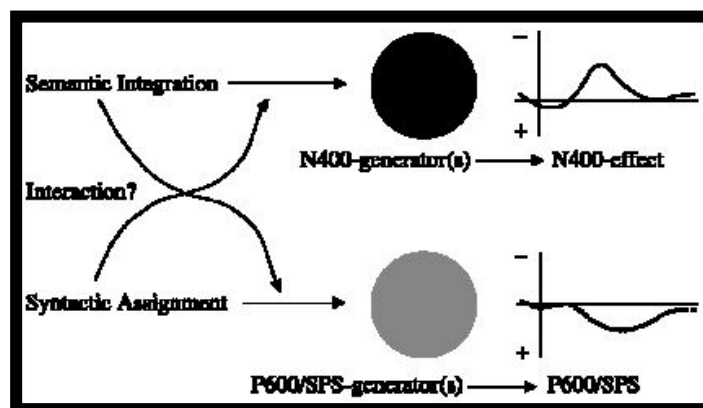


Figure 1. Example of expected ERP responses in case of an interaction between syntax and semantics. (Hagoort et al., 2003)

The four different ERP components to take into consideration are: the N400 component, which correlates with lexical-semantic processes. It takes place around 400 ms after the word onset and appear to be supported by temporal brain regions. 2) The Early Left Anterior Negativity (ELAN), which reflects early syntactic processes, 3) the P600 component, present beyond 600 ms, which reflects late syntactic reanalysis and 4) the Closure Positive Shift (CPS) which reflects aspects of prosodic processing.

Based partially on the electrophysiological data, partially on four independent experiments which explored ERP effects of syntactic processing in German, Friederici (1995, 2002) proposed a neurocognitive model of sentence comprehension consisting on three different functional phases, each of which is reflected by its own ERP component(s): 1) On the first phase (100-300 ms) the initial syntactic structure is formed on the basis of only word category information. 2) In the second processing phase (300-500 ms) independent lexical-semantic and morphosyntactic processes are considered to take place for thematic role assignment, and 3) final phase (500-1000 ms) is where integration of the different types of information occurs.

According to this model, building of the syntactic-phrase structure is always autonomous and precedes semantic processes in the early-time windows, interacting thus, only in the late-time window.

In a nutshell, Friederici's tripartite neurocognitive model follows the basis of the ones proposed by Frazier (1987) and Fodor (1990) even if this last reflects a more developed temporal hierarchy in the availability of the different types of information encoded in the lexical entry, but always with word category information being available first. Hence, Friederici's model has become the most representative supporter of *independent* or *syntax-first models* of language processing.

1.1.1.3 GUNTER ET AL. (1997, 2002)

The study carried out by Gunter et. al in 1997 consisted on three experiments concerning the processing of syntax and semantic violations by using once again, the technique of ERPs. Nevertheless, here we will only review the two of them that are relevant for the issue at hand.

The goal of the first experiment was to manipulate semantic and syntactic violations simultaneously to address their independent or interactive effects. To do this, 24 Dutch speaking students participated. First, they were familiarized with the procedure of the experiment throughout a training phase in which they saw sentences that ended

either with a high cloze verb or a low cloze verb. For each type of sentence ending, the verb was either properly or incorrectly conjugated. Consider the following example:

“*De vuile matten warden door de hulp...*”

“The dirty doormats were by the housekeeper...”

1. *geklopt* (semantically correct and conjugation correct)
beaten
2. *kloppen* (semantically correct, conjugation incorrect)
beat
3. *gekookt*
cooked
4. *koken* (semantically anomalous, conjugation incorrect)
cook

After this initial training, participants started the ERP experiment. They were presented with three blocks of 40 experimental sentences each. The main finding of this study was that the syntax-related positivity elicited showed up in both the congruent and incongruent sentence endings. In other words, the syntactic positivity was identical in both semantic conditions, suggesting thus that it was not modulated by semantics. The results from this experiment, and more precisely the absence of any interaction with the semantic condition, that is, without any ERP related to semantics, lead the authors to conclude that during sentence comprehension, semantic and syntactic processes occur separately in a first phase at the cognitive and neural levels.

In the second experiment, the main aim was to explore working memory load effects during sentence processing. They used two different syntactic structures: temporal subordinate clauses embedded within a main clause (high complexity) and another in which the main clause followed the temporal subordinate clause (lower complexity), and as in experiment 1, the last word of each sentence was either a highly expected or an unexpected verb correctly or incorrectly conjugated. Except for the extra subordinate clauses, sentences were very similar to the ones used in experiment 1 and they were divided into three blocks containing 56 experimental sentences each. Consider the following example of the two types of subordinate structures employed:

1. Lower complexity:

“Terwijl een grote menigte stond toe te kijken, werd de kleine drenkeling door de held gered.”

(While a large crowd stood by to look, **was the small [drowning-person] by the hero saved.**)

2. Higher complexity:

“De kleine drenkeling werd door de held, terwijl een grote menigte stond toe te kijken, gered.”

(**The small [drowning-person] was by the hero,** while a large crowd stood on the look, **saved.**)

However, syntactic chains are costly for short-term memory. Indeed, these two different syntactic structures employed require different levels of WM due to the lineal distance existing in each type of structure. In the high complex structures, a higher level of WM is required, whilst in low complex structures WM load is minor. This is due to the fact that, since, whenever there is evidence for the existence of a chain, we try to complete it as soon as possible (*The Minimal Chain Principle*, De Vincenzi, 1991). Accordingly, there is a preference for postulating short chains instead of longer ones (see Figure 2).

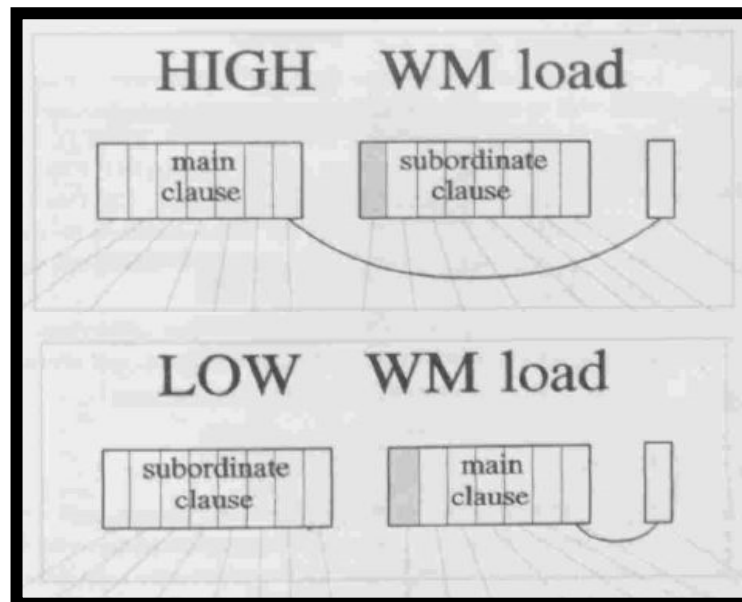


Figure 2. Draw of the processing procedure of “highly complex” sentence structures and “low complex” sentence structures. (Gunter et. al., 1997).

The results from experiment 2 have an important difference from those of experiment 1 since in experiment 2, the P600 tended to be larger in sentences with congruous endings. Thus, these results suggest that the interactions between syntax and complexity (working memory loads) were significant only in the P600 component, which suggests that working memory processes affect only this later syntactic process. Combining the results of both experiments the authors conclude that there was no interaction between the semantic and syntactic information in a first phase but in a late phase there was an interaction between the two types of information with a prevalence effect of semantics over syntax.

In 2002, Gunter et al. run another ERP study with the aim of exploring the effect of semantic expectancy on the processing of grammatical gender, and vice versa. To do so, thirty-two native German speakers participated in this study, in which gender between a noun and its immediately preceding definite article (correct versus incorrect) and semantic expectancy for a noun as direct object of the given verb (high versus low) were crossed (see Figure 3).

<i>Cloze %</i>	<i>Gender</i>	<i>Sentence</i>
High	congruent	(1) Sie bereist <u>das Land</u> auf einem kräftigen Kamel. She travels the _{neuter} land _{neuter} on a strong Camel
High	incongruent	(2) Sie bereist <u>den Land</u> auf einem kräftigen Kamel. She travels the _{masc} land _{neuter} on a strong Camel
Low	congruent	(3) Sie befährt <u>das Land</u> mit einem alten Wartburg. he drives the _{neuter} land _{neuter} with an old Wartburg car
Low	incongruent	(4) Sie befährt <u>den Land</u> mit einem alten Wartburg. She drives the _{masc} land _{neuter} with an old Wartburg car

Figure 3. Examples of the four types of experimental sentences used in the experiment. (Gunter et al., 2002).

The low-cloze nouns elicited a larger N400 than the high-cloze nouns. Gender violations evoked a left-anterior negativity (LAN) for all nouns and an additional P600 component was found only in high-cloze nouns. There was no interaction between the semantic related N400 and the LAN elicited by gender mismatch syntactic violation. Nevertheless, an interaction of the two variables was found in the P600. These results suggest that syntactic and semantic processes are autonomous during an early processing stage but they interact during a later processing phase. Thus, the results obtained for the semantic and syntactic violation in this study replicate the results obtained in Gunter et al. 1997.

1.1.1.4 OSTERHOUT & NICOL (1999)

Osterhout & Nicol (1999) explored the processing of the interface syntax-semantics by carrying out an ERP experiment in English in which two experiments took place. In the first experiment, the main goal was to elicit qualitatively distinct ERP responses under semantically and syntactically anomalous words. In the second experiment, the authors tested the additivity of these responses by presenting doubly as well as singly anomalous words. Four variations of stimulus sentences were used in both experiments: the correct version, the syntactically anomalous version which always involved a modal verb followed by a present participle (-ing) form of the verb, the semantically anomalous version, in which the matrix verb introduced an unsuitable pairing of actions with agents, and the combined syntactic and semantically anomalous version, which was a combination of the two previous versions. Consider the following examples:

1. Nonanomalous controls:

*The cat won't **eat** the food that Mary leaves them.*

*The expensive ointment will **cure** all known forms of skin disease.*

The new fighter planes can fly faster than anyone had expected.

2. Syntactically anomalous (verb tense violations):

*The cat won't **eating** the food that Mary leaves them.*

*The expensive ointment will **curing** all known forms of skin disease.*

*The new fighter planes can **flyng** faster than anyone had expected.*

3. Semantically anomalous (selectional restriction violations):

*The cat won't **bake** the food that Mary leaves them.*

*The expensive ointment will **loathe** all known forms of skin disease.*

*The new fighter planes can **walk** faster than anyone had expected.*

4. Doubly anomalous (verb tense and selectional restriction violations):

*The cat won't **baking** the food that Mary leaves them.*

*The expensive ointment will **loathing** all known forms of skin disease.*

*The new fighter planes can **walking** faster than anyone had expected.*

Semantic anomalies and syntactic anomalies elicited qualitatively distinct ERP responses (N400 and P600 effects, respectively). Combined anomalous words elicited both effects and these effects summated in an approximately linear manner. According to

the two alternative psycholinguistic views as well as with the principle of superposition, these results suggested that syntax and semantic information are processed independently during sentence processing.

1.1.2 The interactive or constraint-satisfaction model

The interactive or constraint-satisfaction model claims that all types of information interact continuously at each stage of language comprehension (early and late). Consequently, it predicts no sequential advantage of any type of information over the other.

1.1.2.1 HAGOORT (2003)

In 2003, Hagoort conducted a study examining the interplay between syntax and semantics during sentence comprehension in Dutch. In particular, he investigated the effects of combined semantic and syntactic violations on language by using ERPs. Syntactic violations consisted of a mismatch in gender or number of the definite article and the noun both in sentence internal and sentence-final noun phrases (NPs). Semantic violations were done by semantically unacceptable combinations of and adjective and its following noun (e.g. *honest umbrella*) in the same NPs (see Figure 4):

(1a)	De kapotte <i>paraplu</i> staat in de garage.	
	Het kapotte <i>paraplu</i> staat in de garage.	(Synt -)
	De eerlijke <i>paraplu</i> staat in de garage.	(Sem -)
	Het eerlijke <i>paraplu</i> staat in de garage.	(Synt -, Sem -)
	(The _{com} / The _{neut} broken/ honest <i>umbrella</i> _{com} is in the garage.)	
(1b)	De bekwame <i>vaklieden</i> zien de kwaliteit van het produkt.	
	Het bekwame <i>vaklieden</i> zien de kwaliteit van het produkt.	(Synt -)
	De zoute <i>vaklieden</i> zien de kwaliteit van het produkt.	(Sem -)
	Het zoute <i>vaklieden</i> zien de kwaliteit van het produkt.	(Synt -, Sem -)
	(The _{plural/com} / The _{singular/neut} skilled/ salty <i>craftsmen</i> _{plural} appreciate the quality of the product.)	
(2a)	Cindy sliep slecht vanwege de griezelige <i>droom</i> .	
	Cindy sliep slecht vanwege het griezelige <i>droom</i> .	(Synt -)
	Cindy sliep slecht vanwege de verkouden <i>droom</i> .	(Sem -)
	Cindy sliep slecht vanwege het verkouden <i>droom</i> .	(Synt -, Sem -)
	(Cindy slept badly due to the _{com} / the _{neut} scary/ sniffing <i>dream</i> _{com} .)	
(2b)	De uitzending is verstoord door de rumoerige <i>jongeren</i> .	
	De uitzending is verstoord door het rumoerige <i>jongeren</i> .	(Synt -)
	De uitzending is verstoord door de bewolkte <i>jongeren</i> .	(Sem -)
	De uitzending is verstoord door het bewolkte <i>jongeren</i> .	(Synt -, Sem -)
	(The broadcasting is interfered with by the _{plural/com} / the _{singular/neut} noisy/ cloudy <i>youngsters</i> _{plural} .)	

Figure 4. Example sentences of the materials with sentence-internal (1) and sentence-final (2) violations used in the experiment. (Hagoort, 2003).

Finally, combined syntactic and semantic violations were a summation of both violation types. Participants were presented with 320 items divided into five blocks of 15 min each, with a short break in between, and they were asked to read the sentences

carefully for comprehension and to indicate for each sentence whether or not it was acceptable.

The electrophysiology results indicated that syntactic violation resulted in a classical P600/SPS, while the semantic violation resulted in a significant N400 effect. The combined violation resulted in a larger increase in the N400 amplitude than a purely semantic violation, but in contrast, no difference in P600/SPS was obtained between the purely syntactic violation and the combined violation. These results reveal an asymmetry between syntax and semantics during on-line comprehension: while in the absence of syntactic ambiguity the assignment of syntactic structure is independent of semantic context, semantic integration is influenced by syntactic processing. Moreover, if semantic integration and syntactic assignment are both fully autonomous processes, the ERP effect of the combined violation should be a summation of the ERP effects of the syntactic and semantic violations. Since non additivity was obtained for the early time window, the author conclude that semantic integration and syntactic assignment are interacting at early stages of language processing with a prevailing role of syntax over semantics. Nevertheless, no interaction was found in later stages.

1.1.2.2 WHICHA ET AL. (2004) STUDY

The study of Whicha et al., (2004) tested the nature and time course of the effect of gender on word-by-word sentence reading by using ERPs recorded to an article and noun. The noun and article in each experimental sentence were manipulated with either the highest expected noun or a semantically anomalous one of the same gender, and an article that either agreed or disagreed with the noun in gender to create four conditions as shown in Figure 5:

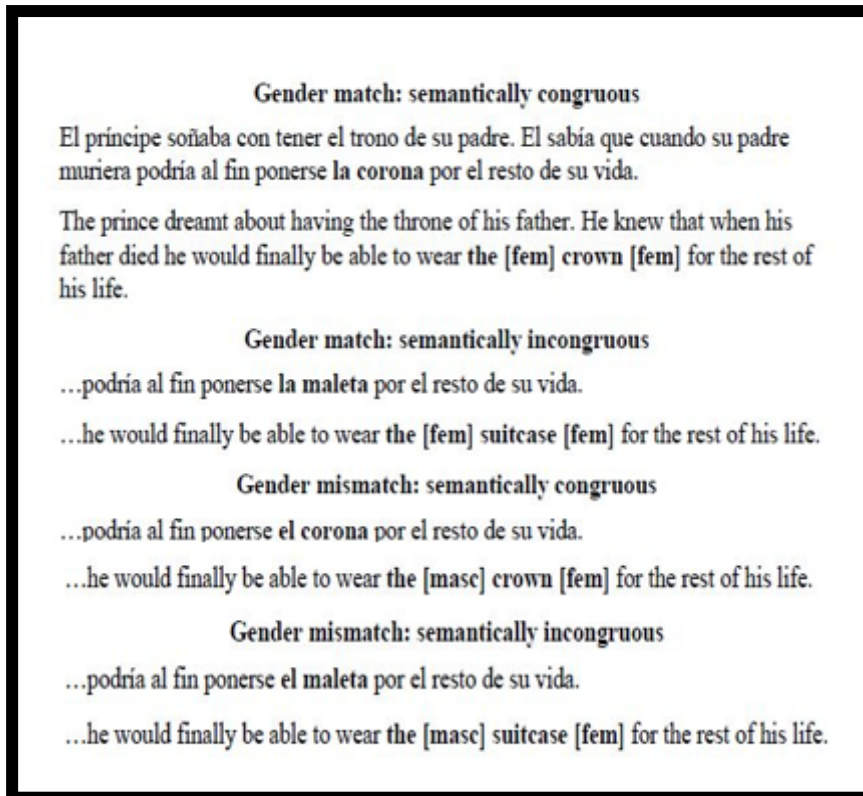


Figure 5. Example sentences of the four conditions used in the experiment. (Whicha et. al., 2004).

Participants performed a reading task for a comprehension task while their ERPs were recorded. As previously informed, at the end of each session, participants completed a 30-sentence recognition test, with 20 absolutely new sentences plus 10 slightly modified and 10 identical versions of previously presented filler sentences. They had to classify each sentence as identical, new or similar. This secondary task was intended to keep their attention and assure they were processing the sentences.

The results revealed that semantically anomalous nouns elicited the N400 window with a larger negativity for double violations and the P600 window with a larger positivity for semantic anomalies. Thus, gender agreement between a noun and its preceding article modulated the amplitude of both the late positivity and the N400 in interaction with semantic congruity. These findings suggest that, similar to Hagoort's (2003) findings, gender and semantic variables were found to interact on the N400. Additionally, and at odds with Hagoort's (2003) results, the authors also found that both semantic congruity and gender agreement modulated LPC/P600 amplitude, suggesting that semantic and syntactic information interact at early and late stages during sentence processing.

1.1.2.3 PALOLATHI ET AL. (2005) STUDY

The study carried out in 2005 by Palolathi et al., was aimed for investigating interaction between syntactic parsing and semantic integration processes during a visual comprehension task with five-word Finnish sentences containing morphosyntactic and/or semantic violations. Four variations of stimulus sentences were used: correct sentences, sentences with a morphosyntactic subject-verb number agreement violation, sentences with a semantic expectancy violation and sentences with a combined morphosyntactic and semantic violation.

Participants of the study were 10 native Finnish speakers. They were instructed to read the sentences and to determine whether the sentence was strange or incorrect (grammaticality judgment task). Meanwhile, the EEG was recorded. The results revealed a left anterior negativity in the 330-440ms time window for the syntactic violation while the semantic violation elicited a negativity (N400) which was more pronounced on the left hemisphere. The combined violation elicited a negative component (combined LAN and N400) in the 320-430 ms time window. In addition, the combined violation also elicited a later positive component (P600) in the 510-800 ms time window. These results were statistically significant, suggesting non-additivity of the summated LAN and N400 responses in the combined violation, which translates in an early interaction. By contrast, no significant interaction effects were found within later time windows (see Figure 6).

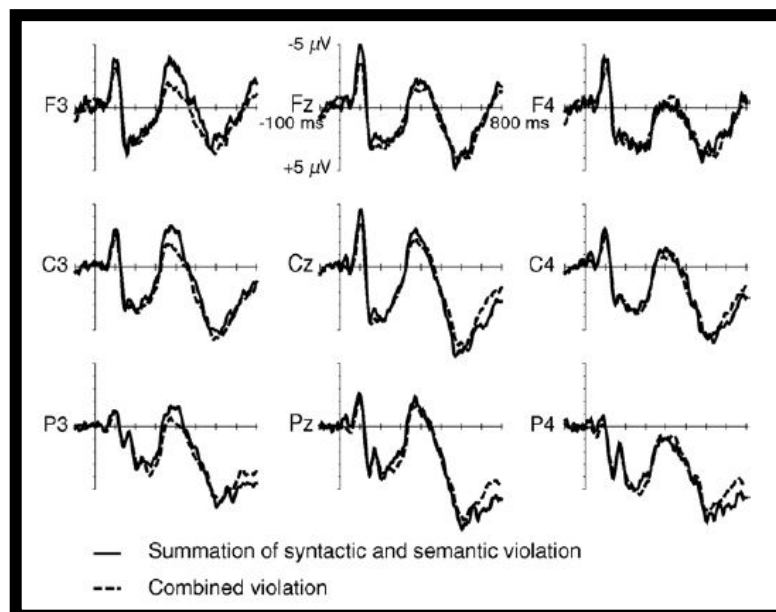


Figure 6. Additivity of ERP responses to syntactic and semantic violations. (Palolathi et. al., 2005).

These results seem to be incompatible with Friederici's three-phase architecture model in which interaction between syntax and semantics is supposed to happen only

during a later phase (reflected by the P600). By contrast, in the study of Palolathi et. al., syntactic and semantic processes are interacting only in an early stage followed by independence during later processing rates, showing thus the opposite pattern to Friederici's model. Accordingly, due to its early interaction, these results seem then more compatible with the interactive or constraint-satisfaction model, whose main supporter is Hagoort.

1.2 Some considerations on previous findings

In accordance with all the previous studies presented here, we can affirm that despite the agreement that syntactic and semantic information has to be integrated within a short period of time during language perception to achieve understanding, the crucial difference between the two classes of psycholinguistic models are their views on the temporal structure of the integration processes: while the *interactive, constraint-based model* predict early interaction, *serial, syntax-first model* predict interaction during a later stage of processing.

Nevertheless, the lack of homogeneity because of the mixed results obtained from the previous studies in support of both accounts points towards a problematic design of the materials, since they seem to depend too much on the type of particular situation implemented in each experimental design, such as: the type of task, the type of violations, the position of the critical word in the sentence, differences in word's length and frequency, or the implemented procedure.

In this respect, Hagoort (2003) pointed two main possible factors for explaining the ERP heterogeneous results. The first of them would be the using of different words for eliciting semantic violations unlike syntactic violations. That is, semantic violations consisted on the substitution of one correct word at the critical position by a different word, whereas syntactic violations consisted on modifying syntactically the properties of a correct word without removing it from its place. However, I consider this reasoning very unlikely since if relevant variables such as length, familiarity or predictability are controlled, it should not be a problem.

Furthermore, according to this author, the second key point able to explaining such temporal differences, is the position of the critical word. In several ERP studies violations occurred in sentence-final position which could obscure the results because of wrap-up effects (cf. Hagoort, 2003; Osterhout & Nicol, 1999). Likewise, in some of the studies, violations also occurred in different points within the sentence.

Additional considerations regarding the materials' design would be the type, that is, the category of the violating word. In the previous studies, the violations occurred only in either nouns or verbs. But the syntax-semantics interaction is different for verbs than for other words, because "properties of the verb determine probable thematic roles and therefore, influence initial meaning/form hypotheses about the sentence" (Martín-Loeches et. al., 2016: 181).

Finally, other variables that could influence the final results obtained are the language used in the study, the modality of stimulus presentation and the task demands. This being so, in this investigation, taking into account all these variables rarely considered beforehand, I have investigated how verb-cloze probability interacts with the computation of gender agreement relation between full DP object arguments and object-clitics.

1.3 The role of working memory

The term working memory (WM) has its origin in *The Working Memory Model* (Baddeley and Hitch, 1974) and it makes reference to the cognitive faculty of temporary retaining task-relevant information over seconds and minutes in an active and accessible state for the purpose of completing complex cognitive and behavioural tasks (*span tasks*) such as language comprehension or reasoning (Engle, 2002). Due to its engagement in such a wide range of cognitive behaviors, it plays an important role in contemporary global models of cognition (e.g., Cowan, 1995).

In general, establishing any kind of linguistic relationship requires some memory of the immediate past. Thus, during sentence reading processing, WM capacity (WMC) has been judged to have a fundamental role since individuals have to hold context or past information in memory while retrieving new information, which requires a high memory load. Hence, only throughout working memory, linguistic relations between temporally distal parts of the sentence can be rapidly computed. Accordingly, larger working memory capacity supports stronger and more accurate predictive processing.

Furthermore, although WMC is the mechanism which enables on-line information storage and retrieval from memory when access to old linguistic representation is needed in order to comprehend and integrate grammatical relationships between often long-distance words in a sentence, there are severe limits regarding the amount of linguistic input that can be actively kept in mind. According to Miller (1956) there is a recall limit of about 7 items. By contrast, many studies have proved that "working memory capacity

varies among people, predicts individual differences in intellectual ability, and changes across the life span” (Cowan, 2005). With reference to this point, In 1980 while investigating individual differences in WM, Daneman and Carpenter developed the first complex working memory span task, *the reading span task*, argued to measure working memory because of its integration of both a processing component (sentences to be read) and a storage component (the word to be remembered). They defend this approach as critical to assess individual differences in WMC. Since then, similar tasks to the reading span (*complex span tasks*) have emerged in order to assess working memory capacity and so determine to what extent larger rates of WM could influence the processing and comprehension of sentence reading and, more precisely, the active maintenance and retrieval mechanisms for recovering old information.

1.4 The eye-tracking technique in the research of the processing of the syntax-semantics interplay

The eye-tracking technique has been used to study sentence reading comprehension, since it provides direct evidence of predictability. Thus, unlike ERPs, it provides information about to what extent a word has been predicted. Since readers move their eyes through a text in order to acquire information about its content, measurements of the duration and location of the fixations they make have taught researchers a great deal about how people acquire information from the printed text, how they represent it, and how they integrate it in the course of understanding. Thus, it has been proved that (1) fixation time on a word is shorter if the reader has a valid preview of the word prior to fixating it, and (2) fixation time is shorter when the word is easy to identify and understand. Accordingly, since eye-movements can provide valuable insights into the mechanisms and strategies of the syntax-semantics interplay processing, this issue has also been investigated in studies of eye movements during reading. (cf. 1.4.1 and 1.4.2).

1.4.1 Veldre & Andrews (2018) study

Veldre & Andrews carried out an investigation in 2018 for investigating the parafoveal processing of semantic and syntactic information during reading. To this end, the authors designed two different and complementary experiments in which they used the gaze-contingent boundary paradigm to compare contextually plausible previews to semantically acceptable and anomalous previews that either matched or violated syntactic rules. In this paradigm, when the reader made a saccade across the invisible boundary, indicated by the dotted line, the preview was replaced by the target word (see Figure 7).

They specially investigated the independent contributions of syntactic and semantic plausibility to parafoveal preview effects. Thus, through the boundary paradigm they compared four parafoveal preview conditions: *Identical* (to the target), *plausible* (plausible continuation of the sentence that shared the same grammatical class as the target word but was semantically unrelated to it), *implausible/No violation* (a contextually implausible continuation of the sentence that shared the same grammatical class as the target word and *implausible/violation* (a contextually implausible continuation that was from a different word class to the target word).

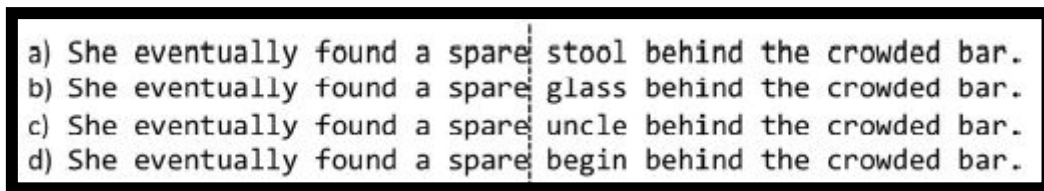


Figure 7. Sample of the four preview conditions used in Experiment 1: (a) identical, (b) plausible, (c) implausible/No violation, (d) implausible/violation. (Veldre & Andrews, 2018).

Fifty-nine students participated on this experiment and they were told to silently read the sentences for meaning and to respond to occasional comprehension questions. Meanwhile, the eye-tracker was recording their eye movements. The syntactic validity effect was limited to first-pass fixation duration measures, which are assumed to reveal early processing. The results of this first experiment suggested that parafoveal syntactic information is not processed early enough to affect skipping. Thus, skipping effects appear to be due only to the contextual plausibility.

In the second experiment, they changed the manipulation of syntactic validity (now subject-verb agreement and verb tense errors were used). The four parafoveal conditions used in the boundary paradigm were: *identical* (to the target), *plausible* (a semantically and syntactically plausible continuation of the sentence), *plausible/violation* (a semantically plausible but syntactically invalid continuation of the sentence due to a subject/verb-unagreement or a verb tense error) and finally *implausible/no violation* (a semantically implausible continuation of the sentence that matched the word class of the target word), as shown in Figure 8.

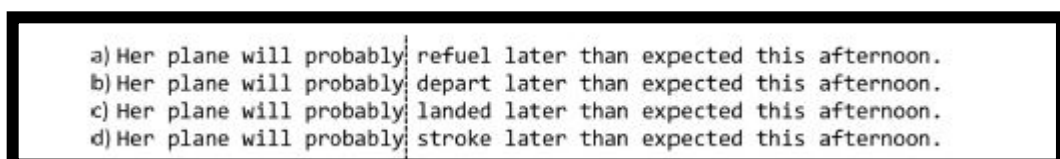


Figure 8. Sample of the four preview conditions used in experiment 2. (Veldre & Andrews, 2018). (a) Identical, (b) plausible, (c) plausible/violation, (d) implausible/no violation.

In this occasion, sixty students participated on the experiment. The procedure was identical to experiment 1. By contrast, benefits from a plausible preview relative to a plausible/violation preview was now observed on both skipping rate and first-pass reading measures. Nevertheless, the following reading measures were analysed in both experiments: *first fixation duration* (the duration of the reader's first fixation on a word provided that the word was not skipped), *single fixation duration* (the fixation duration in cases when only one first-pass fixation is made on the target word) and ¹*gaze duration* (the sum of all first-pass fixation on the target word. Possible regressions included). All these measures are considered *early* measures. In addition, two late measures of reading were analysed: *go-pass duration* (the sum of all fixations from the first fixation on the target word until a word to the right is fixated) and *total duration* (the sum of all fixations on the target word including first-pass reading and any later rereading of the target after later words in the sentence are fixated, that is, regressions).

In experiment 1 the results from previous measures revealed a significant plausibility preview effect across all first-pass measures because readers spent less time fixating the target word when the preview was plausible compared to an implausible/no violation preview (conditions b vs. c in Figure 7). Thus, observing a plausibility preview effect does not depend on syntactic violations but on semantics since there was also a significant benefit to first-pass reading from a semantically plausible preview relative to an implausible, but syntactically legal, word. Nevertheless, this plausibility preview effect was not significant on total duration. Regressions analysis showed that readers were marginally more likely to regress to the target after a plausible preview compared to an implausible/ No violation preview. Hence, late rereading counteracted the early benefit of a plausible preview. Finally, a syntactic validity preview effect was also found only at the gaze and go-past duration, which were lower in the implausible/No violation condition than in the implausible/Violation condition (condition c vs. d in Figure 7).

Furthermore, the results from experiment 2 converge with those of experiment 1 since they confirm that readers' first pass processing benefits from a preview of a plausible word relative to the control of a semantically plausible but syntactically invalid word. This was reflected in a significant syntactic agreement preview effect on first fixation duration, gaze duration, and go-past duration, since readers spent less time fixating the target word when the preview was plausible compared to a

¹ In some versions of Tobii studio, as is the case of the present study, this measure receives the name *fixation duration*.

Plausible/Violation preview (condition b vs c in Figure 8). In addition, this syntactic agreement effect was marginal on single fixation duration and not significant on total duration, because readers were equally likely to regress to the target in the two conditions.

Hence, the combination of the results obtained in both experiments lead the authors to conclude that “readers extract both semantic and syntactic information from the parafovea and that this information can accrue very early in the timecourse of reading” (Veldre & Andrews, 2018: 10).

1.4.2 Mancini et al., (2014) study

Making use of the Spanish unagreement pattern, Mancini et al., tested in 2014 the time-course of agreement processing throughout four eye tracking experiments. The Spanish unagreement pattern entails the acceptance of the presence of a 3rd person plural subject followed by a 1st person plural verb. In these cases, grammaticality is ensured by re-interpreting the subject as 1st person plural. Consider the following example:

Los manifestantes anunciamos una huelga.

The protesters_{3rd pl.} announced_{1st pl.} a strike → (We protesters announced a strike).

In the first experiment, they compared unagreement with structurally similar sentences to identify potential differences and similarities in their processing. Thus, the experimental materials were divided into four conditions: standard agreement, unagreement, null subject and overt pronoun (see Figure 9).

Hace mucho tiempo los manifestantes anunciaron una huelga en tv	Standard Agreement (SA)
A long time ago the protesters _{3,pl} announced _{3,pl} a strike on tv	
Hace mucho tiempo los manifestantes anunciamos una huelga en tv	Unagreement (UN)
A long time ago the protesters _{3,pl} announced _{1,pl} a strike on tv	
Hace tiempo para los manifestantes pro _o anunciamos una huelga en tv	Null Subject (NS)
Some time ago for the protesters _{3,pl} we _o announced _{1,pl} a strike on tv	
Hace tiempo nosotros los manifestantes anunciamos una huelga en tv	Overt Pronoun (OP)
Some time ago we the protesters _{3,pl} announced _{1,pl} a strike on tv	

Figure 9. Sample of the materials used in experiments 1. (Mancini et al., 2014).

Thirty students participated on this experiment. The sentences were presented to them and they were told to read the sentences carefully while the eye tracking was recording their eye movements.

In the following experiments (experiment 2 and 3) the authors compared unagreement with true person violations throughout a grammaticality judgment test (experiment 2) and an eye movement experiment (experiment 3) which contribute to their insight into unagreement processing. Thus, in the first experiment the aim was to verify the unagreement processing cost with respect to other agreement dependencies, whilst the second one was designed to investigate to what extent a mismatch, although legal, can mislead the reader and how fast the correctness of unagreement is recognized compared to standard agreement and truly mismatching sentences. The third one was aimed to see whether and when, in the reading process, a mere feature mismatch is disentangled from a true agreement anomaly.

After these three experiments, the authors conducted a last experiment (experiment 4) in which they compared unagreement with discourse-incongruous sentences in order to obtain a greater insight into the time-course of unagreement. Discourse-uncongruous sentences were created by manipulating the plausibility of the subject-verb relation also at a discourse level, that is, whether the entity referred to by the subject argument could be successfully integrated into the discourse representation of the sentence or not. To do this, they established a comparison between the type of being at the subject position (animal vs. human).

All participants were Spanish native speakers and they were instructed to read the sentences and evaluate its grammaticality. They accurately evaluated standard agreement and person mismatch in a 97% of the cases and unagreement in a 94%. In addition, data analysis showed a constant first-pass effect elicited by unagreement with respect to structurally similar sentences across the four experiments, which means that morphosyntactic evaluation is sensitive at early stages. That is, whether grammatical or not, the presence of a mismatch disrupts the reading process and this perturbation is reflected in the first pass of fixation (early measure) through the area of interest. Furthermore, early mismatch detection is followed by a reanalysis process, aimed at overriding the apparent mismatch between subject and object. Finally, the results from the comparative of the last experiment between human and animal unagreement have revealed that the type of being referred to affects only later stages of processing, as shown by the significant interaction of total reading times (later measures) at verb position and in the analysis of go-past in the spillover area. This suggests that a mismatch between subject and verb, even if grammatical, yields initial morphosyntactic integration difficulties that are not modulated by the conceptual features of the subject. Thus, while

a human being can be regarded as the speaker of a utterance, an animal cannot, which generates discourse anchoring difficulties. These results revealed then a clear disassociation between morphosyntactic-related and discourse-related analysis in agreement comprehension. Accordingly, the authors concluded that there was evidence of early sensitivity to morphosyntactic evaluation whilst the discourse-related analysis was considered to deal with the parser in later stages of processing. In sum, the eye-tracking technique has been shown to be very adequate to study agreement encoding.

2. THE PRESENT STUDY

The aim of the present study is to investigate the course of lexico-semantic predictability effects with gender agreement in Spanish. More precisely, I explore how verb-cloze probability interacts with the computation of gender agreement relation between full DP object arguments and object-clitics on eye-tracking measures (*first fixation duration, total fixation duration, fixation duration* and *total visit duration*). To this end, gender agreement has been manipulated (syntactic condition) and so it has predictability in terms of plausibility (semantic condition). In what follows, I will present the research questions, the hypothesis and the predictions made and I will detail the method, the procedure and the data analysis employed.

2.1 Research question, hypothesis and predictions

2.1.1 Research question & main hypothesis

Q1: Evidenced by the eye-movements, during sentence reading comprehension, how do we process and integrate semantic (verb-cloze probability) and syntactic information (gender agreement relations between full DP object arguments and object-clitics)? Are both types of information processed simultaneously from early stages by the same cognitive mechanisms (*interactive models of processing*) or do we process the syntax-semantics interplay independently first and consequently by different cognitive mechanisms (*syntax-first models*)?

Q2: To what extent are the predictability effects different in subjects with larger WM capacity than those who have lower rates of WM? Does WM capacity constrain predictability during sentence reading?

2.1.2 Predictions

P1: If we employ the same cognitive mechanisms for processing semantics and syntax, we would observe directly and continuously interaction between the two from the

beginning (that is from early stages), reflected in larger times for First Fixation Duration in low cloze verbs and agreement violations, as well as longer times for the Total Duration Fixations (late stages).

P2: If we employ different cognitive mechanisms for processing semantics and syntax, we would only find interaction at late stages with independent processing of the syntax and semantics at early stages. That is, we expect to find interaction effects only in the Total Duration Fixations in which regressions are included. This interaction is going to be reflected by longer times for that measure in the combined condition (low-cloze verb & ungrammatical clitic) compared with the times obtained for the syntactic and semantic conditions.

P3: The span measures are expected to correlate with the magnitude of the predictability effects. Hence, those subjects with shorter rates of WM would present lower rates of Total Fixation Durations and more regressions than those with higher WM. Likewise, longer levels of Total Fixation Durations would indicate that less regressions have been done during sentence reading.

2.2 Method

2.2.1 Participants

The experiment has been conducted with 24 Spanish native speakers, of which 15 were females², ranging in age from 18 to 34 years old. All of them were undergraduate students from the University of the Basque Country (UPV/EHU) and had normal or corrected-to normal vision.³ In reward, they perceive 10€ per hour. Before the experiment began, they all read and signed an informed consent.

2.2.2 Materials and Design

The experimental sentences were taken from the ongoing study of Santesteban, Lorusso, Hatzidaki, Laka & Zawiszewski (2019), where the cloze-probability of the verb with which the clitic appeared was controlled by means of 2 norming studies. The first study consisted of a cloze-probability task in which 64 Spanish native speakers were asked to read 160 sentence preambles *El consejero repasó el comunicado dos veces antes de...* “The counsellor revised the statement twice before...” and complete them with a

² Participants were prevented from wearing makeup on their eyes, since this could affect the eye movement’s recording.

³ Only one of the 24 participants reported to suffer from strabismus on its right-eye (not appreciable at sight) but since the eye-tracker detected both eyes perfectly, it has not been ruled out.

single word (e.g., *enviarlo* “sending it”). 150 of the sentences included in the first norming study and the responses given by the participants were used in a second norming study in which 14 Spanish native speakers were asked to perform a 4-choice cloze probability ranking task. That is, participants were presented with a sentence preamble (*El consejero repasó el comunicado dos veces antes de...* “The counsellor revised the statement twice before...”) and 4 possible endings of the sentence (e.g. *enviarlo* “sending it”; *borrarlo* “deleting it”, *leerlo* “reading it”; and *dictarlo* “dictating it”). Participants were asked to rank the probability of ending the sentence with each of these verbs from 1 (most-likely) to 4 (less-likely). From these results, 120 sentences and the most likely and less likely verb endings were selected. These verbs were matched in frequency (subtlex-es), length (number of letters), familiarity, imageability and concreteness (all ps > .1), and only were significantly different in the cloze-probability rank (3.5 (0.3) vs. 1.6 (0.2) for high- and low-cloze verbs, respectively (p < .001)

2.2.2.1 EXPERIMENTAL SENTENCES

For this experiment, 240 sentences have been used, of which 120 were experimental sentences, 60 masculine and 60 feminine direct objects. The remaining 120 were filler sentences that were grammatical with different word order.

The experimental sentences were structured in a 2x2 design as a result of manipulating Grammaticality (Grammatical vs. Ungrammatical object clitic gender agreement) and Verb Predictability (High-cloze vs. Low-cloze verbs). Each participant was presented with 30 sentences per condition.

Experimental conditions:

- Condition 1: High-cloze verb – Grammatical clitic

*El conductor frenó muy bruscamente el tren para intentar **pararlo** en el andén.*

- Condition 2: High-cloze verb- Ungrammatical clitic (gender)

*El conductor frenó muy bruscamente el tren para intentar ***pararla** en el andén.*

“The driver stopped very abruptly **the train** SG-MASC to try to stop it CL-SG-MASC/***FEM** at the platform.”

- Condition 3: Low-cloze verb- Grammatical clitic

*El conductor frenó muy bruscamente el tren para intentar **aparcarlo** en el andén.*

- Condition 4: Low-cloze verb-Ungrammatical clitic (gender)

*El conductor frenó muy bruscamente el tren para intentar ***aparcarla** en el andén.*

“The driver stopped very abruptly *the train* SG-MASC to try to park it CL-SG-MASC/*FEM at the platform.”

In order to ensure that each participant did only read one version of the same sentence, they were randomly distributed in 4 lists according to a Latin Square design. Thus, each list had 4 blocks with 3 breaks, and each participant saw 60 phrases per block. The lists also included comprehension questions about the meaning of the sentences in 33% of trials, only in grammatical sentences. This was done with the aim of keeping participant’s attention.

Moreover, in all four versions of the sentences, the critical words, i.e. the verbs + object clitics, were of comparable familiarity (frequency) and length, and they all occurred in the same position within the sentence.

The responses to these comprehension questions were given with index and middle finger of one hand, pressing buttons 1 for *yes* and 2 for *no*. In order to counterbalance finger response, another 4 lists were created by duplicating the originals and renaming them as lists 5, 6, 7 and 8. This simple operation enabled to reassign finger to response type and so, button 1 was now used for *no* and 2 for *yes*.

2.2.2.2 AREAS OF INTEREST (AOI)

In order to be able to account for the eye-tracking measures which indicate how factors that guide integration of text affect eye movements, such as *fixations or gaze points* (they show what the eyes are looking at and so they are able to reflect that more visual attention has been directed to a certain word in a sentence) and *saccades* (eye movements between fixations), the identification and creation of critical regions has been needed. Thus, 4 areas of interest (AOI) corresponding to the critical verb position (V+clitic), the subject (Subject), the antecedent (Antecedent) and the spillover region (Spillover) have been created for the four experimental conditions. Hence, in total for the four experimental conditions and each critical position, 480 regions have been created (4 regions per sentence). Consider the following example:

El conductor frenó muy bruscamente el tren para intentar pararlo en el andén

AOI 1 (Subject)	AOI 2 (antecedent)	AOI 3 (V+clitic)	AOI 4 (Spillover)
--------------------	-----------------------	---------------------	----------------------

All the AOI in each critical position have the same coordinates throughout the four experimental conditions concerning their position in the center of the screen and their vertical amplitude, varying for high vs. low cloze only in their horizontal amplitude between words.

2.2.3 Procedure

First of all, for running this experiment, a desktop computer and a laptop were needed. Likewise, two software were employed: Eprime, to create and run the experiment in the laptop, which presented the experiment to the participants, and Tobii Studio, that simultaneously was recording the experiment in the desktop computer. That is, triggers were sent from the laptop through a TCP/IP port and the image was collected in the desktop computer by Tobii Studio throughout a special device.

The experiment was divided in two different phases: in a first phase, they did a working memory test whilst in the second part of the experiment, they read a bunch of sentences and respond a few simple comprehension questions about the meaning of these sentences while the eye tracker was recording their eye movements. In total, experimental sessions lasted about 1h 10 min. including the firm of the consent, the questionnaire about personal data to fill in, the WMT and the eye tracking experiment.

2.2.3.1 WORKING MEMORY TASK (WMT); (UNSWORTH ET AL., 2005)

The working memory task employed was a *computerized reading span task* (Unsworth et.al, 2009 a, b) adapted from *the automated operation span task* (Conway et. al., 2005; Unsworth et al., 2005) which is, at the same time, a more complex task that follows the original reading span task created by Daneman and Carpenter's (1980). Both tasks follow the same general procedure: the painting of a task followed by a to-be-remembered element such that subsequent tasks interfere with the previous elements presented. Hence, the core difference between both working memory tasks is the main task to be performed: whilst in the *automated operation span task* examinees are given a series of very simple arithmetic operations and they have to indicate whether it is true or false, in the *computerized reading span task* (RSPAN) examinees are asked whether a presented sentence makes sense or not. After that, in both tasks the element to be remembered was a series of letters (see figure 10).

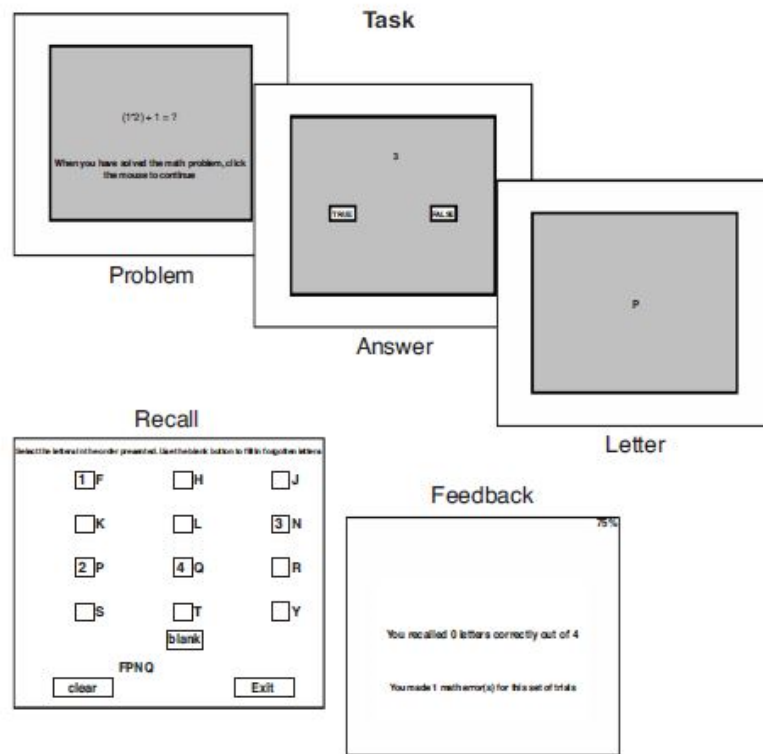


Figure 10. Illustration of the automated operation span task. The screen of the elements to be recalled (e.g. letters) is identical to the computerized reading span task. (Unsworth et.al, 2005).

The WMT used in the present study was run on the desktop computer and it lasted about 15/20 minutes depending on the person. This version allowed the participant to complete the task by just clicking the mouse button. This task was divided in two sections:

- **Training phase:** this phase was thought in order to help participants to familiarize themselves with the procedure of the experiment. Thus, in order to guide them step by step, this training phase was also broken down into 3 sections. The first practice session was a simple letter span. Participants only saw a sequence of isolated letters which appear on screen for 800 msec. and they were required to remember them in the same order in which they appeared. Then, in the following window, they saw a 4 x 3 matrix of letters (F, H, J, K, L, N, P, Q, R, S, T and Y) and they had to select the letters they had seen in the exactly order they appeared on the screen by clicking the box next to the appropriate letters (no verbal response was required). The recall phase was untimed and after they end their letter selection, the computer provided feedback about the number of letters correctly recalled in each set. In the second phase of this training, they saw a whole sentence and in the following window they had to indicate if the sentence had sense or not by clicking on the corresponding button. E.g. *Los glaciares se están descongelando debido a la salchicha climática*, participants would have to say that this

sentence had no sense. The last part of this training was a combination of the two previous training phases and it served as an introduction of the real working memory test of the experimental phase. Thus, they had to indicate if the sentence they saw had sense or not and, in combination, they had also to remember the sequence of letters that would appear in an alternate order with these sentences.

- **Experimental phase:** once this initial training phase was finished, a screen appeared indicating the participants that the training phase was over and that once they clicked on the screen the real experiment would start. In addition, a warning message popped up reminding them that the upcoming phase was going to be identical to the last part of the training phase.

During this task both speed, known as speed of response, and accuracy were measured. Participants were able to see their numerical rate (over 100) of correct responses in red in the upper-right corner of the screen.

2.2.3.2 EYE-TRACKING

Once participants finished the WMT, they were seated 60 cm from a 19-inch LCD screen in a quiet, lit up booth and a chin and a forehead rest was used to minimize head movements. At the beginning of each individual session, Tobii Studio was launched and a first 9-point calibration procedure started. During this calibration, which took approximately 5 min., participants had to fixate 9 different positions indicated by a red point, linearly distributed along the bottom, central and top line of the screen until stable position values were obtained. After this initial calibration procedure of 9 points, Tobii Studio started recording participants' eye movements and the experiment was run from the laptop via Eprime software, which displayed the stimuli. Eye-movements were recorded using a remote TobiiX120 eye tracker interface with a PC. At that moment, participants went through a second 9-point- recalibration procedure. After that, participants were tested individually and assigned one of the eight lists. They were advised of taking a comfortable posture on the chair, since once the experiment began, they would have to remain as quite as possible, and they were prevented for blinking or doing abrupt movements. In addition, before starting, they were instructed to carefully read the sentences for meaning at his or her normal rate and to respond to occasional comprehension questions, but they did not receive any feedback.

In addition, before each trial appeared on the screen, participants fixated a little cross on the left side of the screen (positioned exactly where the first word of the sentence

would appear) and as soon as the fixation reached a stable value, the sentence was displayed. Once they finished reading each sentence, they had to press the space bar. They read these instructions on the screen. The sentences were presented phrase by phrase in the centre of a screen of 23", with a resolution of 1920x1080. The letters occupied a single line and were presented in black font over a light grey background. Likewise, according to eye-tracker's literature, we decided to set the letter's font style in courier new bold and in size 18. The two possible answers of the comprehension questions, that is, YES/NO, were in capital letters, in courier new bold and size 50. Viewing was binocular and fixation position was monitored from both eyes. Before conducting the eye-tracking experiment, each session started with a practice of 3 sentences and 2 comprehension questions in order to familiarize participants with the procedure of the experiment. This second part of the experiment lasted about 30 minutes including the four blocks of sentences and the optional breaks in between each block.

2.2.4 Data analysis

According to previous eye-movement studies on sentence processing (Deutsch & Bentin, 2001; Veldre & Andrews, 2018, Mancini et.al., 2014) the following reading measures were analysed for the 4 regions of interest identified (subject, critical verb + clitic position, the antecedent and the spillover region): *first fixation duration* (the duration of the reader's first fixation on a word provided that the word was not skipped. The *fixation* is the period of time when the focus of the participant's gaze is relatively still on an area for taking in information about that which is looked at), *fixation duration* (the sum of all fixation on a critical region before leaving it during a reader's first pass through the region. It includes only first-pass reading, not regressions), *total fixation duration* (the sum of all fixations durations in a region. Possible regressions included) and *total visit duration* (A visit is defined as the interval of time between a participant's first fixation on a region and the next fixation outside the region, including the duration of saccades. Total visit duration is then the sum of all visits to the region.). In addition to these latency measures, we also analysed the probability that a regression was made into a specific interest area, that is, the *probability of regressions in* (the probability of re-reading earlier parts of the sentence. This measure has been calculated by deducting the first fixation duration to the total number of fixations, which is represented in the value (N), i.e., the number of fixations or visits (N) is employed for deducing the total number of fixations (*Total Fixation Durations*) to which we deduce the *First Fixation Duration*,

which indicates us how many revisits are in each item. Any value with the value of 1 or higher means that the region was revisited once or more times, and was thus codified as 1 while the absence of any revisit was codified as 0).

Only subjects whose data accuracy was 70% or above were taken into consideration for further analysis. Accordingly, three subjects did not meet this criterion and were excluded. In addition, individual fixations that were longer than 800 milliseconds (ms) and shorter than 80 were removed from the analyses.

First Fixation duration, fixation duration, total fixation duration, total visit duration, and probability of regression into a specific region were analyzed separately. For the latency measures, values that were higher or lower than 2,5 standard deviations around the mean were winsorized and were replaced by those upper and lower RT limits.

In the analysis of the data, the dependent variables were the binomial probability of regression (whether a regression to the region was made or not) and the log-transformed reaction times. The fixed factors included in the models were Grammaticality (grammatical vs. ungrammatical clitic), Predictability (high-cloze vs. low cloze verb), the mean WM-span value of each participant and their interactions. The random-effects included subjects and items. The model used for all analysis did not include any random slope. In addition, whenever a significant interaction effect appeared, simpler models were run that split without one of the factors involved (either Grammaticality or Predictability) to find the source of the interaction. All analyses were carried out in R, version 3.6.0, using package lmerTest.

For each experimental condition in each region of interest the intercept, the estimated regression coefficients (Estimate), standard error (SE), t/Wald's z values and the p-values resulting from the linear mixed-effect model analysis are reported in all the different eye tracking measures in the text.

3. RESULTS

In this section the performance of participants in the WMT as well as the accuracy and the aforementioned eye-tracking measures concerning to the reading comprehension task are analysed. The first section starts with the comprehension-question accuracy of the reading-comprehension task. This allows us to determine to what extend participants were really processing the sentences. Then, the different eye-tracking measures taken into consideration in this study are discussed in the following order: *first fixation duration*,

fixation duration, total fixation duration, total visit duration and probability of regressions. In each of these measures' subsections, the effect of WM related to the effects of each particular measure is going to be discussed in order to shed light into the relation between the limits of WMC and the reading processing and language comprehension. To do this, as previously stated (cf. 2.2.3.1) WMC has been measured throughout a RSPAN task in which the score was the cumulative number of words recalled from perfectly recalled trials.

	Subject	Antecedent	Verb + Clitic	Spillover
First Fixation Duration				
GH	206 (2)	242 (3)	230 (3)	228 (3)
GL	210 (2)	238 (3)	233 (3)	222 (3)
UH	211 (2)	239 (3)	234 (3)	230 (3)
UL	206 (2)	236 (3)	241 (3)	228 (3)
Fixation Duration				
GH	114 (2)	133 (2)	123 (2)	116 (3)
GL	114 (2)	129 (2)	125 (2)	114 (2)
UH	115 (2)	126 (2)	130 (3)	119 (3)
UL	112 (2)	132 (3)	129 (2)	119 (3)
Total Fixation Duration				
GH	433 (8)	408 (8)	377,41 (7)	419 (7)
GL	448 (8)	413 (8)	386,41 (7)	419 (8)
UH	452 (8)	408 (8)	384,42 (8)	423 (8)
UL	444 (8)	416 (7)	400,34 (8)	426 (8)
Total Visit Duration				
GH	585 (11)	567 (10)	562 (10)	587 (10)
GL	582 (11)	569 (10)	558 (10)	589 (11)
UH	593 (11)	562 (10)	554 (10)	585 (10)
UL	597 (11)	575 (10)	563 (10)	602 (11)
Probability of regressions in (%)				
GH	0,84 (0,014)	0,73 (0,018)	0,62 (0,019)	0,78 (0,017)
GL	0,85 (0,014)	0,73 (0,017)	0,64 (0,019)	0,82 (0,015)
UH	0,85 (0, 014)	0,70 (0,018)	0, 65 (0,019)	0,77 (0,017)
UL	0,85 (0,014)	0,72 (0,018)	0,68 (0,019)	0,78 (0,016)

Table 1. Mean reading times (in milliseconds) obtained for each experimental condition in the four regions of interest, averaged across participants (standard error in parenthesis).

Notes: GH= Grammatical + High, GL= Grammatical + Low, UH= Ungrammatical + High, UL= Ungrammatical + Low.

3.1 Comprehension-question accuracy.

Participants correctly answered comprehension questions in 91.7 % of the cases in grammatical sentences with high-cloze verbs and 87.5 % of the cases in grammatical sentences with low-cloze verbs, with the difference being non-significant ($p = 0.08$).

3.2 First Fixation Duration

The analyses (see Table 2) showed a main significant effect of predictability at the critical verb + clitic region, with longer first fixation durations in sentences with low-cloze than with high-cloze verbs ($\beta = 2.778$, $z = 2.144$, $p < .03$). This reveals that low-cloze verbs result more costly for participants to integrate in the reading discourse since they constitute a violation of their context expectations. There was also a marginally significant main effect of grammaticality at this region, with a tendency for longer first fixation durations in ungrammatical than in grammatical sentences ($\beta = 2.240$, $z = 1.729$, $p = .08$), meaning that participants effectively detect syntactic violations (these results are graphically illustrated in figure 11). In addition, there was a significant interaction between WMC and predictability effects at the antecedent region ($\beta = -2.907e-03$, $z = -2.731$, $p < .001$). That is, subjects with larger WMC showed longer first fixation times as a result of the effect of WMC in reading and integration speed, and vice versa (see figure 12). No other effects were found at any region.

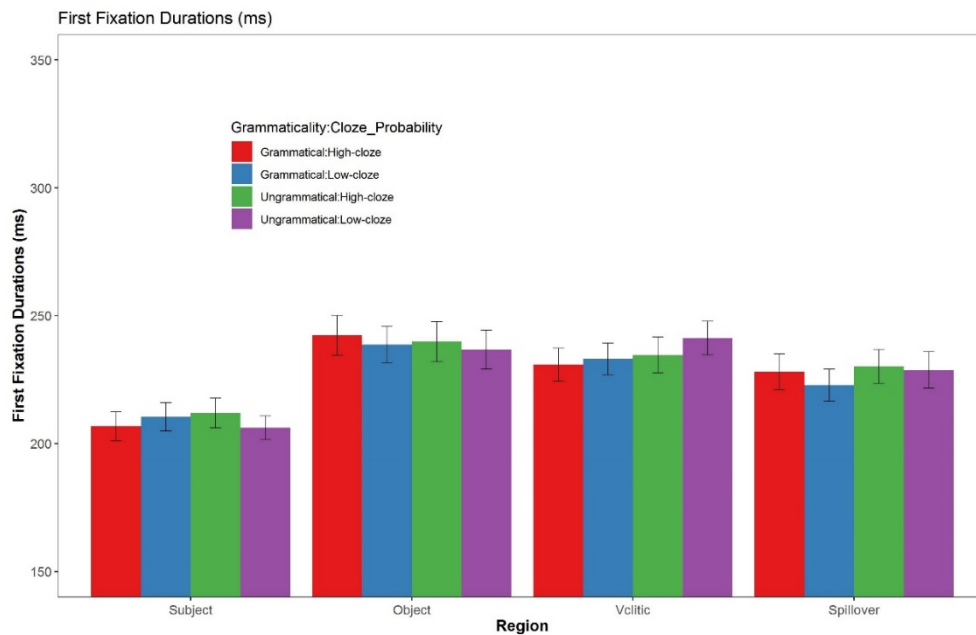


Figure 11. Average times (in milliseconds) for First Fixation Duration in the four conditions at every region.

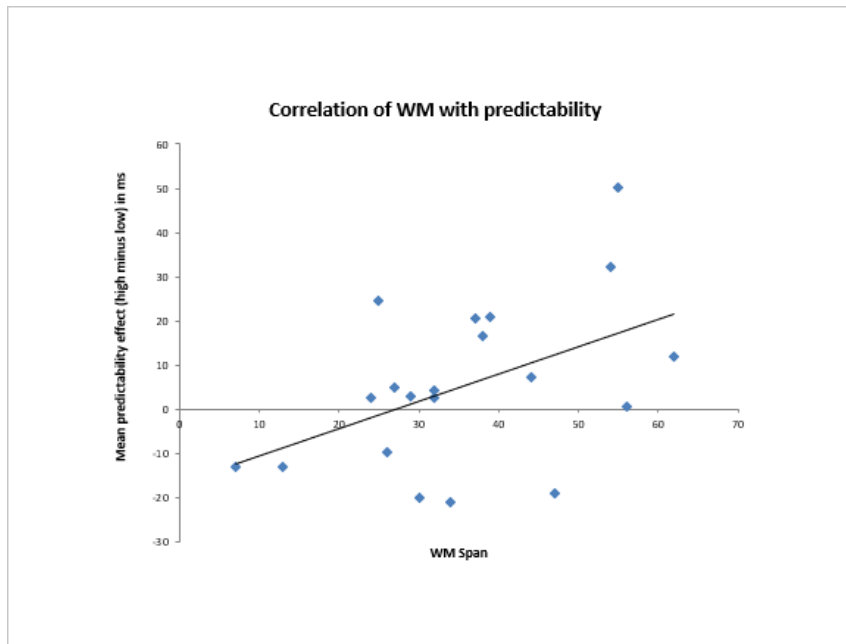


Figure 12. Correlation of WM with predictability by participants at the antecedent region.

3.3 Fixation Duration

The data obtained in Fixation Duration measure (see table 3) revealed a marginal effect of predictability with a tendency for longer fixation durations for low-cloze verbs than high-cloze ones ($\beta = 5.197e-02$, $z = -1.943$, $p = .05$), as well as a marginal effect of grammaticality, with a tendency for longer fixation durations for ungrammatical than grammatical sentences at the critical verb + clitic region ($\beta = 5.197e-02$, $z = 1.943$, $p = .001$). In addition, a main significant effect of grammaticality with longer fixation durations in grammatical than in ungrammatical sentences ($\beta = -6.439e-02$, $z = -2.349$, $p < .02$) was found at the antecedent region. There was also a marginally significant interaction between grammaticality and predictability at this region ($\beta = 1.010e-01$, $z = 1.842$, $p = .065$). Separate analysis showed that the grammaticality effect was only significant in the sentences with high-cloze verbs ($\beta = -1.154e-01$, $z = -2.887$, $p = .003$), with larger fixation durations in grammatical than ungrammatical sentences, while the effect was not significant with low-cloze verbs ($p > .1$). Concurrent analysis showed no predictability effects in either grammatical or ungrammatical sentences (both $p > .1$). No other effects were found at any region (see Figure 13).

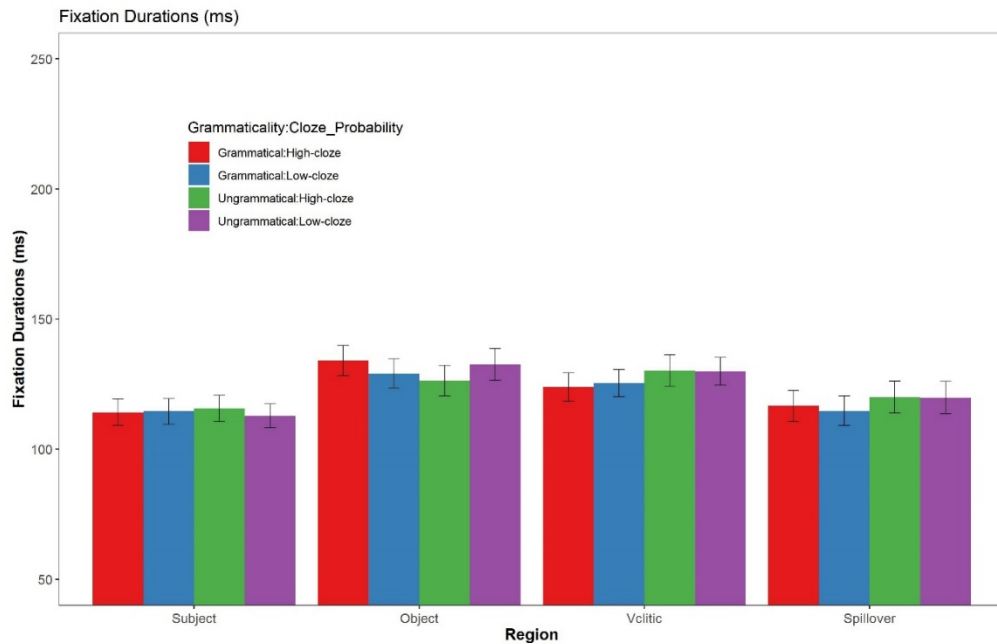


Figure 13. Average times (in milliseconds) for Fixation Duration in the four conditions at every region of interest.

3.4 Total Fixation Duration

Results for the Total Fixation Duration (see table 4) showed a main effect of predictability at the critical verb + clitic region, with longer total fixation durations in sentences with low-cloze than with high-cloze verbs ($\beta = 5.205e-02$, $z = 2.596$, $p = .009$). In addition, a marginally significant main effect of grammaticality was also found at this region, with a tendency for longer first fixation durations in ungrammatical than in grammatical sentences ($\beta = 3.689e-02$, $z = 1.839$, $p = .06$), (see figure 14). Likewise, there was also a marginally significant effect of WM at the critical verb + clitic region ($\beta = -7.181e-03$, $z = -2.007$, $p = .06$), meaning that subjects with larger WMC showed slightly longer total fixation durations at this region (see figure 15). Finally, at the antecedent region, there was a marginally significant 3-way interaction between predictability, grammaticality and WM ($\beta = 4.836e-03$, $z = 1.736$, $p = .082$). According to this interaction, the predictability effect is larger in grammatical than ungrammatical sentences, generally because the predictability effects show larger Fixations in low-cloze than high-cloze verbs. Hence, the correlations suggest that the lower WMC, the higher asymmetry (see figure 16). No other effects were found at any region.

On the interaction between syntax, semantics and working memory

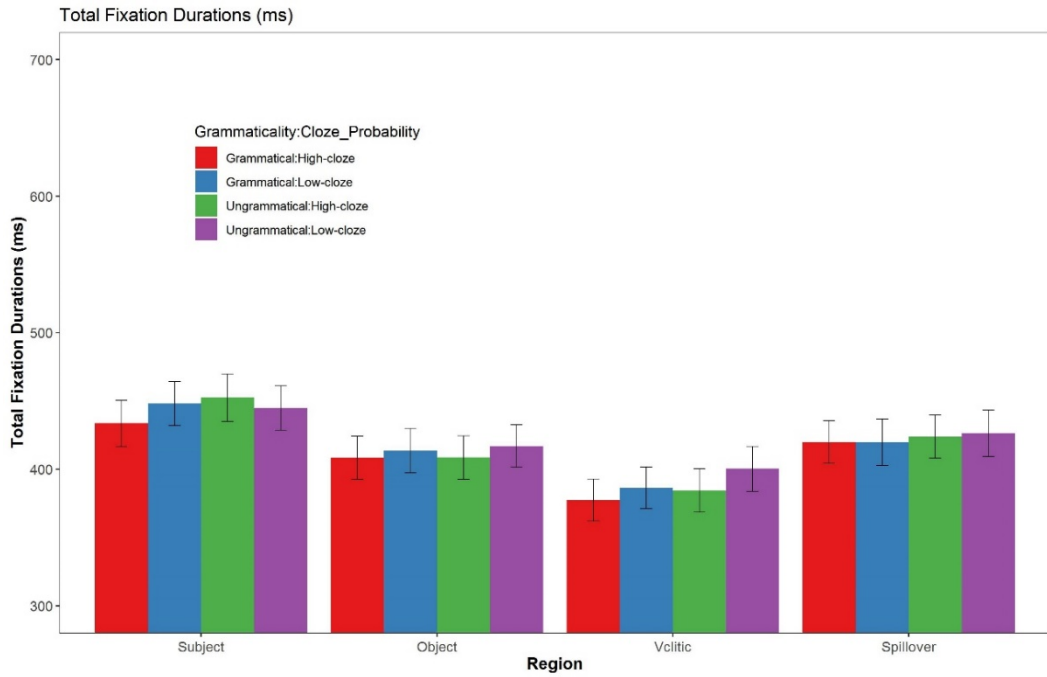


Figure 14. Average times (in milliseconds) for Total Fixation Duration in the four conditions at every region.

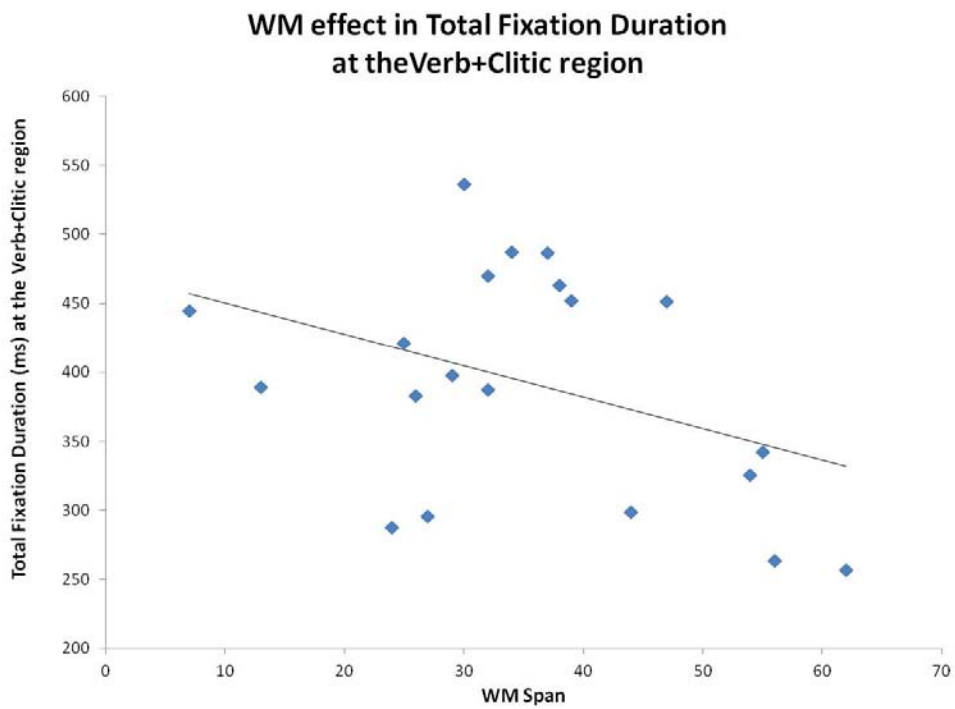


Figure 15. WM effect in Total Fixation Duration at the critical verb + clitic region.

On the interaction between syntax, semantics and working memory

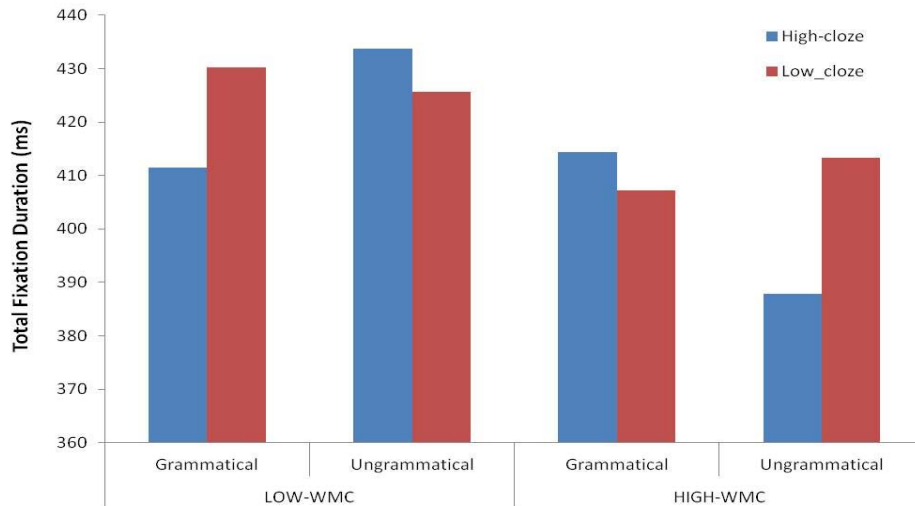


Figure 16. Tripartite interaction effect in Total Fixation Duration between WM, grammaticality and predictability at the antecedent region

3.5 Total Visit Duration

In the total visit duration (see table 5), the effects of predictability yielded were not significant at any region, and neither so the effects of grammaticality. Likewise, no interaction between both factors was found (see figure 17). However, there was a marginally significant effect of WM at the antecedent region ($\beta = -3.197e-03$, $z = -2.059$, $p = .05$), which shows that participants with more WMC tended to have faster total visit durations at the antecedent region, and vice versa (see figure 18).

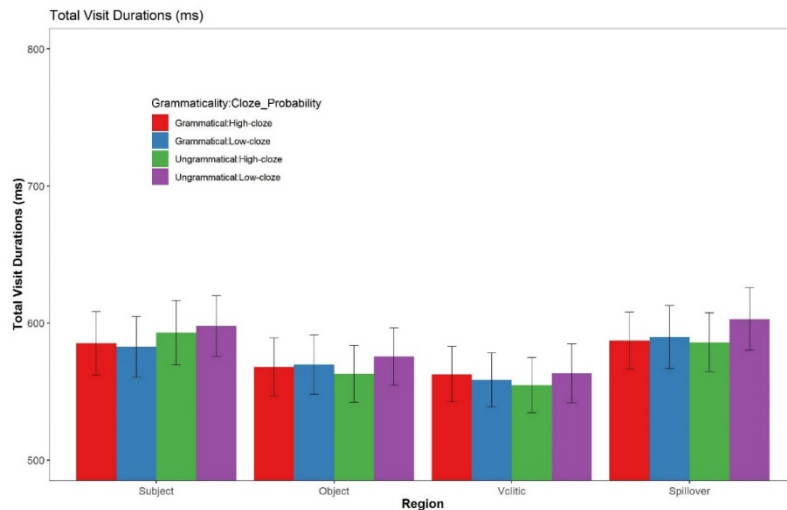


Figure 17. Average times (in milliseconds) for Total Visit Duration in the four conditions at every region.

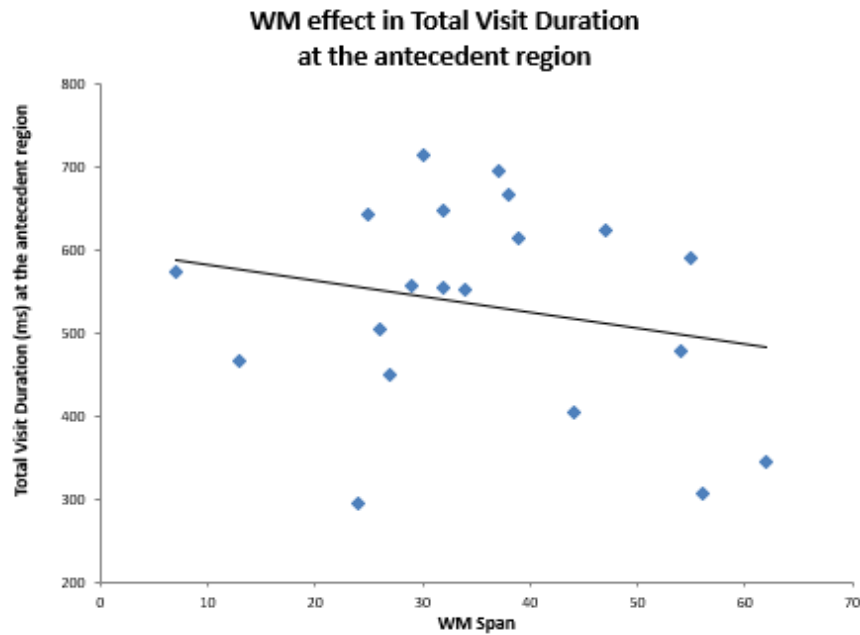


Figure 18. WM effect in Total Visit Duration at the antecedent

3.6 Probability of regression

The analysis (see table 6) showed no significant predictability effects at any region. By contrast, the main effect of grammaticality at the critical verb + clitic region was significant ($\beta = 0.193983$, $z = 2.040$, $p = .04$), with a higher probability of regressions in ungrammatical than grammatical sentences (see figure 19). A significant effect of WM was also found at this region, which means that participants with larger WMC do less regressions at this region than those with lower WMC (see figure 20). In addition, a significant main effect of WM was found at the antecedent region ($\beta = -0.022916$, $z = -2.134$, $p = .03$), meaning that participants with larger WMC present less probability of regressions to the antecedent. Likewise, a marginally significant interaction was also found at the antecedent region between WMC and grammaticality ($\beta = -0.012163$, $z = -1.673$, $p = .09$). That is, participants with larger WMC showed a tendency for regressions to the antecedent in ungrammatical sentences (see figure 21). Finally, at the subject region, there was a significant interaction between WMC and predictability ($\beta = 0.017345$, $z = 1.960$, $p = .05$), which indicate that participants with larger WMC showed a predictability effect with more probability of regressions to the subject in low-than high-cloze verbs, while participants with shorter WMC showed the reverse pattern, with more probability of regressions in high-than low-cloze verbs (see figure 22). No other effects were found at any region.

On the interaction between syntax, semantics and working memory

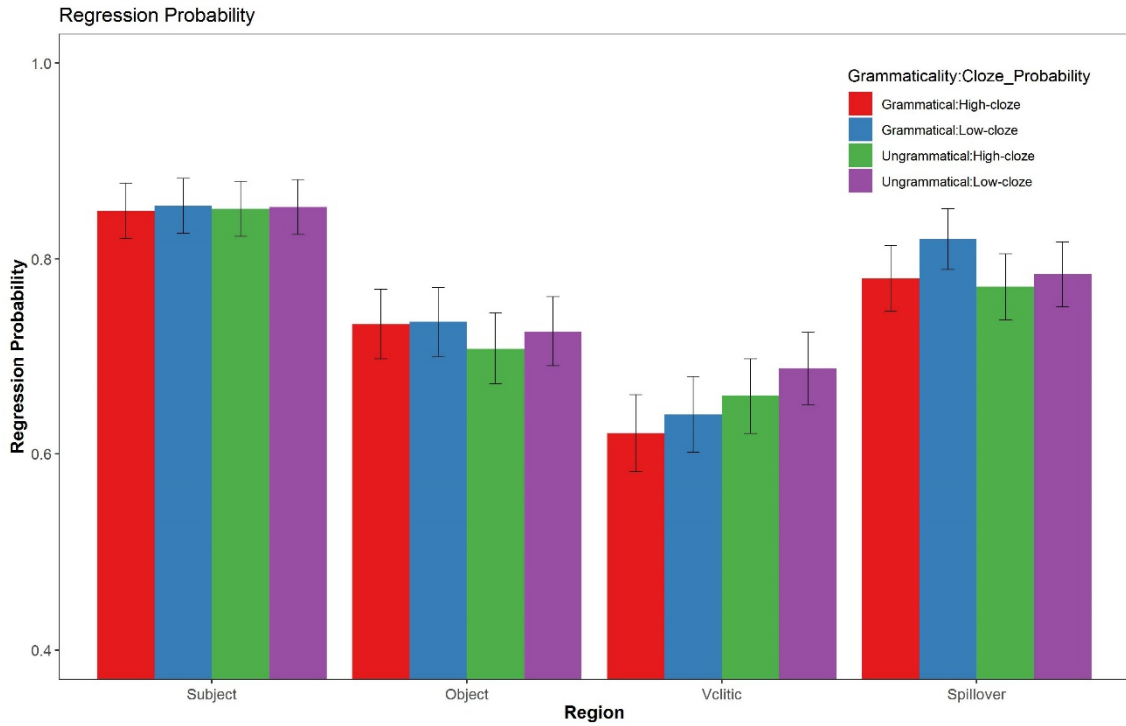


Figure 19. Average times (in milliseconds) for the probability of regressions in the four conditions at every region.

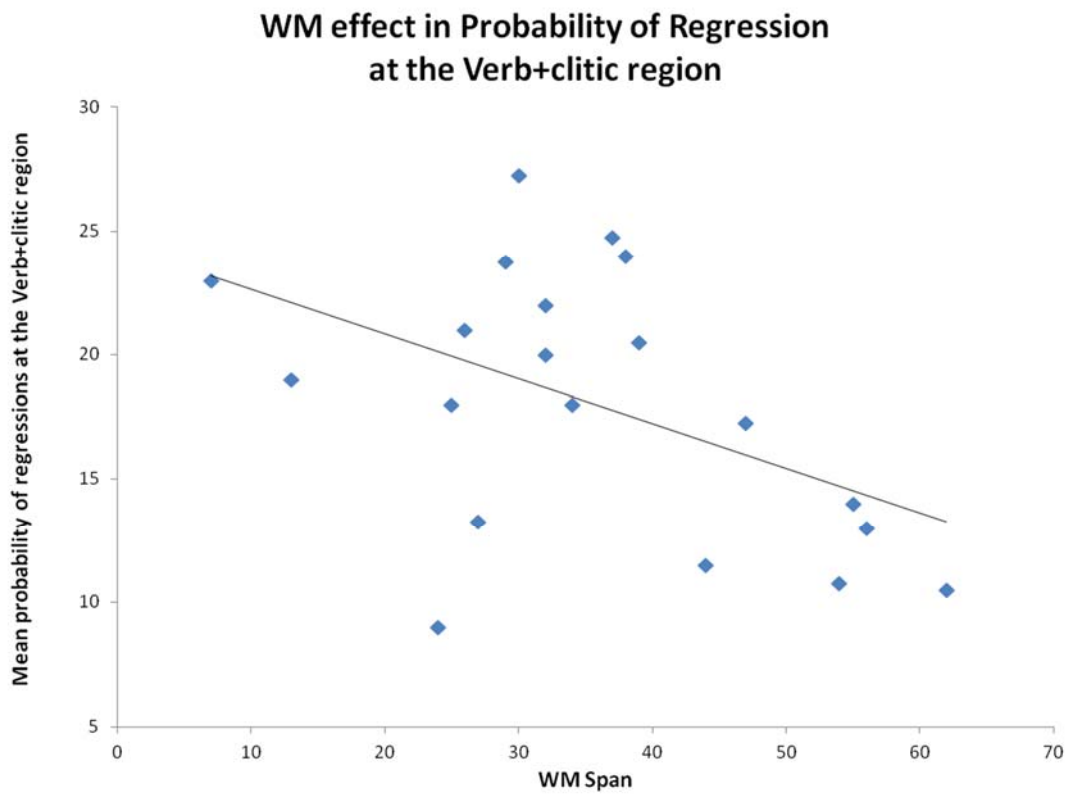


Figure 20. Correlation of WM with Probability of Regressions by participants at the critical verb + clitic region.

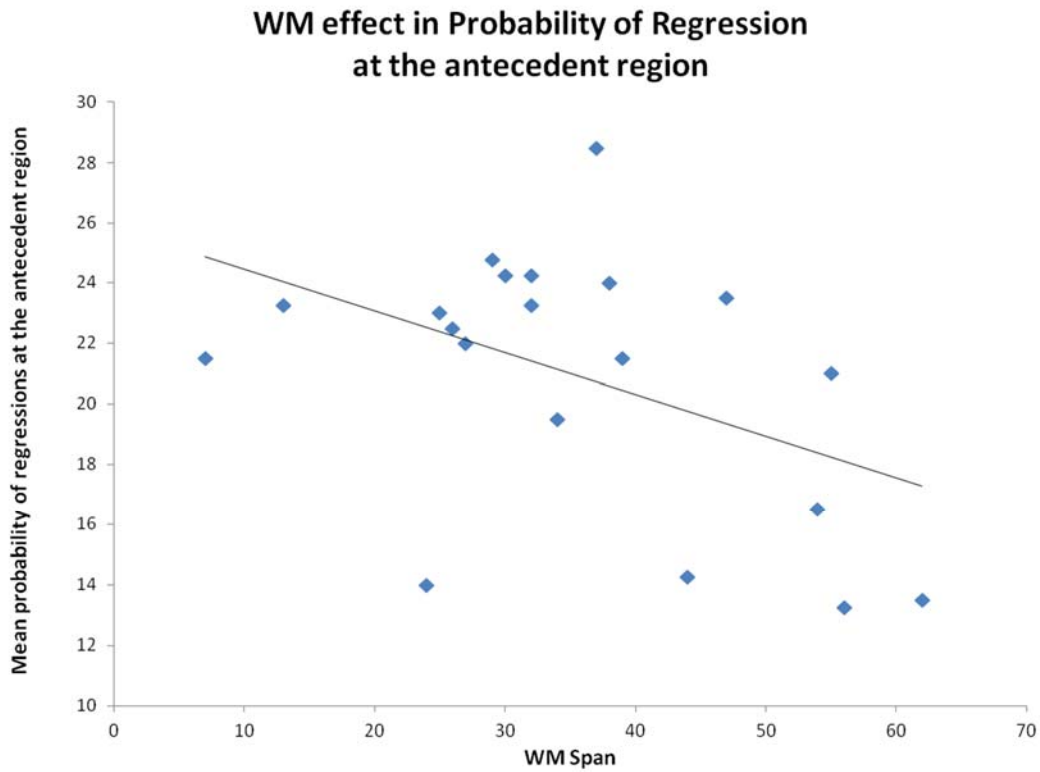


Figure 21 Interaction effect between WM and predictability in Regression probability at the antecedent region.

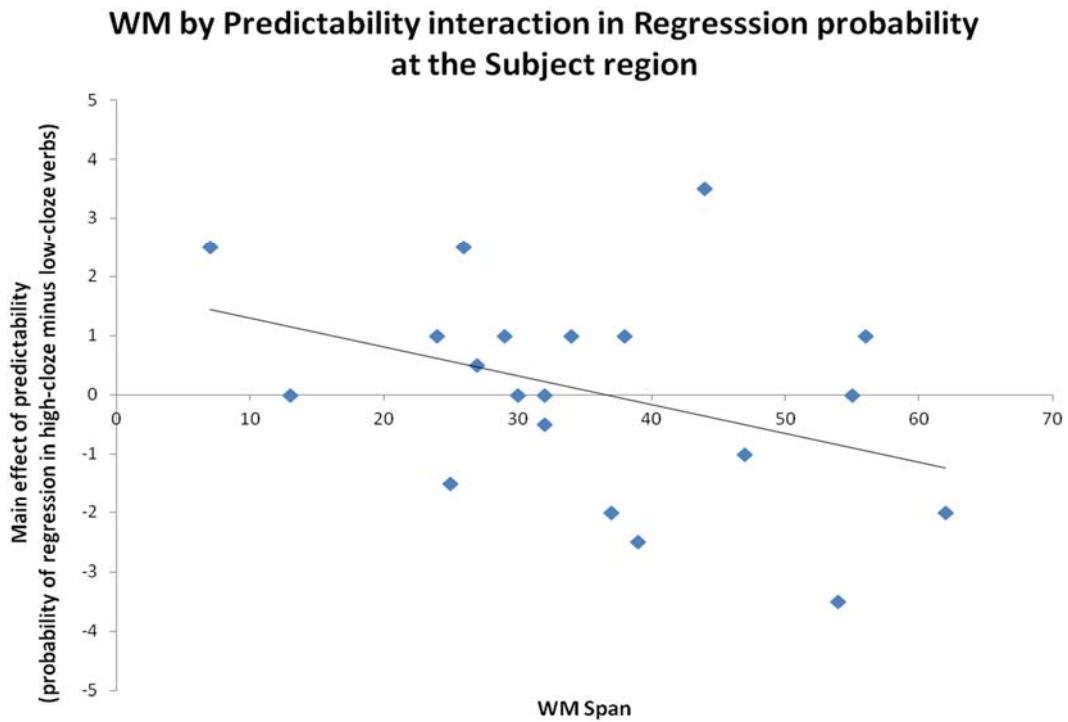


Figure 22. Interaction effect between WM and predictability in Regression probability at the subject region.

4. DISCUSSION

The main goal of the current study was to investigate the processing and integration of semantic and syntactic information during sentence reading comprehension. To this end, in this experiment the computation between cloze-probability and gender agreement violations between full DP arguments and object-clitics has been analysed throughout an eye tracking experiment.

Two alternative hypotheses have been considered in this study: the *syntax-first* model which supports that syntax and semantics are processed independently first and integrated at late stages and the *interactive* model according to which both types of information are processed simultaneously from early stages.

Previous ERP studies on the field have provided mixed results in support of both models. Gunter et. al., (1997,2002), Friederici (2002) and Wicha et.al., among others, found no interaction between syntax and semantics during reading comprehension at early stages of processing, while Hagoort (2003), Whicha et al., (2004) in Spanish and Palolathi et.al., (2005) in Finnish found evidence of early and late interaction between syntactic and semantic information.

Furthermore, the role of WM has been proved to be decisive during sentence reading comprehension (Cowan, 1995), reason why in this study the role of WM has also been considered parallelly. More precisely, I have investigated the influence of WMC in language processing, analysing the correlation between WM and predictability during sentence reading. Hence, the hypothesis considered regarding the constraint of WM in predictability during sentence reading was that higher WMC would imply longer fixation durations, which will correlate with higher regressions done during sentence reading.

In line with this, for what concerns to the interaction between syntax-semantics interplay, the results of the present study add evidence for the *syntax-first model* of processing since interaction between syntax and semantics was only found at late stages of processing. Thus, results in early measures such as First Fixation duration only showed a main effect of predictability with longer first fixation durations for sentences with low-cloze verbs than with high-cloze ones and a marginal effect of grammaticality, both at the critical + verb region with longer first fixation durations in ungrammatical sentences. Nevertheless, no interaction effects were found in this early phase of processing.

By contrast, eye movements in late measures such as Total Fixation Duration, revealed a marginal 3-way interaction between predictability, grammaticality and WM at

the antecedent region. This 3-way interaction suggests that participant's WMC modulates the way syntactic and semantic information interact. More precisely, it seems to suggest that participants with low-WMC show an interaction pattern with longer predictability effects (longer total fixation durations with low- than high-cloze verbs) in grammatical than ungrammatical sentences, while participants with high-WMC show a different interaction pattern, with longer predictability effects in ungrammatical than grammatical sentences. In addition, Total Fixation Duration also reflected a main effect of predictability at the critical verb + clitic region, with longer total fixation durations in sentences with low-cloze verbs than with high-cloze ones, which can be translated in higher costs of integrating the critical word in the discourse reading because of a violation of the reader's contextual expectations. Likewise, a marginal effect of grammaticality with a tendency for longer fixations in the ungrammatical than grammatical sentences was found at this critical region, what remarks the early syntactic awareness of participants during sentence processing.

Fixation Duration results at the critical verb + clitic region revealed a marginal effect of predictability and a significant effect of grammaticality with the same tendency pattern as the one reported in Total Fixation Duration for each effect, respectively. That is, longer fixations for low-cloze verbs than for high-cloze verbs, as well as for ungrammatical sentences compared to grammatical ones. Hence, these findings converge with those found in Total Fixation Duration, strengthening the consistence of the effects. In addition, a significant effect of grammaticality with longer fixation durations in grammatical than in ungrammatical sentences was also found at the antecedent region, as well as a marginally significant interaction showing that the grammaticality effect was only significant in sentences with high-cloze verbs. And there were no predictability effects in either grammatical or ungrammatical sentences. A possible explanation could be that, even if the task was not an acceptability judgment one, in grammatical sentences participants were trying to be sure that the phrase is grammatically correct throughout regressions whilst in the ungrammatical sentences they rapidly identify the mismatch.

In total visit duration, no effects of predictability, grammaticality nor interaction were found at any region. Hence, the fact that the effects found in Total Fixation Duration were not replicated in this measure suggests that saccades (included visit durations) are not a good measure of processing load, as its inclusion made the main effects disappear.

Finally, in the probability of regressions measure, the results showed also a main effect of grammaticality at the critical verb + clitic region with a higher probability of

regressions in ungrammatical than grammatical sentences. Hence, focusing on results such as those of First Fixation Duration (no interaction) and Total Fixation Duration (marginal interaction) we can affirm that the results of the present study go in line with the first hypothesis (syntax-first model of Friederici, 2002) considered in this experiment regarding the processing of the syntax-semantics interplay, which states that interaction occurs only at late stages of reading processing.

With regard to the role of WM during sentence reading, in light of the results of the present study we can affirm that WMC modulates the way syntactic and semantic information interact. In Total Fixation Duration, a WM effect was showed at the critical verb + clitic region, meaning that subjects with larger WMC showed longer total fixation durations at this region, which at the same time is consistent with the predictability pattern found at the same region. That is, the predictability effect revealed that participants presented longer fixations durations for those sentences containing low-cloze verbs compared to those with high cloze verb and the WM effect correlates with this predictability effect in such a way that as higher WMC longer fixations are showed in sentences with low-cloze verbs. The increase of Total Fixation Duration rates for those subjects with larger WMC when reading sentences with low-cloze verbs and with syntactic manipulations is due to the fact that during reading processing, participants have to hold context information in memory while retrieving new information, which requires a high memory load. Accordingly, as soon as they detect a mismatch in the sentence it would take more time for them to integrate the critical word in the discourse reading. On the contrary, those subjects with low WMC would present shorter total fixation durations since they will not be able to retain all the needed past information in memory to detect the sentence mismatch. This correlation pattern between predictability and WMC with longer fixation durations in low-cloze sentences and the early syntactic violation detection matches our prediction (cf. P3).

In Total Visit Duration, a marginal significant effect of WM was found at the antecedent region, which suggested that participants with higher WMC tended to have faster total visit durations at the antecedent region than participants with lower WMC.

Finally, at the Probability of Regressions measure, a significant WM effect was found at the critical verb + clitic region, meaning that participants with larger WMC did less regressions at this region than those with lower WMC. Likewise, a WM effect was found at the antecedent region, which reflected the same pattern, that is, that participants with larger WMC capacity do fewer regressions at this region than those with lower

WMC (i.e. longer total fixations but fewer regressions). In addition, a marginal significant interaction was also found at the antecedent region between WM and grammaticality, meaning that participants with larger WMC made more regressions to the antecedent in ungrammatical sentences. Finally, there was also an interaction between WMC and predictability at the subject region, which indicate that participants with larger WMC made more regressions to the subject in low-than high-cloze verbs, whilst participants with shorter WMC showed the reverse pattern, with more regressions done in high- than in low-cloze verbs. Thus, the interaction already described between WMC and predictability at the subject region, was an unexpected result for the present study, and it is difficult to explain and to integrate it in the general comprehension framework of the present study. It contradicts the reasoning provided so far for the correlation between WM and predictability, as well as the predictions made regarding regressions. Further research is then needed in order to clarify this finding. To be clear, according to the WM results obtained in this study, it is possible to say that WMC constrains sentence comprehension in such a way that subjects with larger WMC showed longer Fixation Durations but less probability of regressions in those sentences containing words which constitute a cloze-manipulation or a syntactic violation of their context expectation. These findings seem reasonable since higher WMC would allow participants to retain active in memory more past information, which would translate in longer Total Fixation Durations when they detect that there is some mismatch in the sentence since they will try to integrate all the information in a first pass reading. But, at the same time, this would result in less regressions to previous parts of the sentence, as they would not need to regress to earlier parts of the sentence as much as those subjects with lower rates of WMC.

In a nutshell, regarding the interaction between syntax-semantics interplay the main finding of the present results, is that such interaction has been attested only in late measures (Total Fixation Duration and Fixation Duration) but not in early ones such as First Fixation Duration, which matches the basis of the syntax-first theoretical model of processing hypothesis. Thus, syntactic and semantic information would interact only at a late phase of processing during sentence reading comprehension. In addition, the results from WMC (Rspan measures) related to predictability during sentence reading comprehension reveal that, effectively, it constrains reading comprehension since participants with higher WMC show more accurate predictions during processing, which enables them to better integrate all the information at first-pass reading.

5. CONCLUSIONS

This study provides an insight into the processing of syntax and semantics interplay throughout the computation, for the first time, of cloze-verb probability and gender agreement violations between full DP arguments and object-clitics. The aim of the research was to determine how we process and integrate both types of information during comprehension. The study also investigated the influence of WMC in predictability during sentence reading.

The main finding to emerge from this study is that syntax and semantics are processed independently at early stages of processing, while they only interact during late ones. In addition, WMC showed to interact with both predictability and grammaticality effects, suggesting that readers with higher WMC are able to keep active past information during more time and so, to detect a mismatch in the sentence immediately during sentence processing. As a consequence, since the critical word implies a violation of their context expectations, it takes time for them to integrate the corresponding word into the discourse reading but they would not need to come back to previous parts of the sentence as much as those participants with lower rates of WMC since they would have the previous information active in their brains. By contrast, those subjects with lower rates of WMC, could even do not remark the mismatch and skipped the critical word or in case they detect it, they would do more regressions to past information in comparison with those readers with higher WMC.

Overall, this study provides evidence that under the experimental conditions implemented in this study, the processing of syntax-semantics interplay seems to follow the syntax-first model (Friederici, 2002) of processing and that WMC plays a determinant role in reading comprehension. Nevertheless, further research on the syntax-semantics interplay is still needed, since no universal conclusions could still be drawn.

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7. APPENDICES

7.1 First Fixation Duration data analysis

FIRST FIXATION DURATION				
Subject				
	Estimate	SE	t-value	Pr(> t)
(Intercept)	5.281e+00	1.803e-02	292.854	<2e-16 ***
Cloze-probability	7.004e-03	1.172e-02	0.598	0.550
Grammaticality	9.770e-03	1.172e-02	0.833	0.405
WM-span	-2.036e-03	1.293e-03	-1.574	0.133
C.loze-probability by Grammaticality	-3.613e-02	2.345e-02	-1.541	0.124
Cloze-probability by WM-span	-6.178e-04	8.434e-04	-0.732	0.464
Grammaticality by WM-span	9.193e-04	8.439e-04	1.089	0.276
Cloze probability by Grammaticality and WM-span	1.035e-03	1.687e-03	0.614	0.540
Antecedent				
	Estimate	SE	t-value	Pr(> t)
(Intercept)	5.392e+00	4.025e-02	133.959	< 2e-16 ***
Cloze-probability	-2.234e-02	1.477e-02	-1.512	0.13058
Grammaticality	-1.696e-02	1.477e-02	-1.149	0.25083
WM-span	-8.608e-04	2.877e-03	-0.299	0.76819
Cloze-probability by Grammaticality	-2.504e-03	2.954e-02	-0.085	0.93245
Cloze-probability by WM-span	-2.907e-03	1.065e-03	-2.731	0.00637 **
Grammaticality by WM- span	9.184e-04	1.080e-03	0.850	0.39531
Cloze-probability by Grammaticality and WM-span	1.910e-03	2.162e-03	0.884	0.37705
Verb + clitic				
	Estimate	SE	t-value	Pr(> t)
(Intercept)	5.392e+00	3.629e-02	148.558	<2e-16 ***
Cloze-probability	3.170e-02	1.310e-02	2.419	0.0156 *
Grammaticality	2.403e-02	1.310e-02	1.834	0.0668 .
WM-span	-1.973e-03	2.599e-03	-0.759	0.4577
Cloze-probability by grammaticality	3.043e-02	2.621e-02	1.161	0.2457
Cloze probability by WM-span	8.850e-04	9.320e-04	0.950	0.3424
Grammaticality by WM-span	-5.561e-04	9.350e-04	-0.595	0.5521

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Cloze probability by Grammaticality and WM-span	6.165e-04	1.870e-03	0.330	0.7417
Spillover				
	Estimate	SE	t-value	Pr(> t)
(Intercept)	5.359e+00	3.142e-02	170.587	<2e-16 ***
Cloze-probability	-1.775e-02	1.400e-02	-1.267	0.205
Grammaticality	1.583e-02	1.400e-02	1.130	0.258
WM-span	-1.927e-03	2.243e-03	-0.859	0.401
Cloze-probability by Grammaticality	-1.468e-02	2.800e-02	-0.524	0.600
Cloze probability by WM-span	9.652e-04	9.991e-04	0.966	0.334
Grammaticality by WM-span	7.511e-04	1.012e-03	0.742	0.458
Cloze-probability by Grammaticality and WM-span	9.824e-04	2.026e-03	0.485	0.628

Table 2. First Fixation duration results obtained from the linear mixed-effect model analysis for each experimental condition in each region of interest.

7.2 Fixation Duration data analysis

FIXATION DURATION				
Subject				
	Estimate	SE	t-value	Pr(> t)
(Intercept)	4.546e+00	5.963e-02	76.245	<2e-16 ***
Cloze-probability	1.236e-02	2.387e-02	0.518	0.605
Grammaticality	5.995e-03	2.387e-02	0.251	0.802
WM-span	-4.931e-03	4.230e-03	-1.166	0.259
Cloze probability by grammaticality	1.078e-02	4.776e-02	0.226	0.821
Cloze-probability by WM- span	-1.476e-03	1.722e-03	-0.857	0.392
Grammaticality by WM-span	2.561e-03	1.780e-03	1.439	0.150
Cloze-probability by Grammaticality and WM-span	4.975e-03	3.566e-03	1.395	0.163
Antecedent				
	Estimate	SE	t-value	Pr(> t)
(Intercept)	4.659e+00	6.993e-02	66.621	<2e-16 ***
Cloze-probability	4.152e-03	2.742e-02	0.151	0.8797
Grammaticality	-6.439e-02	2.742e-02	-2.349	0.0189 *
WM-span	-1.721e-03	5.000e-03	-0.344	0.7347
Cloze-probability by Grammaticality	1.010e-01	5.484e-02	1.842	0.0656 .

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Cloze-probability by WM-span	-2.596e-03	1.972e-03	-1.316	0.1882
Grammaticality by WM-span	7.719e-04	1.995e-03	0.387	0.6988
Cloze-probability by Grammaticality and WM-span	6.750e-04	3.990e-03	0.169	0.8657
Verb + clitic				
	Estimate	SE	t-value	Pr(> t)
(Intercept)	4.665e+00	6.018e-02	77.510	<2e-16 ***
Cloze-probability	5.197e-02	2.675e-02	1.943	0.0522 .
Grammaticality	4.618e-02	2.675e-02	1.726	0.0845 .
WM-span	-3.104e-03	4.298e-03	-0.722	0.4794
Cloze-probability by Grammaticality	1.459e-02	5.351e-02	0.273	0.7852
Cloze-probability by WM-span	1.719e-03	1.908e-03	0.901	0.3676
Grammaticality by WM-span	2.829e-03	1.930e-03	1.466	0.1429
Cloze-probability by Grammaticality and WM-span	-2.271e-03	3.861e-03	-0.588	0.5565
Spillover				
	Estimate	SE	t-value	Pr(> t)
(Intercept)	4.532e+00	6.331e-02	71.584	<2e-16 ***
Cloze-probability	-7.260e-03	3.034e-02	-0.239	0.811
Grammaticality	2.946e-02	3.034e-02	0.971	0.332
WM-span	-2.417e-03	4.525e-03	-0.534	0.600
Cloze-probability by Grammaticality	-6.128e-02	6.067e-02	-1.010	0.313
Cloze-probability by WM-span	2.024e-04	2.169e-03	0.093	0.926
Grammaticality by WM-span	3.351e-03	2.186e-03	1.533	0.125
Cloze-probability by Grammaticality and WM-span	-1.508e-03	4.373e-03	-0.345	0.730

Table 3. Fixation duration results obtained from the linear mixed-effect model analysis for each experimental condition in each region of interest.

7.3 Total Fixation Duration data analysis

TOTAL FIXATION DURATION				
Subject				
	Estimate	SE	t-value	Pr(> t)
(Intercept)	6.053e+00	4.437e-02	136.419	<2e-16 ***
Cloze-probability	3.393e-03	1.746e-02	0.194	0.8460
Grammaticality	7.647e-03	1.749e-02	0.437	0.6621

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WM-span	-4.042e-03	2.778e-03	-1.455	0.1631
Cloze-probability by Grammaticality	-3.211e-02	3.499e-02	-0.918	0.3589
Cloze-probability by WM-span	2.106e-03	1.233e-03	1.708	0.0878
Grammaticality by WM-span	1.668e-03	1.332e-03	1.252	0.2109
Cloze-probability by Grammaticality and WM-span	1.175e-04	2.693e-03	0.044	0.9652
Antecedent				
	Estimate	SE	t-value	Pr(> t)
(Intercept)	5.934e+00	4.967e-02	119.468	<2e-16 ***
Cloze-probability	1.947e-02	1.889e-02	1.030	0.3029
Grammaticality	-1.451e-03	1.894e-02	-0.077	0.9390
WM-span	-4.717e-03	3.478e-03	-1.356	0.1918
Cloze-probability by Grammaticality	2.803e-02	3.784e-02	0.741	0.4588
Cloze-probability by WM-span	-7.102e-05	1.322e-03	-0.054	0.9572
Grammaticality by WM-span	-1.312e-03	1.396e-03	-0.940	0.3476
Cloze probability by Grammaticality and WM-span	4.836e-03	2.786e-03	1.736	0.0827 .
Verb + clitic				
	Estimate	SE	t-value	Pr(> t)
(Intercept)	5.856e+00	5.034e-02	116.317	< 2e-16 ***
Cloze-probability	5.205e-02	2.005e-02	2.596	0.00952 **
Grammaticality	3.689e-02	2.007e-02	1.839	0.06614 .
WM-span	-7.181e-03	3.579e-03	-2.007	0.06021 .
Cloze-probability by Grammaticality	2.750e-02	4.010e-02	0.686	0.49300
Cloze-probability by WM-span	9.206e-05	1.394e-03	0.066	0.94735
Grammaticality by WM-span	6.825e-05	1.429e-03	0.048	0.96191
Cloze-probability by Grammaticality and WM-span	-5.115e-04	2.860e-03	-0.179	0.85808
Spillover				
	Estimate	SE	t-value	Pr(> t)
(Intercept)	5.956e+00	5.298e-02	112.414	<2e-16 ***
Cloze-probability	-1.032e-03	1.992e-02	-0.052	0.959
Grammaticality	9.555e-03	1.987e-02	0.481	0.631
WM-span	-3.099e-03	3.669e-03	-0.845	0.409
Cloze-probability by Grammaticality	1.851e-02	3.972e-02	0.466	0.641
Cloze-probability by WM-span	1.495e-04	1.395e-03	0.107	0.915

Grammaticality by WM-span	-9.480e-04	1.489e-03	-0.637	0.524
Cloze-probability by Grammaticality and WM-span	-8.035e-04	2.983e-03	-0.269	0.788

Table 4. Total Fixation Duration results obtained from the linear mixed-effect model analysis for each experimental condition in each region of interest.

7.4 Total Visit Duration data analysis

TOTAL VISIT DURATION				
Subject				
	Estimate	SE	t-value	Pr(> t)
(Intercept)	6.197e+00	2.101e-02	294.918	<2e-16 ***
Cloze-probability	2.889e-02	3.279e-02	0.881	0.378
Grammaticality	7.167e-03	3.280e-02	0.219	0.827
WM-span	-2.206e-03	1.423e-03	-1.550	0.141
Cloze-probability by Grammaticality	4.231e-02	6.560e-02	0.645	0.519
Cloze-probability by WM-span	2.092e-03	2.348e-03	0.891	0.373
Grammaticality by WM-span	1.350e-03	2.380e-03	0.567	0.571
Cloze-probability by Grammaticality and WM-span	3.227e-03	4.762e-03	0.678	0.498
Antecedent				
	Estimate	SE	t-value	Pr(> t)
(Intercept)	6.163e+00	2.337e-02	263.676	<2e-16 ***
Cloze-probability	1.101e-02	3.293e-02	0.334	0.7382
Grammaticality	1.296e-02	3.293e-02	0.393	0.6941
WM-span	-3.197e-03	1.553e-03	-2.059	0.0543 .
Cloze-probability by Grammaticality	4.321e-02	6.588e-02	0.656	0.5120
Cloze-probability by WM-span	-2.267e-03	2.363e-03	-0.959	0.3375
Grammaticality by WM-span	-1.929e-03	2.415e-03	-0.799	0.4244
Cloze-probability by Grammaticality and WM-span	6.313e-04	4.830e-03	0.131	0.8960
Verb + clitic				
	Estimate	SE	t-value	Pr(> t)
(Intercept)	6.177e+00	2.671e-02	231.253	<2e-16 ***
Cloze-probability	-5.280e-03	2.943e-02	-0.179	0.858
Grammaticality	4.800e-04	2.943e-02	0.016	0.987
WM-span	-3.156e-03	1.909e-03	-1.653	0.116

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Cloze-probability by Grammaticality	-1.328e-02	5.885e-02	-0.226	0.822
Cloze-probability by WM-span	1.746e-03	2.095e-03	0.834	0.405
Grammaticality by WM-span	2.513e-03	2.095e-03	1.200	0.230
Cloze-probability by Grammaticality and WM-span	-1.784e-03	4.189e-03	-0.426	0.670
Spillover				
	Estimate	SE	t-value	Pr(> t)
(Intercept)	6.206e+00	2.366e-02	262.339	<2e-16 ***
Cloze-probability	-2.159e-02	3.286e-02	-0.657	0.511
Grammaticality	7.286e-04	3.286e-02	0.022	0.982
WM-span	1.256e-04	1.692e-03	0.074	0.942
Cloze-probability by Grammaticality	1.926e-02	6.572e-02	0.293	0.769
Cloze-probability by WM-span	-8.318e-04	2.350e-03	-0.354	0.723
Grammaticality by WM-span	1.919e-03	2.350e-03	0.816	0.414
Cloze probability by Grammaticality and WM-span	-5.054e-03	4.700e-03	-1.075	0.282

Table 5. Total visit duration results obtained from the linear mixed-effect model analysis for each experimental condition in each region of interest.

7.5 Probability of regressions data analysis

PROBABILITY OF REGRESSION				
Subject				
	Estimate	SE	z-value	Pr(> t)
(Intercept)	2.501427	0.240086	10.419	<2e-16 ***
Cloze-probability	0.023386	0.130832	0.179	0.858
Grammaticality	0.008809	0.131202	0.067	0.946
WM-span	-0.011176	0.012315	-0.907	0.364
Cloze-probability by Grammaticality	0.063164	0.263367	0.240	0.810
Cloze-probability by WM-span	0.017345	0.008849	1.960	0.050 *
Grammaticality by WM-span	0.010573	0.009669	1.093	0.274
Cloze-probability by Grammaticality and WM-span	-0.013856	0.019254	-0.720	0.472
Antecedent				
	Estimate	SE	z-value	Pr(> t)
(Intercept)	1.106004	0.163095	6.781	1.19e-11 ***
Cloze-probability	0.069963	0.099730	0.702	0.4830

Grammaticality	-0.106139	0.100110	-1.060	0.2890
WM-span	-0.022916	0.010737	-2.134	0.0328 *
Cloze-probability by Grammaticality	0.067159	0.200090	0.336	0.7371
Cloze-probability by WM-span	0.007783	0.006816	1.142	0.2535
Grammaticality by WM-span	-0.012163	0.007270	-1.673	0.0943 .
Cloze-probability by Grammaticality and WM-span	0.016511	0.014528	1.136	0.2558
Verb + clitic				
	Estimate	SE	z-value	Pr(> t)
(Intercept)	0.675376	0.168849	4.000	6.34e-05 ***
Cloze-probability	0.117808	0.094986	1.240	0.2149
Grammaticality	0.193983	0.095077	2.040	0.0413 *
WM-span	-0.027799	0.011838	-2.348	0.0189 *
Cloze-probability by Grammaticality	0.083438	0.190044	0.439	0.6606
Cloze-probability by WM-span	-0.004903	0.006548	-0.749	0.4539
Grammaticality by WM-span	0.005363	0.006741	0.796	0.4263
Cloze-probability by Grammaticality and WM-span	-0.006836	0.013497	-0.506	0.6125
Spillover				
	Estimate	SE	z-value	Pr(> t)
(Intercept)	1.719517	0.259039	6.638	3.18e-11 ***
Cloze-probability	0.188818	0.116475	1.621	0.105
Grammaticality	-0.154267	0.116284	-1.327	0.185
WM-span	-0.010817	0.016965	-0.638	0.524
Cloze-probability by Grammaticality	-0.113042	0.232345	-0.487	0.627
Cloze-probability by WM-span	-0.002246	0.007947	-0.283	0.777
Grammaticality by WM-span	-0.001256	0.008549	-0.147	0.883
Cloze-probability by Grammaticality and WM-span	-0.020757	0.017243	-1.204	0.229

Table 6. Probability of regressions results obtained from the linear mixed-effect model analysis for each experimental condition in each region of interest.

7.6 List 1: Experimental sentences and comprehension questions.

La viajera se sentó sobre la maleta tras conseguir cerrarla en la estación.

El pintor francés enmarcó orgullosamente el cuadro después de pintarlo en el pueblo.

La leñadora sacudió con fuerza la rama hasta conseguir partirla antes de almorzar.

Ana recogió con la bayeta la leche después de derramarla sobre la mesa.

El arrepentido ladrón decidió devolver el cuadro tras conseguir robarlo sin grandes dificultades.

La chica al final compró la trompeta para intentar tocarla en su casa.

El preocupado dueño sujetó fuertemente al perro para intentar frenarlo durante el concurso.

El veterinario calmó muy pacientemente al perro para intentar examinarlo en su consulta.

La montañera lavó muy cuidadosamente la cantimplora después de llenarla en la fuente.

El editor abrió con entusiasmo el libro para poder editarlo sin más demora.

La coleccionista tuvo que vender la colección tras conseguir comprarla en varios plazos.

La ingeniera bajó varias veces esta aplicación hasta conseguir utilizarla en mi móvil.

El hastiado empresario gritó enfurecido al trabajador antes de promocionarlo sin ninguna oposición.

El policía custodió muy celosamente al confidente para poder torturarlo durante varios días.

El policía detuvo esta mañana al acusado para poder liberarlo en la comisaría.

La camarera limpió con cuidado la botella después de vaciarlo con mucha rapidez.

La niña arrancó sin avisar la furgoneta para intentar conducirlo sin ser vista.

La señora frotó con fuerza la mancha hasta conseguir quitarlo con gran esfuerzo.

La adolescente manipuló varias veces la hucha hasta conseguir abrirlo sin hacer ruido.

El alumno ha preparado bien el examen para intentar aprobarla sin ningún problema.

El policía identificó muy rápidamente al asesino antes de atraparla en el callejón.

Esta mañana el cirujano anestesió al paciente antes de operarla ante su familia.

La florista acercó con cuidado la rosa para poder tratarlo con mucho cariño.

La doctora abrió con cuidado la herida para poder coserlo con más atención.

La hacker introdujo con exactitud la contraseña tras conseguir robarlo en un instante.

La sedienta clienta pidió rápidamente otra cerveza para poder derramarlo en la barra.

El arqueólogo limpió de tierra el jarrón tras conseguir romperla durante la excavación.

El ayuntamiento pondrá en marcha el proyecto tras conseguir paralizarla por mayoría simple.

El comprador regateó con vehemencia el precio hasta conseguir subirla un poco más.

El árbitro apercibió varias veces al jugador antes de felicitarla por su actuación.

¿Manchó la montañera la cantimplora?

¿Abrió el editor el libro para poder fotocopiarlo?

¿Tuvo que vender la coleccionista la colección?

¿Bajó la ingeniera esta aplicación hasta conseguir utilizarla?

¿Gritó el empresario al trabajador?

¿Se puso la viajera de pie sobre la maleta?

¿Enmarcó el pintor francés una fotografía?

¿Sacudió con fuerza la rama la leñadora?

¿Recogió Ana la leche después de derramarla?

¿Decidió el arrepentido ladrón devolver el cuadro?

María metió en la fiamblera la paella para poder guardarla en la oficina.

La exploradora ha depurado cuidadosamente esta agua antes de beberla en el oasis.

La especuladora visitó varias veces la casa hasta conseguir rebajarla en sus términos.

El ladrón escondió muy bien el botín tras conseguir robarlo el día anterior.

Mi padre buscó con insistencia mi diario hasta conseguir encontrarlo el otro día.

La atleta besó con emoción la medalla tras conseguir ganarla durante la olimpiada.

El taxista cerró muy bien su coche después de aparcarlo en el parking.

La chica fue a buscar una enciclopedia para poder leerla con mucha atención.

Ella metió en la secadora la ropa para poder lavarla con más rapidez.

El conductor metió al parking el coche para poder venderlo sin más demora.

La ladrona manipuló muy sigilosamente la cerradura para intentar cerrarla sin ser descubierta.

El ayuntamiento finalmente inaugurará mañana el edificio tras conseguir comprarlo dentro del plazo.

El sumiller se acercó delicadamente el vino para intentar reconocerlo con mucha precisión.

La emigrante cerró muy cuidadosamente la carta antes de abrirla con mucha emoción.

El vendedor finalmente se deshizo del coche tras conseguir quemarlo en el desguace.

La cinéfila buscó con ahínco esta película hasta conseguir encontrarlo en la filmoteca.

La camarera nos ofreció amablemente la jarra después de llenarlo en la cocina.

La pianista tuvo que ensayar la sonata para poder interpretarlo a la perfección.

El consejero repasó dos veces el comunicado antes de enviarla sin ningún problema.

El peluquero secó muy bien el cabello antes de peinarla con la espuma.

El ferretero amartilló con insistencia el clavo hasta conseguir clavarla en el tablón.

El mono golpeó con insistencia el coco hasta conseguir partirla bajo el árbol.

La conductora frenó con fuerza la moto hasta conseguir apagarlo en el arcén.

La marquesa guardó muy celosamente la pulsera tras conseguir robarlo durante la gala.

La modista tiene que remendar la falda para intentar venderlo antes del domingo.

La manifestante mojó con gasolina la bandera para intentar ondearlo sin ser vista.

El mono comió con rapidez el plátano tras conseguir aplastarla con sus manos.

Mikel puso en la fotocopiadora el dibujo antes de regalarla en la oficina.

El escritor presentó muy ilusionado su libro tras conseguir venderla antes de navidad.

El ladrón fue a inspeccionar el banco para intentar quemarla al día siguiente.

¿Tendió el vecino el mantel con unas tijeras?

¿Mostró el enfermo el corte sin ningún miedo?

¿Elaboró el cocinero el menú con mucho detalle?

¿Fue la chica a comprar una enciclopedia?

¿Metió ella la ropa en la secadora para poder teñirla?

¿Metió el conductor el coche al parking para poder esconderlo?

¿Manipuló la ladrona la cerradura?

¿Inaugurará el ayuntamiento el edificio tras conseguir comprarlo?

¿Se acercó el sumiller el vino para intentar olerlo?

¿Metió María la paella en una cazuela?

¿Ha depurado la exploradora esta agua antes de embotellarla?

¿Consiguió la especuladora rebajar la casa?

¿Escondió el ladrón el botín?

¿Buscó mi padre mi diario con insistencia?

Mi amiga Ana criticó positivamente la novela después de leerla en la librería.

La mecánico empujó con fuerza la moto hasta conseguir arrancarla con el impulso.

El fontanero tuvo que desmontar el fregadero para intentar desatascarlo con mucho esfuerzo.

Luis acercó a un clavo el globo para poder pincharlo sin ser visto.

El estudiante puso a remojo el pantalón para poder lavarlo antes de anochecer.

La conserje sujetó boca abajo la botella hasta conseguir vaciarla en el fregadero.

Ella tiró repetidamente al suelo la botella hasta conseguir romperla con gran habilidad.

La traviesa niña reparó minuciosamente la escultura después de comprarla en la tienda.

El editor ha decidido rechazar el artículo tras conseguir plagiarlo en una hora.

El fiscal provocó con reiteración al acusado hasta conseguir humillarlo delante del juez.

La joven utiliza siempre la misma contraseña para poder recuperarla sin ningún problema.

El famoso pintor finalmente entregó el cuadro después de robarlo durante la exhibición.

La estudiante vació ayer completamente la papelera después de levantarla con mi ayuda.

La inquilina visitó muchas veces la casa antes de limpiarla para el verano.

El charcutero sujetó con fuerza el jamón para intentar venderlo esa misma mañana.

La alumna estudió varias veces esta asignatura hasta conseguir aprobarlo sin ningún problema.

La encargada limpió a fondo la piscina antes de llenarlo durante el verano.

La piloto finalmente pudo arrancar la moto tras conseguir arreglarlo en el taller.

RTVE grabó hace una semana la gala para poder retransmitirlo el próximo domingo.
El dueño siempre limpia bien al perro después de pasearla por la mañana.
El joven informático ha desmontado el ordenador para intentar repararla esta misma tarde.
El pirata buscó con esmero el tesoro hasta conseguir encontrarla el mes pasado.
Fermín apuntó en el brazo el número para intentar recordarla sin gran dificultad.
La niña acercó al fuego la mecha hasta conseguir secarlo con mucho cuidado.
María partió por la mitad la naranja antes de pelarlo con gran habilidad.
La enfermera cosió con esmero la herida hasta conseguir abrirlo por ambos lados.
La acalorada cocinera empujó fuertemente la ventana para intentar romperlo de una vez.
El complacido empresario llamó urgentemente al albañil para intentar despedirla lo antes posible.
El gobierno ya dispone de un presupuesto tras conseguir recaudarla con gran dificultad.
El periodista revisó con atención el artículo antes de imprimirla en la revista.
¿Criticó mi amiga Ana la novela negativamente?
¿Empujó la mecánico la moto hasta conseguir detenerla?
¿Intentó el fontanero cambiar el fregadero?
¿Acercó Luis el globo a un clavo para poder pincharlo?
¿Puso el estudiante el pantalón a remojo?
¿Reparó la niña la escultura después de robarla?
¿Ha decidido el editor aceptar el artículo?
¿Consiguió el fiscal tranquilizar al acusado?
¿Utiliza la joven siempre la misma contraseña?
¿Entregó el famoso pintor el cuadro después de robarlo?
La duquesa descubrió robando a la criada antes de despedirla sin ningún remordimiento.
Aitor tuvo que planchar bien el pantalón después de lavarlo en su casa.
El actor agitó muy bruscamente el mechero para intentar encenderlo sin más demora.
La niña cogió con cuidado la patata antes de comerla en su cuarto.
El pastor persiguió con determinación al lobo para intentar cazarlo en su redil.
La carpintera fijó con precaución la estantería después de montarla en la carpintería.
El ilusionado grafitero fotografió cuidadosamente el dibujo después de terminarlo con mucho empeño.
El técnico borró sin problemas el virus después de localizarlo en el ordenador.
El abuelo sacó del bolsillo el puro antes de romperlo dentro del restaurante.
El camionero llevó al autolavado el camión para poder venderlo antes del viaje.
La motorista se colocó tras la furgoneta para intentar embestirla aprovechando el rebufo.

Lucía dejó en la pared la chincheta tras conseguir quitarla con el martillo.
La madre vio bostezando a la niña antes de acariciarla con mucho cariño.
La atiborrada niña cogió sigilosamente la tarta para poder tirarla durante la fiesta.
El juez confirmó la coartada del sospechoso antes de condenarlo en su sentencia.
La vigilante apagó por fin la radio después de escucharlo durante un rato.
La escaladora comenzó a descender la montaña tras conseguir escalarlo con mucho esfuerzo.
La refugiada pudo dejar atrás la frontera tras conseguir cruzarlo tras varios intentos.
La enfermera limpió con cuidado la herida antes de coserlo con mucha precaución.
El informático instaló sin problemas el programa después de descargarla antes de marcharse.
El lector devolvió a tiempo el periódico después de leerla sin poner atención.
El terrorista apuñaló sin piedad al rehén después de secuestrarla en el desierto.
El hombre cocinó el domingo un atún para poder comerla con su cuadrilla.
La estudiante planeó muy detenidamente la frase antes de expresarlo ante sus compañeros.
La excursionista raspó con fuerza la cerilla para intentar limarlo sin ningún problema.
La chica cantó muchas veces la canción hasta conseguir olvidarlo sin darse cuenta.
El conductor frenó muy bruscamente el tren para intentar aparcarla en el andén.
El carpintero sujetó con cuidado el clavo para intentar sacarla sin dejar marcas.
El jeque despilfarró muy alegremente mucho dinero hasta conseguir multiplicarla en poco tiempo.
El socorrista logró finalmente reanimar al ahogado tras conseguir curarla con el médico.
¿Descubrió a la criada robando antes de premiarla?
¿Tuvo que planchar Aitor una camisa?
¿Agitó el actor el mechero para intentar vaciarlo?
¿Cogió la niña la patata antes de comerla?
¿Persiguió el pastor al lobo para intentar cazarlo?
¿Sacó el abuelo una rosa del bolsillo?
¿Llevó el camionero el camión a la gasolinera?
¿Se colocó la motorista delante de la furgoneta?
¿Dejó Lucía en la pared la chincheta tras conseguir quitarla?

7.7 List 2: Experimental sentences and comprehension questions.

La florista acercó con cuidado la rosa para poder olerla con mucho cariño.
El complacido empresario llamó urgentemente al albañil para intentar contratarlo lo antes posible.
La conductora frenó con fuerza la moto hasta conseguir detenerla en el arcén.
La niña acercó al fuego la mecha hasta conseguir prenderla con mucho cuidado.

El arqueólogo limpió de tierra el jarrón tras conseguir desenterrarlo durante la excavación.
La chica cantó muchas veces la canción hasta conseguir memorizarla sin darse cuenta.
El comprador regateó con vehemencia el precio hasta conseguir rebajarlo un poco más.
El árbitro apercibió varias veces al jugador antes de amonestarlo por su actuación.
Mi amiga Ana criticó positivamente la novela después de comprarla en la librería.
El actor agitó muy bruscamente el mechero para intentar llenarlo sin más demora.
La niña cogió con cuidado la patata antes de pintarla en su cuarto.
Luis acercó a un clavo el globo para poder perforarlo sin ser visto.
El estudiante puso a remojo el pantalón para poder plancharlo antes de anochecer.
El ilusionado grafitero fotografió cuidadosamente el dibujo después de enmarcarlo con mucho empeño.
El técnico borró sin problemas el virus después de crearlo en el ordenador.
La motorista se colocó tras la furgoneta para intentar adelantarlo aprovechando el rebufo.
La estudiante vació ayer completamente la papelera después de llenarlo con mi ayuda.
La inquilina visitó muchas veces la casa antes de alquilarlo para el verano.
La atiborrada niña cogió sigilosamente la tarta para poder comerlo durante la fiesta.
El conductor metió al parking el coche para poder aparcarla sin más demora.
El famoso pintor finalmente entregó el cuadro después de acabarla durante la exhibición.
El policía detuvo esta mañana al acusado para poder interrogarla en la comisaría.
La vigilante apagó por fin la radio después de buscarlo durante un rato.
La alumna estudió varias veces esta asignatura hasta conseguir dominarlo sin ningún problema.
La encargada limpió a fondo la piscina antes de venderlo durante el verano.
La enfermera limpió con cuidado la herida antes de quemarlo con mucha precaución.
El informático instaló sin problemas el programa después de romperla antes de marcharse.
El dueño siempre limpia bien al perro después de lavarla por la mañana.
El joven informático ha desmontado el ordenador para intentar actualizarla esta misma tarde.
El hombre cocinó el domingo un atún para poder almorzarla con su cuadrilla.
¿Alejó la florista la rosa?
¿Escribió el empresario al albañil?
¿Frenó con fuerza la conductora la moto?
¿Consiguió prender la niña la mecha?
¿Limpió el arqueólogo un jarrón?
¿Criticó mi amiga Ana la novela negativamente?
¿Agitó el actor el mechero para intentar vaciarlo?

¿Cogió la niña la patata antes de pintarla?

¿Acercó Luis el globo a un clavo para poder pincharlo?

¿Puso el estudiante el pantalón a remojo?

La doctora abrió con cuidado la herida para poder examinarla con más atención.

El conductor frenó muy bruscamente el tren para intentar pararlo en el andén.

La estudiante planeó muy detenidamente la frase antes de pronunciarla ante sus compañeros.

La hacker introdujo con exactitud la contraseña tras conseguir descifrarla en un instante.

El carpintero sujetó con cuidado el clavo para intentar clavarlo sin dejar marcas.

María partió por la mitad la naranja antes de exprimirla con gran habilidad.

El jeque despilfarró muy alegremente mucho dinero hasta conseguir gastarlo en poco tiempo.

La viajera se sentó sobre la maleta tras conseguir encontrarla en la estación.

La duquesa descubrió robando a la criada antes de golpearla sin ningún remordimiento.

Aitor tuvo que planchar bien el pantalón después de mancharlo en su casa.

Ana recogió con la bayeta la leche después de escupirla sobre la mesa.

El arrepentido ladrón decidió devolver el cuadro tras conseguir venderlo sin grandes dificultades.

El pastor persiguió con determinación al lobo para intentar domarlo en su redil.

La carpintera fijó con precaución la estantería después de romperla en la carpintería.

El veterinario calmó muy pacientemente al perro para intentar operarlo en su consulta.

La chica fue a buscar una enciclopedia para poder consultarlo con mucha atención.

La ladrona manipuló muy sigilosamente la cerradura para intentar abrirlo sin ser descubierta.

Lucía dejó en la pared la chincheta tras conseguir clavarlo con el martillo.

El editor ha decidido rechazar el artículo tras conseguir leerla en una hora.

El fiscal provocó con reiteración al acusado hasta conseguir alterarla delante del juez.

El camionero llevó al autolavado el camión para poder lavarla antes del viaje.

El editor abrió con entusiasmo el libro para poder leerla sin más demora.

La camarera limpió con cuidado la botella después de beberlo con mucha rapidez.

La niña arrancó sin avisar la furgoneta para intentar robarlo sin ser vista.

La escaladora comenzó a descender la montaña tras conseguir recorrerlo con mucho esfuerzo.

La refugiada pudo dejar atrás la frontera tras conseguir saltarlo tras varios intentos.

El alumno ha preparado bien el examen para intentar copiarla sin ningún problema.

El policía identificó muy rápidamente al asesino antes de fusilarla en el callejón.

El lector devolvió a tiempo el periódico después de cerrarla sin poner atención.

El terrorista apuñaló sin piedad al rehén después de interrogarla en el desierto.

¿Abrió la doctora la herida para poder limpiarla?

¿Aceleró el conductor bruscamente el tren?

¿Planeó muy detenidamente la estudiante la frase?

¿Introdujo con exactitud la hacker la contraseña?

¿Intentó el carpintero clavar el clavo?

¿Se puso la viajera de pie sobre la maleta?

¿Descubrió a la criada robando antes de premiarla?

¿Tuvo que planchar Aitor una camisa?

¿Recogió Ana la leche después de escupirla?

¿Decidió el arrepentido ladrón devolver el cuadro?

¿Persiguió el pastor al lobo para intentar domarlo?

La enfermera cosió con esmero la herida hasta conseguir cerrarla por ambos lados.

El mono comió con rapidez el plátano tras conseguir pelarlo con sus manos.

El escritor presentó muy ilusionado su libro tras conseguir publicarlo antes de navidad.

La modista tiene que remendar la falda para intentar arreglarla antes del domingo.

El ladrón fue a inspeccionar el banco para intentar atracarlo al día siguiente.

La excursionista raspó con fuerza la cerilla para intentar encenderla sin ningún problema.

La sedienta clienta pidió rápidamente otra cerveza para poder beberla en la barra.

María metió en la fiambarrera la paella para poder comerla en la oficina.

La exploradora ha depurado cuidadosamente esta agua antes de venderla en el oasis.

El pintor francés enmarcó orgullosamente el cuadro después de comprarlo en el pueblo.

La leñadora sacudió con fuerza la rama hasta conseguir deshojarla antes de almorzar.

Mi padre buscó con insistencia mi diario hasta conseguir robarlo el otro día.

La atleta besó con emoción la medalla tras conseguir robarla durante la olimpiada.

La chica al final compró la trompeta para intentar escucharla en su casa.

El preocupado dueño sujetó fuertemente al perro para intentar dormirlo durante el concurso.

La coleccionista tuvo que vender la colección tras conseguir completarlo en varios plazos.

La madre vio bostezando a la niña antes de acostarlo con mucho cariño.

La emigrante cerró muy cuidadosamente la carta antes de enviarlo con mucha emoción.

La montañera lavó muy cuidadosamente la cantimplora después de utilizarlo en la fuente.

El ayuntamiento finalmente inaugurará mañana el edificio tras conseguir restaurarla dentro del plazo.

El policía custodió muy celosamente al confidente para poder protegerla durante varios días.

El hastiado empresario gritó enfurecido al trabajador antes de despedirla sin ninguna oposición.

El sumiller se acercó delicadamente el vino para intentar olerla con mucha precisión.

La camarera nos ofreció amablemente la jarra después de lavarlo en la cocina.

La pianista tuvo que ensayar la sonata para poder ejecutarlo a la perfección.

La señora frotó con fuerza la mancha hasta conseguir extenderlo con gran esfuerzo.

La adolescente manipuló varias veces la hucha hasta conseguir llenarlo sin hacer ruido.

El ferretero amartilló con insistencia el clavo hasta conseguir doblarla en el tablón.

El mono golpeó con insistencia el coco hasta conseguir comerla bajo el árbol.

Esta mañana el cirujano anestesió al paciente antes de despedirla ante su familia.

¿Tapó con fuerza la enfermera la herida?

¿Comió el mono el plátano tras conseguir cocinarlo?

¿Presentó el escritor su libro tras conseguir plagiarlo?

¿Tiene que remendar la modista la falda?

¿Inspeccionó el ladrón el banco para intentar atracarlo?

¿Metió María la paella en una cazuela?

¿Ha depurado la exploradora esta agua antes de embotellarla?

¿Enmarcó el pintor francés una fotografía?

¿Sacudió con fuerza la rama la leñadora?

¿Buscó mi padre mi diario con insistencia?

La acalorada cocinera empujó fuertemente la ventana para intentar abrirla de una vez.

Mikel puso en la fotocopidora el dibujo antes de fotocopiarlo en la oficina.

El gobierno ya dispone de un presupuesto tras conseguir aprobarlo con gran dificultad.

La marquesa guardó muy celosamente la pulsera tras conseguir encontrarla durante la gala.

El periodista revisó con atención el artículo antes de publicarlo en la revista.

La manifestante mojó con gasolina la bandera para intentar quemarla sin ser vista.

El ayuntamiento pondrá en marcha el proyecto tras conseguir aprobarlo por mayoría simple.

El socorrista logró finalmente reanimar al ahogado tras conseguir rescatarlo con el médico.

La mecánico empujó con fuerza la moto hasta conseguir destrozarla con el impulso.

El fontanero tuvo que desmontar el fregadero para intentar limpiarlo con mucho esfuerzo.

La especuladora visitó varias veces la casa hasta conseguir venderla en sus términos.

El ladrón escondió muy bien el botín tras conseguir donarlo el día anterior.

La conserje sujetó boca abajo la botella hasta conseguir romperla en el fregadero.

Ella tiró repetidamente al suelo la botella hasta conseguir descorcharla con gran habilidad.

El taxista cerró muy bien su coche después de arrancarlo en el parking.

La joven utiliza siempre la misma contraseña para poder recordarlo sin ningún problema.

La traviesa niña reparó minuciosamente la escultura después de romperlo en la tienda.

La ingeniera bajó varias veces esta aplicación hasta conseguir instalarlo en mi móvil.

Ella metió en la secadora la ropa para poder secarlo con más rapidez.

El abuelo sacó del bolsillo el puro antes de encenderla dentro del restaurante.

El charcutero sujetó con fuerza el jamón para intentar deshuesarla esa misma mañana.

El juez confirmó la coartada del sospechoso antes de absolverla en su sentencia.

El vendedor finalmente se deshizo del coche tras conseguir venderla en el desguace.

La cinéfila buscó con ahínco esta película hasta conseguir analizarlo en la filmoteca.

La piloto finalmente pudo arrancar la moto tras conseguir encontrarlo en el taller.

RTVE grabó hace una semana la gala para poder visionarlo el próximo domingo.

El consejero repasó dos veces el comunicado antes de borrarla sin ningún problema.

El peluquero secó muy bien el cabello antes de mojarla con la espuma.

El pirata buscó con esmero el tesoro hasta conseguir robarla el mes pasado.

Fermín apuntó en el brazo el número para intentar reconocerla sin gran dificultad.

¿Empujó la cocinera la ventana para intentar cerrarla?

¿Sacó Mikel el dibujo de la fotocopiadora?

¿Dispone el gobierno de un presupuesto tras conseguir financiarlo?

¿Consiguió encontrar la marquesa la pulsera?

¿Revisó el periodista el artículo antes de publicarlo?

¿Empujó la mecánico la moto hasta conseguir detenerla?

¿Intentó el fontanero cambiar el fregadero?

¿Escondió el ladrón el botín?

7.8 List 3: Experimental sentences and comprehension questions.

La vigilante apagó por fin la radio después de escucharla durante un rato.

El policía identificó muy rápidamente al asesino antes de atraparlo en el callejón.

La niña arrancó sin avisar la furgoneta para intentar conducirla sin ser vista.

La señora frotó con fuerza la mancha hasta conseguir quitarla con gran esfuerzo.

El alumno ha preparado bien el examen para intentar aprobarlo sin ningún problema.

La enfermera limpió con cuidado la herida antes de coserla con mucha precaución.

El terrorista apuñaló sin piedad al rehén después de secuestrarlo en el desierto.

El hombre cocinó el domingo un atún para poder comerlo con su cuadrilla.

La enfermera cosió con esmero la herida hasta conseguir abrirla por ambos lados.

El gobierno ya dispone de un presupuesto tras conseguir recaudarlo con gran dificultad.
La marquesa guardó muy celosamente la pulsera tras conseguir robarla durante la gala.
La modista tiene que remendar la falda para intentar venderla antes del domingo.
El ladrón fue a inspeccionar el banco para intentar quemarlo al día siguiente.
El ayuntamiento pondrá en marcha el proyecto tras conseguir paralizarlo por mayoría simple.
El socorrista logró finalmente reanimar al ahogado tras conseguir curarlo con el médico.
María metió en la fiamblera la paella para poder guardarlo en la oficina.
La duquesa descubrió robando a la criada antes de despedirlo sin ningún remordimiento.
La carpintera fijó con precaución la estantería después de montarlo en la carpintería.
Ella tiró repetidamente al suelo la botella hasta conseguir romperlo con gran habilidad.
El ladrón escondió muy bien el botín tras conseguir robarla el día anterior.
El arrepentido ladrón decidió devolver el cuadro tras conseguir robarla sin grandes dificultades.
El taxista cerró muy bien su coche después de aparcarla en el parking.
La joven utiliza siempre la misma contraseña para poder recuperarlo sin ningún problema.
La coleccionista tuvo que vender la colección tras conseguir comprarlo en varios plazos.
La madre vio bostezando a la niña antes de acariciarlo con mucho cariño.
Ella metió en la secadora la ropa para poder lavarlo con más rapidez.
El abuelo sacó del bolsillo el puro antes de romperla dentro del restaurante.
El ayuntamiento finalmente inaugurará mañana el edificio tras conseguir comprarla dentro del plazo.
El policía custodió muy celosamente al confidente para poder torturarla durante varios días.
El vendedor finalmente se deshizo del coche tras conseguir quemarla en el desguace.
¿Encendió la vigilante la radio?
¿Fotografió el policía al asesino antes de atraparlo?
¿Arrancó la niña la furgoneta para intentar conducirla?
¿Frotó la señora la mancha hasta conseguir quitarla?
¿Ha preparado bien el alumno el examen?
¿Tapó con fuerza la enfermera la herida?
¿Dispone el gobierno de un presupuesto tras conseguir financiarlo?
¿Consiguió robar la marquesa la pulsera?
¿Tiene que remendar la modista la falda?
¿Inspeccionó el ladrón el banco para intentar quemarlo?
La camarera limpió con cuidado la botella después de vaciarla con mucha rapidez.

La camarera nos ofreció amablemente la jarra después de llenarla en la cocina.
La pianista tuvo que ensayar la sonata para poder interpretarla a la perfección.
El consejero repasó dos veces el comunicado antes de enviarlo sin ningún problema.
El dueño siempre limpia bien al perro después de pasearlo por la mañana.
La encargada limpió a fondo la piscina antes de llenarla durante el verano.
Esta mañana el cirujano anestesió al paciente antes de operarlo ante su familia.
La florista acercó con cuidado la rosa para poder tratarla con mucho cariño.
La acalorada cocinera empujó fuertemente la ventana para intentar romperla de una vez.
Mikel puso en la fotocopidora el dibujo antes de regalarlo en la oficina.
La niña acercó al fuego la mecha hasta conseguir secarla con mucho cuidado.
El arqueólogo limpió de tierra el jarrón tras conseguir romperlo durante la excavación.
El periodista revisó con atención el artículo antes de imprimirlo en la revista.
La manifestante mojó con gasolina la bandera para intentar ondearla sin ser vista.
El árbitro apercibió varias veces al jugador antes de felicitarlo por su actuación.
Mi amiga Ana criticó positivamente la novela después de leerlo en la librería.
La especuladora visitó varias veces la casa hasta conseguir rebajarlo en sus términos.
La conserje sujetó boca abajo la botella hasta conseguir vaciarlo en el fregadero.
Aitor tuvo que planchar bien el pantalón después de lavarla en su casa.
El fontanero tuvo que desmontar el fregadero para intentar desatascarla con mucho esfuerzo.
Mi padre buscó con insistencia mi diario hasta conseguir encontrarla el otro día.
El actor agitó muy bruscamente el mechero para intentar encenderla sin más demora.
La motorista se colocó tras la furgoneta para intentar embestirlo aprovechando el rebufo.
La estudiante vació ayer completamente la papelera después de levantarlo con mi ayuda.
La traviesa niña reparó minuciosamente la escultura después de comprarlo en la tienda.
La ingeniera bajó varias veces esta aplicación hasta conseguir utilizarlo en mi móvil.
El conductor metió al parking el coche para poder venderla sin más demora.
El famoso pintor finalmente entregó el cuadro después de robarla durante la exhibición.
El charcutero sujetó con fuerza el jamón para intentar venderla esa misma mañana.
El juez confirmó la coartada del sospechoso antes de condenarla en su sentencia.
¿Limpió la camarera la botella después de pintarla?
¿Nos vendió la camarera la jarra?
¿Tuvo que ensayar la pianista la sonata?
¿Repasó el consejero el comunicado?

¿Limpia siempre el dueño al perro después de lavarlo?

¿Alejó la florista la rosa?

¿Empujó la cocinera la ventana para intentar cerrarla?

¿Sacó Mikel el dibujo de la fotocopidora?

¿Consiguió secar la niña la mecha?

¿Limpió el arqueólogo un jarrón?

¿Revisó el periodista el artículo antes de imprimirlo?

La cinéfila buscó con ahínco esta película hasta conseguir encontrarla en la filmoteca.

La escaladora comenzó a descender la montaña tras conseguir escalarla con mucho esfuerzo.

El ferretero amartilló con insistencia el clavo hasta conseguir clavarlo en el tablón.

El informático instaló sin problemas el programa después de descargarlo antes de marcharse.

El joven informático ha desmontado el ordenador para intentar repararlo esta misma tarde.

La piloto finalmente pudo arrancar la moto tras conseguir arreglarla en el taller.

La adolescente manipuló varias veces la hucha hasta conseguir abrirla sin hacer ruido.

La doctora abrió con cuidado la herida para poder coserla con más atención.

El conductor frenó muy bruscamente el tren para intentar aparcarlo en el andén.

El complacido empresario llamó urgentemente al albañil para intentar despedirlo lo antes posible.

La conductora frenó con fuerza la moto hasta conseguir apagarla en el arcén.

El carpintero sujetó con cuidado el clavo para intentar sacarlo sin dejar marcas.

María partió por la mitad la naranja antes de pelarla con gran habilidad.

La chica cantó muchas veces la canción hasta conseguir olvidarla sin darse cuenta.

El comprador regateó con vehemencia el precio hasta conseguir subirlo un poco más.

La leñadora sacudió con fuerza la rama hasta conseguir partirlo antes de almorzar.

La niña cogió con cuidado la patata antes de comerlo en su cuarto.

La exploradora ha depurado cuidadosamente esta agua antes de beberlo en el oasis.

Ana recogió con la bayeta la leche después de derramarlo sobre la mesa.

Luis acercó a un clavo el globo para poder pincharla sin ser visto.

El estudiante puso a remojo el pantalón para poder lavarla antes de anochecer.

El pastor persiguió con determinación al lobo para intentar cazarla en su redil.

El técnico borró sin problemas el virus después de localizarla en el ordenador.

La ladrona manipuló muy sigilosamente la cerradura para intentar cerrarlo sin ser descubierta.

Lucía dejó en la pared la chincheta tras conseguir quitarlo con el martillo.

La inquilina visitó muchas veces la casa antes de limpiarlo para el verano.

La atiborrada niña cogió sigilosamente la tarta para poder tirarlo durante la fiesta.

El camionero llevó al autolavado el camión para poder venderla antes del viaje.

El editor abrió con entusiasmo el libro para poder editarla sin más demora.

El policía detuvo esta mañana al acusado para poder liberarla en la comisaría.

¿Buscó la cinéfila la película hasta conseguir borrarla?

¿Comenzó la escaladora a fotografiar la montaña?

¿Pulió el ferretero el clavo con insistencia?

¿Instaló sin problemas el informático el programa?

¿Ha desmontado el informático el ordenador?

¿Abrió la doctora la herida para poder limpiarla?

¿Aceleró bruscamente el tren el conductor?

¿Escribió el empresario al albañil?

¿Frenó con fuerza la conductora la moto?

¿Intentó el carpintero sacar el clavo?

La alumna estudió varias veces esta asignatura hasta conseguir aprobarla sin ningún problema.

El peluquero secó muy bien el cabello antes de peinarlo con la espuma.

El lector devolvió a tiempo el periódico después de leerlo sin poner atención.

La refugiada pudo dejar atrás la frontera tras conseguir cruzarla tras varios intentos.

El mono golpeó con insistencia el coco hasta conseguir partirlo bajo el árbol.

RTVE grabó hace una semana la gala para poder retransmitirla el próximo domingo.

El pirata buscó con esmero el tesoro hasta conseguir encontrarlo el mes pasado.

Fermín apuntó en el brazo el número para intentar recordarlo sin gran dificultad.

El mono comió con rapidez el plátano tras conseguir aplastarlo con sus manos.

El escritor presentó muy ilusionado su libro tras conseguir venderlo antes de navidad.

La estudiante planeó muy detenidamente la frase antes de expresarla ante sus compañeros.

La hacker introdujo con exactitud la contraseña tras conseguir robarla en un instante.

La excursionista raspó con fuerza la cerilla para intentar limarla sin ningún problema.

La sedienta cliente pidió rápidamente otra cerveza para poder derramarla en la barra.

El jeque despilfarró muy alegremente mucho dinero hasta conseguir multiplicarlo en poco tiempo.

La viajera se sentó sobre la maleta tras conseguir cerrarlo en la estación.

La atleta besó con emoción la medalla tras conseguir ganarlo durante la olimpiada.

La mecánico empujó con fuerza la moto hasta conseguir arrancarlo con el impulso.

La chica al final compró la trompeta para intentar tocarlo en su casa.

El pintor francés enmarcó orgullosamente el cuadro después de pintarla en el pueblo.

El ilusionado grafitero fotografió cuidadosamente el dibujo después de terminarla con mucho empeño.

El preocupado dueño sujetó fuertemente al perro para intentar frenarla durante el concurso.

El veterinario calmó muy pacientemente al perro para intentar examinarla en su consulta.

La chica fue a buscar una enciclopedia para poder leerlo con mucha atención.

La emigrante cerró muy cuidadosamente la carta antes de abrirlo con mucha emoción.

La montañera lavó muy cuidadosamente la cantimplora después de llenarlo en la fuente.

El editor ha decidido rechazar el artículo tras conseguir plagiarla en una hora.

El fiscal provocó con reiteración al acusado hasta conseguir humillarla delante del juez.

El hastiado empresario gritó enfurecido al trabajador antes de promocionarla sin ninguna oposición.

El sumiller se acercó delicadamente el vino para intentar reconocerla con mucha precisión.

¿Estudió la alumna varias veces la asignatura hasta conseguir suspenderla?

¿Secó el peluquero el cabello antes de teñirlo?

¿Devolvió el lector el periódico después de robarlo?

¿Dejó atrás la refugiada la frontera tras conseguir saltarla?

¿Golpeó el mono el coco hasta conseguir partirlo?

¿Comió el mono el plátano tras conseguir cocinarlo?

¿Presentó el escritor su libro tras conseguir plagiarlo?

¿Planeó muy detenidamente la estudiante la frase?

¿Introdujo con exactitud la hacker la contraseña?

7.9 List 4: Experimental sentences and comprehension questions.

La chica fue a buscar una enciclopedia para poder consultarla con mucha atención.

La traviesa niña reparó minuciosamente la escultura después de romperla en la tienda.

La montañera lavó muy cuidadosamente la cantimplora después de utilizarla en la fuente.

Ella metió en la secadora la ropa para poder secarla con más rapidez.

El editor ha decidido rechazar el artículo tras conseguir leerlo en una hora.

El abuelo sacó del bolsillo el puro antes de encenderlo dentro del restaurante.

El conductor metió al parking el coche para poder aparcarlo sin más demora.

El fiscal provocó con reiteración al acusado hasta conseguir alterarlo delante del juez.

El camionero llevó al autolavado el camión para poder lavarlo antes del viaje.

El editor abrió con entusiasmo el libro para poder leerlo sin más demora.

La joven utiliza siempre la misma contraseña para poder recordarla sin ningún problema.
La motorista se colocó tras la furgoneta para intentar adelantarla aprovechando el rebufo.
La coleccionista tuvo que vender la colección tras conseguir completarla en varios plazos.
La ladrona manipuló muy sigilosamente la cerradura para intentar abrirla sin ser descubierta.
Lucía dejó en la pared la chincheta tras conseguir clavarla con el martillo.
La ingeniera bajó varias veces esta aplicación hasta conseguir instalarla en mi móvil.
El ayuntamiento finalmente inaugurará mañana el edificio tras conseguir restaurarlo dentro del plazo.
El famoso pintor finalmente entregó el cuadro después de acabarlo durante la exhibición.
El hastiado empresario gritó enfurecido al trabajador antes de despedirlo sin ninguna oposición.
El sumiller se acercó delicadamente el vino para intentar olerlo con mucha precisión.
La estudiante vació ayer completamente la papelera después de llenarla con mi ayuda.
La madre vio bostezando a la niña antes de acostarla con mucho cariño.
La emigrante cerró muy cuidadosamente la carta antes de enviarla con mucha emoción.
La inquilina visitó muchas veces la casa antes de alquilarla para el verano.
La atiborrada niña cogió sigilosamente la tarta para poder comerla durante la fiesta.
El policía custodió muy celosamente al confidente para poder protegerlo durante varios días.
El charcutero sujetó con fuerza el jamón para intentar deshuesarlo esa misma mañana.
El juez confirmó la coartada del sospechoso antes de absolverlo en su sentencia.
El policía detuvo esta mañana al acusado para poder interrogarlo en la comisaría.
El vendedor finalmente se deshizo del coche tras conseguir venderlo en el desguace.
La vigilante apagó por fin la radio después de buscarla durante un rato.
La camarera limpió con cuidado la botella después de beberla con mucha rapidez.
La cinéfila buscó con ahínco esta película hasta conseguir analizarla en la filmoteca.
La alumna estudió varias veces esta asignatura hasta conseguir dominarla sin ningún problema.
La camarera nos ofreció amablemente la jarra después de lavarla en la cocina.
La escaladora comenzó a descender la montaña tras conseguir recorrerla con mucho esfuerzo.
El peluquero secó muy bien el cabello antes de mojarlo con la espuma.
El policía identificó muy rápidamente al asesino antes de fusilarlo en el callejón.
El ferretero amartilló con insistencia el clavo hasta conseguir doblarlo en el tablón.
El lector devolvió a tiempo el periódico después de cerrarlo sin poner atención.
La niña arrancó sin avisar la furgoneta para intentar robarla sin ser vista.
La pianista tuvo que ensayar la sonata para poder ejecutarla a la perfección.
La refugiada pudo dejar atrás la frontera tras conseguir saltarla tras varios intentos.

La señora frotó con fuerza la mancha hasta conseguir extenderla con gran esfuerzo.
El consejero repasó dos veces el comunicado antes de borrarlo sin ningún problema.
El informático instaló sin problemas el programa después de romperlo antes de marcharse.
El alumno ha preparado bien el examen para intentar copiarlo sin ningún problema.
El dueño siempre limpia bien al perro después de lavarlo por la mañana.
El joven informático ha desmontado el ordenador para intentar actualizarlo esta misma tarde.
El mono golpeó con insistencia el coco hasta conseguir comerlo bajo el árbol.
La encargada limpió a fondo la piscina antes de venderla durante el verano.
La piloto finalmente pudo arrancar la moto tras conseguir encontrarla en el taller.
RTVE grabó hace una semana la gala para poder visionarla el próximo domingo.
La enfermera limpió con cuidado la herida antes de quemarla con mucha precaución.
La adolescente manipuló varias veces la hucha hasta conseguir llenarla sin hacer ruido.
El pirata buscó con esmero el tesoro hasta conseguir robarlo el mes pasado.
El terrorista apuñaló sin piedad al rehén después de interrogarlo en el desierto.
Esta mañana el cirujano anestesió al paciente antes de despedirlo ante su familia.
Fermín apuntó en el brazo el número para intentar reconocerlo sin gran dificultad.
El hombre cocinó el domingo un atún para poder almorzarlo con su cuadrilla.
La florista acercó con cuidado la rosa para poder olerlo con mucho cariño.
La conductora frenó con fuerza la moto hasta conseguir detenerlo en el arcén.
La estudiante planeó muy detenidamente la frase antes de pronunciarlo ante sus compañeros.
La doctora abrió con cuidado la herida para poder examinarlo con más atención.
La marquesa guardó muy celosamente la pulsera tras conseguir encontrarlo durante la gala.
La niña acercó al fuego la mecha hasta conseguir prenderlo con mucho cuidado.
La hacker introdujo con exactitud la contraseña tras conseguir descifrarlo en un instante.
La modista tiene que remendar la falda para intentar arreglarlo antes del domingo.
María partió por la mitad la naranja antes de exprimirlo con gran habilidad.
La excursionista raspó con fuerza la cerilla para intentar encenderlo sin ningún problema.
La manifestante mojó con gasolina la bandera para intentar quemarlo sin ser vista.
La enfermera cosió con esmero la herida hasta conseguir cerrarlo por ambos lados.
La chica cantó muchas veces la canción hasta conseguir memorizarlo sin darse cuenta.
La sedienta cliente pidió rápidamente otra cerveza para poder beberlo en la barra.
La acalorada cocinera empujó fuertemente la ventana para intentar abrirlo de una vez.
El conductor frenó muy bruscamente el tren para intentar pararla en el andén.

El arqueólogo limpió de tierra el jarrón tras conseguir desenterrarla durante la excavación.
El mono comió con rapidez el plátano tras conseguir pelarla con sus manos.
El carpintero sujetó con cuidado el clavo para intentar clavarla sin dejar marcas.
El ayuntamiento pondrá en marcha el proyecto tras conseguir aprobarla por mayoría simple.
Mikel puso en la fotocopidora el dibujo antes de fotocopiarla en la oficina.
El complacido empresario llamó urgentemente al albañil para intentar contratarla lo antes posible.
El comprador regateó con vehemencia el precio hasta conseguir rebajarla un poco más.
El escritor presentó muy ilusionado su libro tras conseguir publicarla antes de navidad.
El gobierno ya dispone de un presupuesto tras conseguir aprobarla con gran dificultad.
El jeque despilfarró muy alegremente mucho dinero hasta conseguir gastarla en poco tiempo.
El ladrón fue a inspeccionar el banco para intentar atracarla al día siguiente.
El periodista revisó con atención el artículo antes de publicarla en la revista.
El socorrista logró finalmente reanimar al ahogado tras conseguir rescatarla con el médico.
El árbitro apercibió varias veces al jugador antes de amonestarla por su actuación.
La viajera se sentó sobre la maleta tras conseguir encontrarlo en la estación.
María metió en la fiamblera la paella para poder comerlo en la oficina.
Mi amiga Ana criticó positivamente la novela después de comprarlo en la librería.
La leñadora sacudió con fuerza la rama hasta conseguir deshojarlo antes de almorzar.
La duquesa descubrió robando a la criada antes de golpearlo sin ningún remordimiento.
La especuladora visitó varias veces la casa hasta conseguir venderlo en sus términos.
La niña cogió con cuidado la patata antes de pintarlo en su cuarto.
La atleta besó con emoción la medalla tras conseguir robarlo durante la olimpiada.
La conserje sujetó boca abajo la botella hasta conseguir romperlo en el fregadero.
La exploradora ha depurado cuidadosamente esta agua antes de venderlo en el oasis.
La mecánico empujó con fuerza la moto hasta conseguir destrozarlo con el impulso.
La carpintera fijó con precaución la estantería después de romperlo en la carpintería.
Ana recogió con la bayeta la leche después de escupirlo sobre la mesa.
La chica al final compró la trompeta para intentar escucharlo en su casa.
Ella tiró repetidamente al suelo la botella hasta conseguir descorcharlo con gran habilidad.
Aitor tuvo que planchar bien el pantalón después de mancharla en su casa.
El pintor francés enmarcó orgullosamente el cuadro después de comprarla en el pueblo.
El ladrón escondió muy bien el botín tras conseguir donarla el día anterior.
El fontanero tuvo que desmontar el fregadero para intentar limpiarla con mucho esfuerzo.

Luis acercó a un clavo el globo para poder perforarla sin ser visto.

El arrepentido ladrón decidió devolver el cuadro tras conseguir venderla sin grandes dificultades.

Mi padre buscó con insistencia mi diario hasta conseguir robarla el otro día.

El estudiante puso a remojo el pantalón para poder plancharla antes de anochecer.

El ilusionado grafitero fotografió cuidadosamente el dibujo después de enmarcarla con mucho empeño.

El actor agitó muy bruscamente el mechero para intentar llenarla sin más demora.

El pastor persiguió con determinación al lobo para intentar domarla en su redil.

El preocupado dueño sujetó fuertemente al perro para intentar dormirla durante el concurso.

El taxista cerró muy bien su coche después de arrancarla en el parking.

El técnico borró sin problemas el virus después de crearla en el ordenador.

El veterinario calmó muy pacientemente al perro para intentar operarla en su consulta.

¿Fue la chica a comprar una enciclopedia?

¿Reparó la niña la escultura después de robarla?

¿Manchó la montañera la cantimplora?

¿Metió ella la ropa en la secadora para poder teñirla?

¿Ha decidido el editor aceptar el artículo?

¿Sacó el abuelo una rosa del bolsillo?

¿Metió el conductor el coche al parking para poder esconderlo?

¿Consiguió el fiscal tranquilizar al acusado?

¿Llevó el camionero el camión a la gasolinera?

¿Abrió el editor el libro para poder fotocopiarlo?

¿Utiliza la joven siempre la misma contraseña?

¿Se colocó la motorista delante de la furgoneta?

¿Tuvo que vender la coleccionista la colección?

¿Manipuló la ladrona la cerradura?

¿Dejó Lucía en la pared la chincheta tras conseguir clavarla?

¿Bajó la ingeniera esta aplicación hasta conseguir instalarla?

¿Inaugurará el ayuntamiento el edificio tras conseguir restaurarlo?

¿Entregó el famoso pintor el cuadro después de acabarlo?

¿Gritó el empresario al trabajador?

¿Se acercó el sumiller el vino para intentar olerlo?

¿Encendió la vigilante la radio?

¿Limpió la camarera la botella después de pintarla?

- ¿Buscó la cinéfila la película hasta conseguir borrarla?
- ¿Estudió la alumna varias veces la asignatura hasta conseguir suspenderla?
- ¿Nos vendió la camarera la jarra?
- ¿Comenzó la escaladora a fotografiar la montaña?
- ¿Secó el peluquero el cabello antes de teñirlo?
- ¿Fotografió el policía al asesino antes de atraparlo?
- ¿Pulió el ferretero el clavo con insistencia?
- ¿Devolvió el lector el periódico después de robarlo?
- ¿Arrancó la niña la furgoneta para intentar robarla?
- ¿Tuvo que ensayar la pianista la sonata?
- ¿Dejó atrás la refugiada la frontera tras conseguir saltarla?
- ¿Frotó la señora la mancha hasta conseguir extenderla?
- ¿Repasó el consejero el comunicado?
- ¿Instaló sin problemas el informático el programa?
- ¿Ha preparado bien el alumno el examen?
- ¿Limpia siempre el dueño al perro después de lavarlo?
- ¿Ha desmontado el informático el ordenador?
- ¿Golpeó el mono el coco hasta conseguir comerlo?