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Putting pronoun resolution in context: The role of syntax, semantics, and pragmatics in pronoun interpretation

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Abstract

The present dissertation is concerned with the mechanisms that are at stake during pronoun resolution in ambiguous contexts where a given pronoun can be resolved in favor of two potential antecedents. Taking as a starting point the premise that the typical psycholinguistic approach to pronoun resolution that puts forward the factors that play a role in this process is not enough, we propose an in-depth analysis of the discourse structure of the context where the pronominal dependency is established with the goal of explaining why the role of these factors varies as a function of the contextual circumstances.

In line with previous proposals (e.g. Miltsakaki, 2002), we argue that the discourse unit (DU) is the optimal framework for the study of pronoun resolution. Based on Johnston (1994), we propose a "relational" definition of DU, according to which the DU configuration of a given sentence depends on (i) the syntactic, semantic, and pragmatic content of the subordinate clause itself and (ii) the relation established between matrix and subordinate clause. We will put the emphasis on two types of adverbial adjuncts: non-relational adjuncts (e.g. temporals), and relational adjuncts (e.g. causals). We argue that, while the former are processed as part of the same DU as the matrix clause, the latter are processed as separate DUs from the matrix clause.

We subsequently claim that the DU configuration of the sentence has an effect on pronoun interpretation and that factors affecting resolution have a different weight according to whether they occur within a DU or across two DUs. We specifically propose that pronoun resolution is firmly rooted in the maxim of discourse coherence and that interpretation preferences come about in the process of *maintaining* coherence (intra-unit), which can be achieved through a general preference for topic or topic-like information, or in the process of *establishing* coherence (inter-unit), which is done through the semantics/pragmatics of certain elements in the proposition.

We test all these claims empirically through a series of experiments that investigate the role of factors traditionally claimed to affect pronoun interpretation –such as the syntactic function of the antecedent, its information status, and the coherence relations that hold between propositions –in the context of 1 or 2 DUs. These experiments are conducted in English, French, and Spanish.

The results of our experiments show that, in the context of a single DU, there is a general preference for clearly established topics (via left-dislocation) but a dispreference for focused antecedents (via it-clefting or the focus-sensitive particles *even* and *only*). This *anti-focus effect,* which contradicts previous findings on the role of focus in inter-sentential pronoun resolution, is claimed to respond to a general preference for entities that are part of the given, old, presupposed part of the cleft construction. In the context of 2 DUs, the same focus particles give way to a more complex pattern of resolution preferences similar to what

has been previously observed with implicit causality (IC) verbs. Following Bott and Solstad (2014), we argue that focus particles, like IC verbs, when combined with discourse connectives like *because,* create expectations for an explanation about the ensuing discourse that need to be filled to avoid the accommodation of missing information. These explanations, which reflect the relationship between the focus entity in the scope of the particle and the set of alternatives related to it, introduce a bias for one of the two potential antecedents given. While these results hold cross-linguistically in the three languages under investigation, certain language-specific patterns are also attested.

Résumé

Cette thèse a pour but d'étudier les mécanismes ayant une influence sur le processus de résolution de pronoms dans des contextes ambigus où le pronom peut renvoyer à deux antécédents potentiels différents. Ayant comme point de départ le postulat selon lequel l'approche psycholinguistique traditionnelle, qui consiste à énumérer les facteurs jouant un rôle dans la résolution de pronoms, est insuffisante, nous proposons une analyse détaillée de la structure discursive du contexte dans lequel la dépendance pronominale a été établie. Cette analyse expliquera ultérieurement pourquoi le rôle des différents facteurs traditionnellement retenus varie en fonction du contexte.

Conformément aux propositions formulées par certains auteurs (cf. Miltsakaki, 2002), nous soutenons que l'unité discursive (UD) est le domaine optimal pour l'étude de la résolution de pronoms. Suivant l'analyse de Johnston (1994), nous proposons une définition 'relationnelle' de l'UD aux termes de laquelle la configuration des UD de la phrase dépend (i) du contenu syntactique, sémantique et pragmatique de la proposition subordonnée et (ii) de la relation entre celle-ci et la proposition principale. Dans ce contexte, nous étudierons plus spécifiquement deux types de subordonnées adjointes adverbiales : les subordonnées non-relationnelles (p.ex. temporelles), d'une part, et les subordonnées relationnelles (p.ex. causales), d'autre part. Selon nous, les premières constituent une seule UD avec la proposition principale, tandis que les secondes constituent une UD indépendante de la proposition principale.

Nous soutenons ensuite que la configuration des UD de la phrase influence l'interprétation de pronoms et que les facteurs jouant un rôle dans ce processus ont un poids différent selon qu'ils se trouvent dans une UD ou au travers de deux UD. Nous défendons plus particulièrement la thèse selon laquelle la résolution de pronoms est fortement basée sur le principe de cohérence discursive : à l'intérieur d'une UD, la résolution des pronoms est guidée par le *maintien* de la cohérence discursive (p.ex. par une préférence générale pour des entités topicales), alors que, lorsque la résolution se fait au travers de plusieurs UD, le principe qui la guide est celui de *l'établissement* de la cohérence (p.ex. suivant le contenu sémantique/pragmatique de certains éléments dans la phrase).

Afin de tester ces hypothèses, nous avons mené une série d'expériences étudiant le rôle des facteurs traditionnellement analysés dans le cadre de la résolution de pronoms – à savoir, la fonction grammaticale de l'antécédent, son statut informationnel et les relations de cohérence entre deux propositions - dans le contexte d'une ou deux UD. Cette démarche a été

suivie d'un point de vue comparatif, en anglais, français et espagnol.

Les résultats de ces expériences montrent que, dans le contexte d'une seule UD, un élément topicalisé (via une dislocation à gauche) est un meilleur antécédent, tandis qu'un élément focalisé (via une clivée ou les particules sensibles au focus *même* et *seul*) est un antécédent moins probable. Cet effet dit « *d'anti-focus* », qui contredit de précédents résultats sur le rôle du focus dans la résolution de pronoms inter-phrastique, est analysé comme étant le résultat d'une préférence générale pour des entités faisant partie du contenu donné et présupposé de la clivée. Par ailleurs, dans le contexte de deux UD, les mêmes particules sensibles au focus donnent lieu à une tendance d'interprétations similaire à celle observé avec les verbes à causalité implicite. Suivant Bott et Solstad (2014), nous soutenons que ces particules, tout comme les verbes à causalité implicite, lorsqu'elles sont combinées avec un connecteur causal tel que *parce que,* créent des attentes pour une explication sur le contenu du discours qui suit. De telles attentes reflètent la relation entre l'entité dans la portée de la particule de focus et ses alternatives et introduisent un biais pour l'un des deux antécédents potentiels donnés. Bien que ces résultats soient confirmés dans les trois langues étudiées, nous constatons également certaines tendances spécifiques à chaque langue.

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Table of contents

List of figures

List of tables

Overview of experiments

- **Experiment 1** – Chapter 3, page 110
  - Goal: Effects of Hanging Topic Left-dislocation and it-clefting on null subject pronoun resolution
  - Language: Spanish
  - Method: Sentence Interpretation Task (SIT)

- **Experiment 2** – Chapter 3, page 115
  - Goal: Effects of Hanging Topic Left-dislocation and it-clefting on object clitic pronoun resolution
  - Language: Spanish
  - Method: SIT

- **Experiment 3** – Chapter 3, page 122
  - Goal: Null vs. overt subject pronoun resolution
  - Language: Spanish
  - Method: SIT

- **Experiment 4** – Chapter 3, page 135
  - Goal: Effects of narrow vs. contrastive focus on null subject pronoun resolution
  - Language: Spanish
  - Method: SIT

- **Experiment 5** – Chapter 3, page 140
  - Goal: Effects of the focus-sensitive particles (FSP) *incluso* 'even', *sólo* 'only', and *también* 'also' on null subject pronoun resolution
  - Language: Spanish
  - Method: SIT

- **Experiment 6** – Chapter 3, page 145
  - Goal: Effects of the FSPs *even* and *only* on subject pronoun resolution
  - Language: English
  - Method: SIT

- **Experiment 7** – Chapter 4, page 163
  - Goal: Effects of the interaction between the FSPs *even* and *only* and the connective *because* on subject pronoun resolution
  - Language: English
  - Method: Sentence Continuation/Completion Task (SCT)

- **Experiment 8** – Chapter 4, page 168
  - Goal: The position of FSPs
  - Language: English
  - Method: Acceptability Judgment Task (AJT)

- **Experiment 9** – Chapter 4, page 173
    - Goal: Effects of the interaction between the FSPs *even* and *only* and the connectives *when* and *because* on subject pronoun resolution
    - Language: English
    - Method: SCT

- **Experiment 10** – Chapter 4, page 176
    - Goal: Effects of the interaction between the FSPs *même* 'even' and *seul* 'only' and the connectives *quand* 'when' and *parce que* 'because' on subject pronoun resolution
    - Language: French
    - Method: SCT

- **Experiment 11** – Chapter 4, page 180
    - Goal: Effects of the interaction between it-clefting and the connectives *quand* 'when' and *parce que* 'because' on subject pronoun resolution
    - Language: French
    - Method: SCT

- **Experiment 12** – Chapter 4, page 184
    - Goal: Effects of the interaction between the FSPs *even* and *only* and the connectives *because* and *although* on subject pronoun resolution
    - Language: English
    - Method: SCT

- **Experiment 13** – Chapter 4, page 187
    - Goal: Effects of the interaction between the FSPs *même* 'even' and *seul* 'only' and the connectives *parce que* 'because' and *bien que* 'although' on subject pronoun resolution
    - Language: French
    - Method: SCT

- **Experiment 14** – Chapter 5, page 203
    - Goal: Effects of the interaction between the FSPs *même* 'even' and *seul* 'only' and the connectives *parce que* 'because' and *bien que* 'although' on subject pronoun resolution
    - Language: French
    - Method: Visual-World paradigm eye-tracking + SCT + SIT

- **Experiment 14.1** – Chapter 5, page 223
    - Goal: Effects of the interaction between the FSPs *même* 'even' and *seul* 'only' and the connectives *parce que* 'because' and *bien que* 'although' on subject pronoun resolution (pronoun prompt)
    - Language: French
    - Method: SCT

- **Experiment 14.2** – Chapter 5, 226
    - Goal: Effects of the interaction between the FSPs *même* 'even' and *seul* 'only' and the connectives *parce que* 'because' and *bien que* 'although' on subject pronoun resolution (*avoir l'habitude de* prompt)
    - Language: French
    - Method: SCT

Introduction

The present dissertation is concerned with the mechanisms that are at stake during discourse processing. We focus specifically on pronoun resolution. Pronominal dependencies are a central part of discourse processing, as they link clauses and sentences together. The correct interpretation of a given pronominal expression, therefore, is going to guarantee a successful communication between interlocutors. While the process of interpreting a pronoun may seem rather mechanical and, for the most part, successful, pronouns are, nevertheless, a big source of ambiguity in language. Here we are concerned with ambiguous contexts where a given pronoun can be resolved in favor of two potential antecedents. The study of these ambiguous contexts is extremely useful as it exposes the factors that make a discourse entity the preferred antecedent for a given pronoun, as well as those factors that lead speakers to choose a pronoun over any other form of reference to refer back to that entity. Previous psycholinguistic research has shown that factors such as the syntactic function of the antecedent, its thematic role, its information status, as well as the semantics of the verb, or the coherence relations established between propositions play an important role in these processes.

Our proposal, which we spell out in Chapter 2, takes as a starting point the premise that the typical psycholinguistic approach to pronoun resolution that puts forward the above-mentioned factors and possibly their interactions is not enough. What we need, besides that, is an in-depth analysis of the discourse structure of the context where the pronominal dependency is established. This analysis will be needed to explain why different factors play a different role in different contextual circumstances. Providing such an analysis will be the main goal of the present dissertation. It is only by synthesizing both aspects – syntactic, semantic, and pragmatic factors on the one hand and the structure of the contexts on the other hand –that one can propose a comprehensive theory (or model) of pronoun resolution that can account for the interpretation patterns observed in the literature. While proposing a full model of pronoun resolution is beyond the purposes of the present dissertation, we shall put forward certain key elements that future proposals should take into account in their formulation.

In the following pages, we will provide a brief outlook on the content of the chapters to come and how they relate to the central proposal underlying this thesis. In **Chapter 1,** we discuss previous theories of the choice of referential expressions and antecedent accessibility that argue that the use of a given form of reference and its correct interpretation is closely correlated with the presence of an entity in the preceding context that has a certain prominent status. Although theoretically informed, the approach of the present dissertation is experimental in nature, and, thus, we subsequently review a series of psycholinguistic studies

that investigate the role of certain factors that contribute to this prominent status of the antecedent and their role in the production and comprehension of referential expressions. In particular, we put the emphasis on two factors pertaining to the utterance level that have been extensively studied in the literature: the syntactic function of the antecedent and its information status. We additionally discuss the role of coherence relations in reference production and interpretation, and accounts therein, which argue that, beyond notions related to the status of the antecedent in the speaker/hearer's discourse model, the mechanisms supporting these processes are driven predominantly by semantics, world knowledge and inference, in the process of establishing coherence at the discourse level. The discussion of this previous literature will expose three important findings that will be central for the purposes of the present study:

1. Not one of these two major proposals –prominent status of the antecedent or coherence relations – on its own is capable of accounting for all the observed facts. Instead, the combined results of these studies speak for the multifactorial nature of pronoun resolution.
2. Factors affecting resolution do not exert their effects to the same extent in all contexts. This will become apparent, for example, when comparing studies that investigate inter-sentential pronoun resolution with studies that investigate intra-sentential pronoun resolution.
3. The effect of some of these factors is subject to cross-linguistic variability. This finding underlines the importance of performing a cross-linguistic comparison of the phenomenon under study.

In **Chapter 2**, we review one of the few models that take into account the abovementioned findings: Miltsakaki (2002). Miltsakaki proposes a theory of pronoun resolution according to which inter-sentential and intra-sentential pronoun resolution are not subject to the same interpretation mechanisms. According to this model, pronoun interpretation across sentences is determined structurally in line with the predictions of Centering Theory (the subject/topic of the sentence is the most salient entity and, thus, the preferred antecedent), while pronoun interpretation within a sentence is guided by semantic/pragmatic information, in line with the predictions of coherence-driven accounts. We will argue that one of Miltsakaki's main contributions is to discuss resolution in terms of Discourse Units (DU), which she describes as consisting of a matrix clause and all dependent

subordinate clauses.

In line with Miltsakaki's proposal, we will argue that the DU is the optimal domain (or framework) for the study of pronoun resolution. However, unlike Miltsakaki's and other purely syntactic-based proposals that uniquely equate the notion of DU to either the sentence or the clause, we propose a "relational" definition of DU, according to which the shape of the unit (e.g. sentence, clause) depends on the semantic content of the subordinate clause itself and the relation established between matrix and subordinate clause. Our evidence will be based on Johnston's (1994) analysis of subordinate adverbial clauses (adjuncts), which distinguishes between non-relational adjuncts, like temporal clauses, which constitute presupposed content, and relational adjuncts, like causal clauses, which constitute non-presupposed or asserted content. Based on this analysis, we hypothesize that the syntax and semantics/pragmatics of certain subordinate clauses in a construction consisting of a matrix clause and an adverbial adjunct will have consequences for the establishment of DUs. Focusing on temporal and causal adjuncts, we argue that temporal adjuncts are processed as part of the same DU as the matrix clause, whereas causal adjuncts are processed as separate DUs from the matrix clause. While this proposal does not constitute by any means a definition of the basic DU, we argue that (i) it constitutes evidence against previous syntactic proposals, and (ii) it contributes key elements that any future description of DUs must take into account.

We conclude Chapter 2 with the claim that the DU configuration of the sentence will have an effect on pronoun interpretation and that factors affecting resolution will not exert their effects to the same extent within a DU as across two DUs. We propose that pronoun resolution searches a maximum of discourse coherence and, thus, interpretation preferences will come about in the process of *establishing* or *maintaining* coherence. The specific predictions for the contexts under study here (i.e. matrix and subordinate adverbial adjunct) are the following:

- When matrix and subordinate clause are processed as a single DU (e.g. non-relational temporal adjuncts), coherence has already been established between both clauses, since the adverbial will specify some aspect of the current event (such as time), and the tendency will be to *maintain* it. Previous empirical evidence shows that this can be achieved through a general preference for topic or topic-like information (or entities therein).

- When matrix and subordinate clause constitute two separate DUs (e.g. relational causal adjuncts) or two sentences, resolution preferences will come about within the process of *establishing* coherence between units. This will be done through the semantics/pragmatics of certain elements in the proposition, such as verbs and connectives.

The subsequent three chapters test empirically the predictions laid out above. More specifically, in Chapter 3 we test the predictions for contexts where matrix and subordinate clause are processed as a single DU (temporal clauses), while in Chapters 4 and 5 we test the predictions for contexts where matrix and subordinate clause are processed as two separate DUs (causal clauses). For this purpose, we employ a series of offline questionnaire studies, such as Sentence-Interpretation Tasks and Continuation Tasks (experiments presented in Chapters 3 and 4) but also an online Visual-world eye-tracking experiment (presented in Chapter 5).

Chapter 3, which is divided in two parts, is devoted to the study of the role of the prominent status of the antecedent in pronoun interpretation. Part 1 (Experiments 1-3) investigates how two syntactic constructions affecting the information status of potential antecedents (Hanging Topic Left-Dislocation to mark topic and *it-clefting* to mark focus) affect antecedent choices for ambiguous (subject and object) pronouns in Spanish. Our results show that these two structures exert different effects on interpretation in the context under investigation: while there is a general preference for left-dislocated antecedents in a sentence like (1), clefted antecedents are generally dispreferred in (2), an effect known as *anti-focus effect* that has also been attested in French and in German (Colonna et al., 2010, 2012, 2015).

(1) Speaking of John, he saw Peter when he was walking on the beach. [he=John]
(2) It was John who saw Peter when he was walking on the beach. [he=Peter]

In Part 2 we investigate further the so-called *anti-focus effect.* The results of Experiments 4-6 show that this dispreference for clefted antecedents is neither exclusive to one type of focus nor to the *it-cleft* construction, as evidenced by the similar results obtained with the focus-sensitive particles (FSPs) *even, only,* and *also* in English and in Spanish in sentences like (3).

(3) a. Even John called Peter last night when he was in the office. [he=Peter]
b. Only John called Peter last night when he was in the office. [he=Peter]

These results suggest that the dispreference for clefted/focused antecedents, which has been explained in terms of an effect of the information status of the antecedent, might also be motivated by an effect of the syntactic, semantic, and pragmatic characteristics of the *it-cleft* construction, as the attested dispreference for clefted antecedents could also be analyzed as a general preference for the antecedent within the presupposed, known, given part of the utterance. We conclude the chapter with the claim that the observed general preference for clearly established topics and topic-like antecedents that constitute presupposed, given, known information, and the general dispreference for antecedents that potentially constitute new, unknown, unexpected information, fit well with the predictions of our account: a potential topic-shift within the unit brings about discontinuity and breaks coherence and is, thus, dispreferred; referring to topic(-like) antecedents helps *maintain* coherence within the unit, a tendency that is favored.

In **Chapter 4**, we investigate the role of coherence relations in pronoun resolution. More specifically, we put the emphasis on causality, a coherence relation that has been shown to enjoy a special status in discourse processing. We focus on the phenomenon of *Implicit Causality* (IC) which concerns certain verbs that, when used with nouns referencing human or animate beings, import an implicit attribution of the cause of the action or attitude indicated by the verb (Garvey & Caramazza, 1974; Garvey et al., 1976; Au, 1986). IC is perhaps the best-studied phenomenon concerning the interaction between coherence relations and pronoun interpretation. Our predictions for this chapter will be strongly influenced by recent studies on IC that observe that IC verbs generate stronger-than-usual expectations for upcoming explanations (Kehler et al., 2008). Bott and Solstad (2014) provide an explanation for this finding, and claim that, if there is causal content that can be specified by an explanation in the form of a *because*-clause or an independent sentence, then providing this explanation should be the default strategy in language processing (i.e. specification of yet unspecified content). Otherwise, interpreters would be forced to accommodate the missing information, a cognitively taxing operation that should be dispreferred.

Causal clauses introduced by the connective *because* are of special interest for the purposes of the present dissertation, as we predicted that they are an example of a context where the subordinate adjunct and the matrix clause are processed as two separate DUs. Our prediction for pronoun interpretation in this context was that resolution preferences would

occur within the process of *establishing* coherence between units, which will be done through the semantics and pragmatics of certain elements in the proposition, such as verbs and connectives.

The experiments that we present in Chapter 4 investigate how the causal connective *because* interacts with the FSPs *even* and *only* that we also manipulate in Chapter 3. This is done in English and in French. We predict that pronoun interpretation preferences will be guided by the interaction of the semantic/pragmatic content of the focus particles and that of the connective in the process of establishing discourse coherence. More specifically, we propose that FSPs behave like IC verbs in that they create expectations for an explanation that need to be filled to avoid the accommodation of missing information (Bott & Solstad, 2014). In particular, we argue that FSPs create expectations for an explanation about the relationship between the focus entity in their scope and the set of alternatives related to it:

- *Only* X VP: X but not Y, Z → expectation for an explanation for the *exhaustiveness* of its associate in relation with its alternatives within the described event
- *Even* X VP: X less likely than Y, Z → expectation for an explanation for the *unlikeliness* of its associate in relation with its alternatives within the described event

These expectations result in different interpretation patterns: a preference for the antecedent within the scope of *only*, as in (4), and a preference for the antecedent outside the scope of *even*, as in (5). These patterns of interpretation, which are different from those observed in the context of a single DU shown in (3), are taken as evidence in favor of our proposal on DUs and their role in pronoun resolution. Interestingly, the results of these experiments also show that the semantics/pragmatics of focus particles and connectives are not the only factors affecting resolution, as the syntactic function of the antecedent plays a role in this process, too. Crucially, the effect of the syntactic function seems to be subject to cross-linguistic variability.

(4) Only John interrupted Mary last night because…[HE]

(5) Even John interrupted Mary last night because…[SHE]

Chapter 4 also explores how these results vary as a function of the connective employed. Adopting the analysis advocated by König (1991) and König and Siemud (2000) that argues that the concessive "q although p" implies the same counterfactual as the entailed by the causal "~q because p", we predict the opposite interpretation patterns to those obtained in previous experiments when the causal connective *because* is replaced by the concessive connective *although.* The results of our experiments confirm these predictions, a finding that constitutes not only empirical evidence for proposals that defend a close connection between causality and concessivity, but also for our own proposal on DUs.

All the data from the experiments in the two previous chapters constitute final interpretations elicited in an offline fashion. In **Chapter 5** we investigate whether the factors that have been shown to affect pronoun interpretation in previous experiments exert their effects incrementally during online sentence processing, and, if so, what is their time-course of integration. For that, we employ a Visual-world eye-tracking experiment combined with a continuation task in French. The results of this experiment show that effects of the FSPs *même* 'even' and *seul* 'only', and of the connectives *parce que* 'because' and *bien que* 'although' exert their influence incrementally as participants build the mental representation of the experimental items they are presented with. Interestingly, these factors do not exert their effects at the same point in time: we observe an early effect of the particles, followed by an effect of the connective, followed by an effect of the interaction of both factors that resembles the interpretation patterns elicited in previous offline experiments. In addition to this, the final interpretation choices elicited in this experiment are also in line with the results of the experiments presented in Chapter 4 and, thus, constitute further evidence for our proposal.

Putting together the results of all the experiments presented in previous chapters, we conclude the present dissertation by drawing general conclusions and by stating future lines of research.

Chapter 1

Background

1. Why study pronoun resolution?

Figure 1.1: An everyday example of pronoun resolution (gone wrong)

Simply put, we study pronoun resolution to comprehend the processes and strategies that the human language parser utilizes to understand what the pronoun *it* in Figure 1.1 refers to, and how it does so in a successful manner that would prevent the situation depicted in the picture from happening.

Human beings tend to make their communicative interchanges as economical as possible. Grice captures this tendency with his *Maxim of Quantity*, which states that humans aim at making their interchanges as informative as necessary but not more informative than necessary (Grice, 1975). This implies that, as discourse unfolds, when we need to refer back to a previously mentioned entity, we tend to use shorter and less specific forms of reference, like for example pronouns, provided that the entity we are referring to is still accessible to the listener, in other words, this entity is still in the current focus of attention. These facts lend themselves well to providing a definition of pronouns: pronouns are linguistic elements that carry minimal information and that can only be understood in relation to other elements of a text or discourse, as in (1.1).

(1.1) Peter would walk on the beach everyday when **he** was on holidays. [he=Peter]

In the example in (1.1), there is only one possible referent for the pronoun *he*. However, often times, we run into utterances where a pronoun has two or more potential

antecedents that agree in gender and number with it, resulting in a globally ambiguous sentence, as in (1.2). Despite the ambiguity, psycholinguistic research has established a number of factors that will guide the resolution process in such contexts making listeners have a preference for one referent over the other. In (1.2), for example, referring back to the subject antecedent and topic of the matrix clause *Peter* would probably be the preferred interpretation for English speakers.

(1.2) Peter saw John the other day when **he** was walking on the beach.
[he=Peter/John]

Resolving pronominal dependencies is crucial for language processing and, although this process seems straightforward at first glance, research has shown that it might be more complex than expected.

The psycholinguistic study of pronoun resolution is different from the formal analysis of anaphora, which is primarily concerned with the characterization of the constraints on coindexation and coreference within a syntactic domain (cf. Chomsky, 1981; Reinhart, 1983; among others). While formal linguists, in particular in generative frameworks, mostly focus on the conditions under which the coindexation process may or may not occur, psycholinguists are more often concerned with the process of coindexation, as well as the constraints following the coindexation process in cases of ambiguity. Nicol and Swinney (2003, pp.73-74) put forward a number of empirical questions that are at the heart of psycholinguistic research on pronoun resolution:

1. When we encounter a pronoun, how quickly is the search for an antecedent initiated?
2. What types of information constrain the reference set?
3. What types of information constrain the elimination of candidates from this reference set?
4. Does pronoun resolution involve activation or inhibition of previously mentioned referents?

For the past few decades, research on discourse constraints, both in comprehension and production (where the primary concern lies on the types of information that constrain a speaker's choice in reference form), have examined these and other questions mainly in terms

of the availability and accessibility of the referent. As we shall see in the following sections, salience seems to lie at the core of these approaches: the more salient an entity, the more likely and the faster it will be retrieved as the antecedent of the pronoun; likewise, the more salient an entity, the more reduced the referential expression will be.

Concluding, a psycholinguistic approach to pronoun resolution does not aim at investigating pronouns as mere linguistic elements but rather as a means to tap into larger questions about the architecture and workings of the discourse processing mechanism. Since pronouns are an important source of ambiguity in language, they are very useful in the investigation of the mechanisms and strategies employed by the parser in language processing.

This chapter is organized as follows: In Section 2, we provide a brief discussion of the main theories of the choice of referential expression and antecedent accessibility proposed in the literature. We show that, regardless of some apparent differences, they all have in common the view that the occurrence of a reduced referential expression, such as a pronoun, is closely correlated with the presence of an entity in the preceding context that has a certain prominent status. Since the approach of the present dissertation is experimental in nature, in Section 3, we review a series of psycholinguistic studies that, putting the predictions of these theories to the test, investigate the role of certain factors that contribute to this "special" status of the antecedent and their role in the production and comprehension of referential expressions. In particular, we put the emphasis on two factors, pertaining to the utterance level, which have been extensively studied in the literature: the syntactic function of the antecedent, and its information status. Finally, in Section 4, we discuss the role of coherence relations in reference production and interpretation, and accounts therein, which argue that, beyond notions related to the status of the antecedent in the speaker/hearer's discourse model, the mechanisms supporting these processes are driven predominantly by semantics, world knowledge and inference, in the process of establishing coherence at the discourse level.

2. Theories of the choice of referential expression and antecedent accessibility

The theories discussed below provide different accounts, on the one hand, of the factors that influence the choice of a referential expression by the speaker, and, on the other hand, of the factors that affect the availability and accessibility for the listener of an antecedent for a given referential expression. As we shall see, although extensionally all these theories deal with the same phenomenon, the perspective from which they do so changes from one theory to another. It is important to note, however, that these theories are not psycholinguistic accounts of pronoun resolution, which we shall discuss in Chapter 2.

2.1. The choice of a referential expression

2.1.1. Prince (1981): Assumed familiarity theory

In order to account for the factors that influence the choice of a referential expression, Prince focuses on the notion of information *givenness* (*given/old* vs. *new*). Prince based her theory on previous work that tried to address this binary distinction, especially Kuno (1972, 1978), Halliday (1967), and Halliday and Hasan (1976), who distinguish *predictable* and *recoverable* information; Chafe's (1976) notion of salience; and Clark and Haviland's (1977) notion of *shared knowledge.*

Based on the binary distinction between given/old and new information and the notion of shared knowledge, i.e. that which stems from the beliefs of the speaker about the knowledge of the information that the hearer has, Prince proposes a familiarity scale where the status of a given entity can go from less to more familiar in the current discourse representation, as shown in Figure 1.2.

Figure 1.2: Prince's *Assumed familiarity* scale

< Less familiar				**More familiar >**
Brand-**new** non-anchored	Brand-new anchored	**Inferable**	Unused	**Evoked**

The cognitive status of a given entity can be new, inferable or evoked. The status of an entity is brand-new if the entity has been introduced in the discourse for the first time, that is, it is not in the mental model of the hearer. If the entity has not been previously introduced in

the discourse but the hearer can recall it from memory, that entity is unused. A brand-new entity can be anchored, if it is linked to another not brand-new referent, or unanchored, if there is not such a link. A referent is inferable when the speaker believes that the hearer can create a mental representation of it from plausible reasoning from another evoked or inferred entity. Finally, a referent is evoked if it is contained within the interlocutors' discourse representation because it has been previously mentioned (textually) or because it is within the hearer's perceptual environment (situational). Prince argues that a speaker will use the form of reference that corresponds to the highest point of the scale that they can, i.e. speakers will not refer to a discourse referent as brand-new if they know it is evoked.

2.1.2. Gundel et al. (1993): Givenness Hierarchy

In the same line, Gundel and colleagues argue that the form of a referential expression depends on the cognitive status of its referent, that is, on the preexistence, or lack thereof, of a mental representation of this referent in the hearer's mental discourse model and on whether or not this referent is in the hearer's current focus of attention.

The cognitive status of a highly accessible referent can be introduced or evoked linguistically or through more general world-knowledge. Gundel et al. identify six cognitive statuses that determine the form of a referential expression that they place along a givenness hierarchy. This hierarchy, given in Figure 1.3, goes from least restrictive to most restrictive.

Figure 1.3: Gundel et al.'s Givenness hierarchy

Most restrictive	In focus (it)
	Activated (that, this, this N)
	Familiar (that N)
	Uniquely identifiable (the N)
	Referential; indefinite (this N)
Least restrictive	Type identifiable (a N)

They suggest that the forms in parentheses above are only appropriate when their cognitive status is met. These forms restrict possible referents to those that are assumed to have the designated memory and attention status for the addressee. They can be thought of

procedurally as processing instructions, as shown in the examples in (1.3) from Gundel (2003, p. 129).

(1.3) a. Type identifiable – identify what kind of thing this is
*I couldn't sleep last night. **A train** kept me awake.*
b. Referential – associate a unique representation by the time the sentence is processed
*I couldn't sleep last night. **This train** kept me awake.*
c. Uniquely identifiable – associate a unique representation by the time the nominal is processed
*I couldn't sleep last night. **The train** kept me awake.*
d. Familiar – associate a representation already in memory
*I couldn't sleep last night. **That train** kept me awake.*
e. Activated – associate a representation from working memory
*I couldn't sleep last night. **This train/this/that** kept me awake.*
f. In focus – associate a representation your attention is currently focused on
*I couldn't sleep last night. **It** kept me awake.*

Gundel et al.'s hierarchy is closely based on Prince's Assumed Familiarity scale with the difference that on Prince's scale categories are mutually exclusive, while on Gundel et al.'s hierarchy an expression that signals a given cognitive status has necessarily all the characteristics of the statuses lower on the hierarchy.

2.2. Accessibility Theories

2.2.1. Givón (1983): Topic continuity theory

Givón proposes that the choice of a given referential expression is linked to the degree of topicality of the entity it refers to. An entity can become increasingly topical (e.g. through subsequent mentions) and, as a consequence, the form of reference employed to refer back to it will vary. Givón proposes three factors that affect the degree of topicality of a given entity:

- Referential distance (or linear distance between two mentions of an entity; recency)
- Persistence (duration of the presence of the entity in discourse)
- Potential interference (number of potential antecedents for the expression)

According to Givón, topicality reflects both the status of the referent in discourse from the point at which it started and the role that the speaker wants to give it in the upcoming discourse. Givón sees this degree of topicality of an entity as a continuum that is statistically correlated to the choice of form of a referential expression. This conception allows him to establish an accessibility scale that follows the principle that the more confusing, surprising, discontinuous or difficult to treat the topic, the more important is the quantity of coding information for that topic. This scale concerns the topicality of a referential expression, although this property is intrinsically associated with the cognitive status of the referent (what is continuous is more predictable, what is predictable is easier to treat). Based on Givon's conception of topic continuity, Ariel subsequently proposed an accessibility theory that focuses more on the antecedent and, as opposed to Givon's proposal, if focuses specifically on anaphoric expressions, such as pronouns.

2.2.2. Ariel (1990, 1994): Accessibility theory

In the same line as the authors discussed so far, Ariel observed that there is a very close relationship between the use of a given referring expression and the cognitive status of the mental entity it represents. Ariel's Accessibility Theory (Ariel, 1990, 1994) views referring expressions as "accessibility markers" for entities in the mental representation of discourse participants. According to this theory, accessibility markers are arranged along a continuous scale that goes from low accessibility markers to high accessibility markers. Figure 1.4 illustrates and exemplifies this point.

Figure 1.4: Accessibility Marking Scale (from Arnold, 1998)

Low accessibility	Name
	Definite description
	Demonstrative
	Stressed pronoun
	Unstressed pronoun
	Cliticized pronoun
	Agreement markers
	Reflexives
High accessibility	Zero expression

Consequently, when a referent is low in accessibility (i.e. not salient in discourse), fuller referring expressions (or low accessibility markers), like proper names, will be used. Likewise, when a referent is high in accessibility (i.e. salient in discourse), less specific expressions (or high accessibility markers), like pronouns, will be chosen.

Ariel suggests that there are a number of factors that influence the level of accessibility of a referent entity, among which the most important ones are saliency, competition, distance and unity. Saliency refers to the antecedent being a salient referent or not, in other words, whether it is a topic or a non-topic, where topic is usually equated with the grammatical subject. More salient antecedents will require less specific referring expressions (or higher accessibility markers) and vice versa. Competition refers to the number of candidates (or competitors) in the role of antecedent. Thus, in contexts with more than one potential candidate, lower accessibility markers will be required, while the opposite is expected in contexts with only one potential antecedent. The distance between the last mention of the potential antecedent and the referring expression also influences the level of accessibility of that antecedent. This implies that recent mentions are expected to be more accessible, and require higher accessibility markers, than remote mentions, which require lower accessibility markers. Finally, unity refers to the effect that discourse structure has on the choice of reference form. In general, the accessibility of a referent is influenced by the degree of cohesion between the clause that contains the antecedent and the clause that contains the anaphoric expression. Therefore, higher accessibility markers, like pronouns, will be chosen to refer to entities from the same discourse segment, and lower accessibility markers, like names, to refer to entities that were mentioned in a different segment.

In addition to these factors, Ariel argues that three criteria influence the association of a particular accessibility marker with a specific degree of accessibility. These are informativity, rigidity, and degree of attenuation. Informativity refers to the amount of information a given expression has. In general, the more information an expression contains, the better it becomes at retrieving a less salient antecedent. Rigidity has to do with how constrained a given form is to denote a referent. In this respect, names are more rigid and pronouns are more “flexible” since they can potentially retrieve a wider range of antecedents. Finally, degree of attenuation refers to the amount of phonological material that a referring form possesses, irrespective of the amount of lexical information. This criterion predicts that a null pronoun, for example, will score higher than an overt one on the attenuation scale, even if they denote the same referent.

These criteria have clear implications for null subject languages like Spanish: a null pronoun has less informational content (fewer features) than an overt pronoun and it also has less phonological content (none), therefore, it should be associated with a more accessible antecedent than the overt pronoun. According to this proposal, null pronouns in languages with rich verbal agreement, like Spanish, would be classified as agreement markers on the Accessibility Marking Scale in Figure 1.3, whereas null pronouns in languages like Chinese, whose verbal agreement is not rich, would be classified as zero markers, further down on the scale.

2.3. Centering Theory

Centering Theory (CT) was intended as a theory that relates focus of attention, choice of referential expression, and perceived coherence of utterances within a discourse segment (Grosz et al., 1995; Walker & Prince, 1996).

The basic assumption behind CT is that certain entities, or centers (discourse referents in DRT), in an utterance are more central than others and that this property imposes constraints on a speaker's use of different types of referring expression. Centers can be forward-looking (Cf), which correspond to the set of discourse entities evoked by an utterance U_i in a discourse segment D. These entities are ranked according to discourse salience, where discourse salience is equated to grammatical function (SUBJ > DOBJ > IOBJ > OTHER). Within the Cf(U_i,D), there are two privileged centers: the backward-looking center (Cb), which represents the entity that the utterance is about (the topic of U_i) and which refers back to an entity in the previous utterance (i.e. it is the highest-ranked element of Cf(U_{i-1},D) realized in U_i), and the preferred center (Cp), which is the highest-ranked Cf(U_i,D) and is predicted to be the Cb of the following utterance.

Based on the distribution of centers, CT proposes a typology of transitions from U_{i-1} to U_i that can be used to measure the coherence of a discourse segment in which U_{i-1} and U_i occur. As Table 1.1 illustrates, these transitions are based on two factors: whether Cb is the same from U_{i-1} to U_i, and whether Cb is the same as the Cp of U_i. In the Continue transition, the speaker has been talking about a given entity and intends to continue talking about that entity. In the Retain transition, the speaker has been talking (U_{i-1}) and is currently talking (U_i) about a given entity but intends to shift to a new entity in the next utterance (U_{i+1}). This upcoming shift is signaled by the realization of the current Cb in a lower-ranked position of the Cf. In the Shift transitions, the speaker has shifted from the Cb in U_{i-1} to a new Cb entity

in U_i. If this new entity is realized as the Cp of U_i, then this signals that the speaker intends to continue talking about this entity and this is a smooth-shift. If it is not the Cp of U_i, then it is a rough-shift. According to CT, transitions are ordered[1]: the Continue transition is preferred to the Retain transition, which is preferred to the Smooth-Shift transition, which, in turn, is preferred to the Rough-Shift transition. This ordering has to do with the fact that not all transitions are equally easy to process: discourse segments that maintain the same topic across adjacent utterances (i.e. the Continue transition) are more coherent and easier to process than discourse segments where the topic changes (i.e. the Shift transitions), which are less coherent and, thus, harder to process.

Table 1.1: Centering Transitions (from Walker & Prince, 1996: 296)

	$Cb(U_i) = Cb(U_{i-1})$	$Cb(U_i) \neq Cb(U_{i-1})$
$Cb(U_i) = Cp(U_i)$	CONTINUE	SMOOTH SHIFT
$Cb(U_i) \neq Cp(U_i)$	RETAIN	ROUGH SHIFT

More in relation with the choice of referential expression and reference interpretation, and their role in signaling discourse coherence, CT argues that, for each U_i in a discourse segment D consisting of utterances $U_1 \ldots U_m$, if some element of the set of Cfs of U_{i-1} is realized as a pronoun in U_i then so is the Cb of U_i. This prediction, known as the Pronoun Rule, explains why continuations like (c), where the $Cb(U_i,D)$ is realized as a pronoun, reads better than (c'), where the $Cb(U_i,D)$ is realized as a full NP, in passages like (1.4). This rule implies that salient (topical) entities are usually realized as a pronoun in subsequent mentions, and that pronouns are a linguistic mechanism for indicating continuity and coherence. As we shall see below, previous experimental studies that tested this prediction observed that, when the Cb is realized as a repeated name instead of as a pronoun, as in (c'), a processing penalty (known as *Repeated Name Penalty*) occurs, while no such penalty was observed when the Cb was realized as a pronoun (e.g. Almor, 1999; Gelormini-Lezama & Almor, 2011).

Although Centering Theory was proposed mainly for English, its predictions can also explain the distribution of null and overt pronominal expressions in null-subject languages like Spanish or Italian. The proposal for these languages has been that the null pronoun is the more appropriate form in the Continue transition, while the overt pronoun is more appropriate in the Retain and Shift transitions, i.e. when it retrieves a referent that in the previous

[1] This is known as Rule 2 in the CT literature.

utterance was not the most prominent member of the Cf (cf. Carminati, 2002 below). In the following sections, the implications of the predictions made by Centering Theory, as well as by Accessibility Theory, will become more evident for a theory of the processing of null and overt anaphoric expressions in Spanish.

(1.4) a. Susan$_i$ gave Betsy$_j$ a pet hamster.
Cf = {Susan, Betsy, hamster}
b. She$_i$ reminded her$_j$ that such hamsters are quite shy.
Cb = Susan, Cf = {Susan, Betsy, hamsters}
c. She$_i$ asked Betsy$_j$ whether she liked the gift.
c'. Susan$_i$ asked her$_j$ whether she liked the gift.
Cb = Susan, Cf = {Susan, Betsy, gift = hamster}

To summarize, the theories discussed in this section claim that the choice of a referential expression and its interpretation are directly related to the status of the antecedent in the speaker/hearer's mental model. However, as we have seen, the status of the antecedent is not defined on the same terms by all of them. Table 1.2 summarizes the main characteristics of the descriptions of the status of discourse antecedents according to each of the theories discussed above. Crucially, focusing on the referential expression that the present dissertation is concerned with –pronouns –, all these theories share the prediction that the occurrence of this kind of reduced form of reference is closely correlated with the presence of an entity in the preceding context that has a prominent status (i.e. it is given (evoked/in focus), it is topical, it is accessible, and it is salient (subject/topic)). Likewise, it is this "special" status of a discourse entity that is going to make it the preferred antecedent for a subsequent pronominal expression.

Table 1.2: Antecedent status according to the theories discussed in Section 2

Status of antecedent	**Structure of discourse referents**	**Main representatives**
Informational (Given-new)	Unordered set of DRs with mutually exclusive statuses	Prince (1981) *Assumed familiarity theory* Gundel et al. (1993) *Givenness hierarchy*
Topical (More-less topical)	Ordered set of DRs with hierarchy of statuses	Givón (1983) *Topic continuity theory*
Accessible (High-low accessibility)		Ariel (1990, 1994) *Accessibility theory*
Salient (Subj>Obj>Others)	Ordered set of DRs with a binary organization	Grosz et al., 1995; Walker and Prince, 1996 *Centering Theory*

3. Evidence from psycholinguistic studies

In this section we discuss a series of psycholinguistic studies that have been concerned with identifying those factors that contribute to the prominent status of discourse antecedents, that is, those factors that render discourse entities more accessible, more topical, more salient, making them good potential discourse antecedents. These studies, which are done from the perspective of the utterance or of a sequence of utterances, identify numerous factors that pertain to syntax (e.g. order of mention, syntactic function, etc.), semantics (e.g. thematic roles), and information structure (e.g. topic, focus). In the following pages, we focus on psycholinguistic studies that investigated mainly syntactic and information structure factors and show that, while these factors can account for some of the observed patterns, they fall short at explaining all these patterns by themselves. We conclude the chapter by claiming that it is most likely that all these factors contribute to the discourse status of antecedents but that they might weigh in differently in different contexts. An optimal approach to the study of pronoun resolution will, thus, take into account not only the factors that affect the discourse status of the antecedent, but also the contextual circumstances where they operate. Note that, although we focus on pronoun resolution, that is, the choice of an antecedent for a given pronoun, this is correlated with the choice of a referential expression in some of the studies discussed below.

3.1. Syntax: The special status of the subject

Research in the psycholinguistic tradition has shown that grammatical subjects enjoy a special status in discourse as they are usually mentioned first, they tend to be agents, they are often interpreted as the topic of the sentence/discourse and, therefore, they receive a high degree of prominence (e.g. Chafe, 1976).

From a syntactic point of view, the special status of the subject antecedents in the production and interpretation of pronouns has been accounted for by two main proposals: the syntactic function view and the order of mention (or surface position) view. The former view argues that it is the syntactic function of the antecedent what contributes to its discourse status and that, in particular, subject entities are more prominent than entities with other syntactic functions. In the pronoun resolution literature, this view has given rise to the *Subject Bias strategy* that accounts for the fact that a pronoun is preferably interpreted as co-referential with a subject antecedent in the preceding sentence or clause (e.g. Crawley et al., 1990; Grober et al., 1978). Although we will not analyze semantic factors such as thematic roles in detail, it is worth mentioning that some authors defend the view that agentivity plays a major role in antecedent prominence and that the subjecthood preference is probably related to a preference for antecedents that are syntactically and semantically prominent (Ferreira, 1994; Kaiser, 2011).

The second view claims that it is the order of mention, or surface position, not the syntactic function, what contributes to the more or less prominent status of discourse referents. In particular, first mentions, regardless of their syntactic function, enjoy a privileged cognitive status in the interlocutors' mental discourse representation (Gernsbacher, 1989). This claim implies that the special status of subject antecedents in discourse stems from the fact that these entities more often than not appear in initial position (specially in languages like English), and not so much from the fact that they are the syntactic subject of the utterance. In the pronoun resolution literature, this view has given rise to the *First mention bias,* which claims that pronouns prefer discourse/utterance first mentions as antecedents, regardless of their syntactic function (Gernsbacher & Hargreaves, 1988).

Although closely related, these two views make significantly different predictions. Moreover, they are confronted with a major difficulty: teasing apart function from order of mention, as grammatical subjects are canonically/frequently mentioned first in canonical transitive sentences. The studies we review below address this potential shortcoming.

3.1.1. Syntactic function vs. Order of mention

Gordon and colleagues (1993) report a series of reading-time experiments that test predictions of Centering Theory (CT) discussed above with respect to the conditions under which it is preferable to realize (refer to) an entity using a pronoun rather than a repeated full NP. Recall that CT predicts salient entities are usually realized as a pronoun in subsequent mentions, and that subject referents are more salient, and thus, generally preferred as antecedents over referents with other syntactic functions (a prediction shared by the *Subject Bias strategy*). Previous experimental studies that tested this prediction observed that, when an entity referring to a salient antecedent is realized as a repeated name instead of as a pronoun, a processing penalty (known as *Repeated Name Penalty,* RNP) occurs, while no such penalty was observed when that same entity is realized as a pronoun.

In their Experiment 1, Gordon et al. investigated the special status of subject antecedents by comparing situations where subject and object antecedents were referred back to with a pronoun or with a name. They presented their participants with short texts in three different conditions, as shown in (1.5)-(1.7). In the first sentence, the first discourse referent *Bruno* was introduced. This entity appeared as the grammatical subject in initial position in all four sentences. In the second sentence, a second discourse referent *Tommy* was introduced. This entity appeared as the grammatical object in second position in all four sentences. In (1.5), both subject and object antecedents were referred back to using a pronoun in the two last sentences. In (1.6), the name was repeated to refer back to the object antecedent *Tommy*, while a pronoun was used to refer back to the subject antecedent *Bruno*. In (1.7), names were used to refer back to both antecedents.

The results of Experiment 1 show that reading times (henceforth RTs) for the two last sentences on the Name-Name conditions were significantly higher than on the Pronoun-Name condition. In other words, there was a bigger RNP when the subject antecedent was referred back to with a name than when only the object was referred back to with a name. The lowest RTs were elicited in the Pronoun-Pronoun condition. These results are evidence in favor of the special status of the subject in discourse processing and show that subject referents are generally preferred as antecedents over entities with other syntactic functions.

(1.5) *Pronoun-Pronoun condition*

a. Bruno was the bully of the neighborhood.
b. He chased Tommy all the way home from school one day.
c. He watched him hide behind a big tree and start to cry.
d. He yelled at him so loudly that all the neighbors came outside.

(1.6) *Pronoun-Name condition*

a. Bruno was the bully of the neighborhood.
b. He chased Tommy all the way home from school one day.
c. He watched Tommy hide behind a big tree and start to cry.
d. He yelled at Tommy so loudly that all the neighbors came outside.

(1.7) *Name-Name condition*

a. Bruno was the bully of the neighborhood.
b. Bruno chased Tommy all the way home from school one day.
c. Bruno watched Tommy hide behind a big tree and start to cry.
d. Bruno yelled at Tommy so loudly that all the neighbors came outside.

Given that the subject antecedents always appeared in initial position in the stimuli employed in Experiment 1, in their Experiment 5, Gordon and colleagues wanted to investigate whether surface position also contributes to antecedent salience by teasing apart syntactic function from order of mention. For that, they employed another reading-time experiment in which they presented participants with passages like the one in (1.8), where two referents were introduced in a first sentence, followed by a second sentence where the order of mention of these two referents is reversed. The two first sentences were followed by two possible continuations that could refer to either the subject antecedent of the preceding sentences (she=Susan) (c), or to the prepositional phrase that appears in initial position in the preceding critical sentence (his=Fred) (c'). These continuations contained either a pronoun or the proper name of the referent. At the end, participants read a final sentence.

In line with the results of Experiment 1, Gordon and colleagues predicted higher RTs for continuations that contained a proper name that refers to the (prominent) subject antecedent (Susan in example 1.8). Moreover, if being a first mention also contributes to the prominent status of a discourse entity, a RNP should also occur when a proper name, instead of a pronoun, is used to refer back to Fred, which is the first mention, although not the subject, of the preceding sentence.

(1.8) a. *Introductory sentence:* Susan gave Fred a pet hamster.
b. *Critical sentence:* In *his* opinion, *she* shouldn't have done that[2].
c. *Continuation A:* **She/Susan** just assumed that anyone would love a hamster.
c'. *Continuation B:* **He/Fred** doesn't have anywhere to put a hamster cage.
d. *Final sentence:* Giving a pet as a gift can be somewhat of an imposition.

The results of Experiment 5 show a RNP for both continuations (c and c') when they contained a repeated proper name, compared to continuations that contained a pronoun, regardless of whether the antecedent was the subject or the first mention of the preceding sentence. These results show that the initial position also contributes to prominence, independently of the subject function. Together, the results of these experiments constitute evidence for the special status of subject entities and the role they play in the choice of a referential expression and its interpretation. Crucially, these results suggest that, besides syntactic function (subject), other factors (e.g. order of mention) also contribute to the prominent status of discourse referents.

3.1.2. Subjecthood and Parallelism

Closely related to those proposals that defend the claim that syntactic function plays a major role in rendering discourse entities more prominent, the *Parallel Function strategy* (PFS) was proposed to account for the resolution pattern of pronominal forms that have a syntactic function other than subject. According to the PFS, pronouns prefer antecedents with parallel grammatical functions (Stevenson et al., 1993, 1995; Sheldon, 1974, see also Smyth, 1994 for the *Extended Feature Match Hypothesis*), that is, a subject pronoun prefers a subject antecedent, while an object pronoun prefers an object antecedent, as in (1.9). Unlike the accounts discussed in the previous section, the PFS is strictly speaking a strategy of pronoun resolution. It does not make any direct predictions regarding the factors that play a role in antecedent prominence.

(1.9) a. John hit Harry and he kicked Sarah. (he=John)
b. John hit Harry and then Sarah hit him. (him= Harry)

[2] The order of mention of the discourse entities was counterbalanced so that in half of the items *Fred* was the subject of the introductory sentence and the second mention of the critical sentence. Note, however, that the manipulation of the order of mention, which is done on the critical sentence, does not distinguish between the first introduction in discourse, which here would occur in the first sentence, from the first mention in the preceding (critical) sentence.

Crawley, Stevenson, and Kleinman (1990) investigated the predictions of the *Parallel Function strategy* against those of then *Subject bias hypothesis*. For that, they ran a self-paced reading task where participants read short texts, like the one in (1.10), which included two introductory sentences, where three different referents were introduced. The introductory sentences were followed by a critical sentence that contained two parallel SVO clauses linked by the coordinating conjunction *and.* The object in the second clause was realized as an ambiguous object pronoun. At the end, participants were asked to answer a comprehension question according to how they interpreted the pronoun. Half of the questions asked about the preceding subject referent and the other half about the preceding object referent.

Both the RTs and answers to the comprehension questions indicate that participants resolved the object pronoun as referring to the subject antecedent (Brenda) more often than to the object antecedent (Harriet). These results are taken as further evidence in favor of the *Subject Antecedent strategy* but against the predictions of the *Parallel Function strategy*.

(1.10) a. *Introductory sentence:* Brenda and Harriet were starring in the local musical.
b. *Introductory sentence:* Bill was in it too and none of them were very sure of their lines or the dance steps.
c. *Critical sentence:* Brenda copied Harriet and Bill watched *her.*
d. *Comprehension question*: Bill watched Brenda/Harriet?[3]

3.1.3. Subjecthood and pronoun type

Carminati (2002) picked up the notion of the prominent status of the subject to investigate the processing of null and overt Italian subject pronouns in intra-sentential pronoun resolution[4]. She proposes a processing hypothesis, the *Position of Antecedent Hypothesis* (PAH), based on the assumption that there is a division of labor in the processing of null and overt pronominal expressions, with the null pronoun preferring a more prominent antecedent than the overt one. She argues that, in intra-sentential pronoun resolution, antecedent prominence is determined

[3] Note that the comprehension questions included in this experiment are declarative questions. Declarative questions are commonly used in informal speech to express surprise or ask for verification. The most likely response to a declarative question is agreement or confirmation. This should not be a major shortcoming, however, given that Crawley and colleagues, after counterbalancing the referents included in the question, still found a subject-antecedent preference.

[4] Previous accounts on null *versus* overt pronoun resolution from the generative tradition go back to Chomsky's (1981) *Avoid Pronoun Principle* and Montalbetti's (1984) *Overt Pronoun Constraint* that account for the interpretation of both types of pronouns in specific syntactic environments illustrated in (i) and (ii).

(i) John$_i$ would much prefer *his*$_{*i/j}$/*PRO*$_i$ going to the movies.
(ii) Nadie$_i$ cree que *él*$_{*i/j}$/*pro*$_{i/j}$ haya ganado la lotería.
'Nobody thinks that he won the lotery'

by syntactic position, with the [Spec, IP] position (i.e. the canonical preverbal position of the subject[5]) being more prominent than other positions lower in the syntactic tree. In other words, Carminati claims that the processing of intra-sentential pronouns is guided primarily by syntactic information.

Carminati's evidence in favor of the PAH comes from a self-paced reading experiment that manipulated the structural position of the antecedent. The experiment consisted of semantically disambiguated sentences formed by a subordinate clause, introducing two human referents of the same gender, followed by a main clause starting with either a null or an overt subject pronoun that could co-refer with either the preceding subject or object, and followed by a statement that would bias the choice of referent towards the subject or towards the object. The four conditions tested in the experiment are shown in (1.11) and (1.12) below.

Carminati measured RTs for the second clause of each sentence and found a significant processing penalty (longer RTs) when a null subject pronoun was forced to retrieve an antecedent in object position (1.12b'), and similarly when an overt subject pronoun was forced to retrieve an antecedent in subject position (1.11b). Carminati takes her results as evidence in favor of the validity of the PAH for intra-sentential pronoun resolution in Italian and of the claim that antecedent prominence is determined by its syntactic position.

(1.11) *Subject-bias*

a. Quando Maria è andata a trovare Vanessa in ospedale,

b. lei le ha portato un mazzo di fiori.

b'. ∅ le ha portato un mazzo di fiori.

'When Maria went to visit Vanessa at the hospital, (she) brought her a bunch of flowers'

[5] The actual position of preverbal subjects in languages like Spanish has generated a substantial debate in the literature, with authors that claim that preverbal subjects in Spanish are hosted in [Spec, IP] (or more specifically in [Spec, TP]) (cf. Cardinaletti, 1996; Ortega-Santos, 2005; Suñer, 2003), others that claim that they occupy a left-peripheral position in the CP domain (cf. Alexiadou & Anagnostopoulou, 1998; Kato, 1999; Ordóñez & Treviño, 1999), and others who argue that preverbal subjects can occupy both positions (cf. Villa-García, 2013). For the purposes of our study, however, the important distinction with regard to our experimental items is whether or not the subject antecedent is *preverbal* (be it in [Spec, IP/TP] or higher up in the syntactic tree) in a canonical SVO structure (i.e. it comes in first place and is susceptible to being interpreted as the topic of the utterance), as opposed to the object antecedent that comes after the verb. Properties of "subjects" in other positions (e.g. postverbal) may play a role in pronoun resolution. Testing experimentally the role of postverbal subjects, for example, can be a good way of teasing apart the purely syntactic dimension of the subject function from other properties (e.g. order of mention, topichood, etc.). This is, however, beyond the scope of this dissertation.

(1.12) *Object-bias*

a. Quando Maria è andata a trovare Vanessa in ospedale,

b. lei era già fuori pericolo.

b'. ∅ era già fuori pericolo.

'When Maria went to visit Vanessa at the hospital, (she) was already out of danger'

Several subsequent studies investigated the validity of the PAH for Spanish (Alonso-Ovalle et al, 2002; Filiaci, 2010; Filiaci et al., 2013; Jegerski et al., 2011; Keating et al., 2011). Alonso-Ovalle and colleagues claim that the PAH holds cross-linguistically and is also valid for inter-sentential pronominal dependencies in Spanish. They used an offline questionnaire that required participants to identify the antecedent of subject pronouns in ambiguous sentences like (1.13).

(1.13) a. Juan pegó a Pedro. Él está enfadado.

b. Juan pegó a Pedro. ∅ Está enfadado.

'Juan hit Pedro. (He) is mad'

Their results show that, with a null subject pronoun (1.13b), participants identified the previous subject as the antecedent 73% of the time, but this preference drops to 50.2% with an overt subject (1.13a) yielding a highly significant difference. Interestingly, the results of the overt subject condition did not replicate Carminati's results for Italian, as antecedent preferences for overt subject pronouns were at chance level.

In line with the previous studies, Filiaci (2010) and Filiaci et al. (2013) tested Carminati's materials (in Italian and adapted and translated into Spanish) in a series of self-paced reading studies. Her results confirmed the cross-linguistic validity of the PAH in Spanish, but only for the subject antecedent bias for null pronouns, as Alonso-Ovalle et al.'s results suggest. As for overt subject pronouns, in Italian, the experiment yielded a significant processing penalty for sentences where an overt pronoun was forced to co-refer with the subject antecedent, confirming Carminati's results. However, the same construction in Spanish did not seem to produce any significant extra processing cost. From these results, Filiaci concluded that, while Italian overt subject pronouns seem to be a cue for switching to a less salient antecedent, Spanish overt subject pronouns do not seem to produce the same effect and are more compatible with a reading where antecedent salience is not defined in

syntactic terms exclusively. Therefore, while in Italian both null and overt subject pronouns seem to be specialized in retrieving different types of antecedents; in (Peninsular) Spanish only null subject pronouns seem to show a bias. Filiaci hypothesizes that these cross-linguistic differences between Italian and Spanish might be due to differences in their pronominal systems, the nature of the verbal morphology in the two languages and the interaction between both factors.

Beyond their specific results, the crucial contribution of these studies to the literature on pronoun resolution is their cross-linguistic nature. It is thanks to the investigation of the processes involved in the resolution of null and overt subject pronouns in languages like Spanish and Italian that we observe that, while previous studies on English subject pronouns show that subjecthood seems to be a key factor contributing to antecedent prominence and, in turn, to pronoun interpretation, the different resolution patterns for null and overt pronouns observed in these studies suggest that subjecthood alone cannot account for these results. These results question, therefore, not only the validity of the PAH, but also the generality of the subject bias.

3.1.4. Interim discussion

Summarizing, the results of the studies reviewed above seem to suggest that the human parser, in search for the antecedent of a pronoun, is guided mainly by syntactic information (i.e. the most salient antecedent, where salience is determined mainly by syntactic function, although sometimes also by the order of mention). This assumption implies that other factors do not influence speakers' antecedent preferences for a pronoun to the same extent. However, the results of overt pronouns in null subject languages suggest that syntactic function alone cannot account for all the observed resolution patterns.

Note that often, albeit not always, especially in languages like English, a referent that is the subject of a given utterance and that appears as a first-mention is also the topic of the utterance (i.e. what the utterance or sequence of utterances is about). That is the case, for example, of the stimuli employed in the studies reviewed above, as the stimuli sample in (1.5) from Gordon et al. (1993), repeated in (1.14), illustrates. In this example, *Bruno* is the subject of the first utterance, it always occupies a pre-verbal position before the second referent *Tommy,* and, crucially, it is also the topic of the discourse segment.

(1.14) a. **Bruno** was the bully of the neighborhood.
b. He chased Tommy all the way home from school one day.
c. He watched him hide behind a big tree and start to cry.
d. He yelled at him so loudly that all the neighbors came outside.

The question that arises then is, what is driving the participants' antecedent preferences? In other words, what makes *Bruno* more salient than *Tommy*? Is it its syntactic function, its order of mention, its information status, or a combination of these factors? An important limitation of the studies reviewed above is, thus, that these three factors are not adequately teased apart. Below we review a series of studies that investigate whether the observed preference for subjects and first-mentions is actually a preference for topic antecedents by investigating the role of the information status of referents in pronoun resolution. Our contribution to this body of research is presented in Chapter 3 where we also address this question by investigating how syntactic function and information status affect the resolution of null subject and object clitic pronouns in Spanish.

3.2. The role of information status in pronoun resolution

3.2.1. What is Information Structure?

The hypothesis of Information Structure (henceforth IS) (Halliday, 1967) was proposed to account for *information packaging,* that is, the fact that, in any given language, speakers have several different ways of expressing the same information without changing the content of the message (Chafe, 1976; Krifka, 2007; Lambrecht, 1994). IS refers, therefore, to changes in the morpho-syntax and/or prosody of a given utterance without implying changes in its semantic content (its truth conditions), as shown in (1.15).

(1.15) a. Peter bought a car.
b. It was Peter who bought a car.
c. PETER bought a car.

Choices in IS reflect the close link between syntactic principles and the context in which the utterance is produced (Lambrecht, 1994). When we speak, the way we phrase an utterance is influenced not only by our own mental state but also by the assumed mental states of our interlocutor(s), that is, our current representation of the ongoing discourse, as well as our beliefs about our interlocutors' current representation of the ongoing discourse. The

interaction between the structure of utterance and the mental states of speakers and hearers is the essence of information packaging.

Interestingly, however, having multiple ways to express the same meaning seems to go against the principles of language economy. Prince (1978) addressed this paradox proposing that language does not employ mechanisms that serve no purpose and that information structure must indeed serve some kind of function in human communication. Given that IS reflects the close relationship between linguistic form and the mental states of interlocutors, it is reasonable to conjecture that choices in IS render communication easier, for example, helping in language processing (Cowles, 2003).

The discussion on the packaging and the transfer of information leads inevitably to the notion of Common Ground that was initially proposed as a way to model the information that is known to be shared by both interlocutors and that is continuously updated in the course of a communicative interchange (Chafe, 1976; Krifka, 2008; Stalnaker, 2002). The notion of Common Ground is useful in establishing the distinction between *presupposed* information (or "old information") and *asserted* information (or "new information"). Lambrecht defines presupposition as "the set of propositions evoked in a sentence which the speaker assumes the hearer already knows or is ready to take for granted at the time the sentence is uttered", and assertion as "the proposition expressed by a sentence which the hearer is expected to know or take for granted as a result of hearing the sentence uttered" (Lambrecht, 1994 p. 52).

Formal dynamic approaches to IS have proposed numerous architectures or articulations to account for the facts above, namely the partition of the content of the utterance in two parts according to whether the content is anchored in the context or added to the context, i.e. informative (the presupposed/asserted, old/new distinctions). Among these proposals we find Theme-Rheme (Contreras, 1976; Halliday, 1967; *inter alia*), Topic-Comment (Gundel, 1988; Reinhart, 1981; *inter alia*), Topic-Focus (Sgall & Hajičová, 1977, 1978; *inter alia*), and Focus-Presupposition (or Focus-Open proposition, Chomsky, 1971; Lambrecht, 1987, 1988; Prince, 1981, 1985, 1986; *inter alia*). While an exhaustive analysis of each of these proposals is beyond the scope of this dissertation, it is worth pointing out that there is no consensus among these theories and frameworks about the terminology or the concepts that are appropriate for analyzing the status of the informative content of utterances.

In his dissertation, Vallduví (1990) provides a thorough analysis of the insights and shortcomings of these proposals and concludes that they are incapable of accounting for all the possible informational splits of the sentence. For example, in (1.16) the Topic/Comment account would have no problem identifying the topic and comment of both sentences.

However, this theory does not say anything about the informational split within the comment where *shirt* is focal but *Harry* is not. This shortcoming is surmounted by the Focus/Open-proposition account for which both sentences are the same since, in both of them, *shirt* is the focus that instantiate the variable in the open proposition "she gave x to Harry". This theory, therefore, captures the fact that *Shirt* and *Harry* belong to two distinct informational units. Concerning the position of 'to Harry' in the examples in (1.16), the Topic/Comment proposal considers *Harry* topic in (b) but not in (a), the Focus/open-proposition, on the other hand, cannot account for this difference.

(1.16) a. $[\text{She}]_{\text{Topic}}$ [gave the SHIRT to Harry]$_{\text{Comment}}$.
b. $[\text{To Harry}]_{\text{Topic}}$ [she gave the SHIRT]$_{\text{Comment}}$.

Based on these facts, Vallduví proposes an architecture whereby the sentence is informationally articulated into a trinominal hierarchical structure consisting of the Focus and the Ground, while the latter is further subdivided into the Link and the Tail, as in (1.17). This articulation reflects both the traditional focus-background split and the fact that within the ground there often is a special topic-like element, the link, which appears in sentence initial position.

(1.17) a. S = {FOCUS, GROUND}
b. GROUND = {LINK, TAIL}

In Vallduví's proposal, the Focus corresponds to the focus in previous accounts. It constitutes the only informative part of the sentence (cf. Halliday, 1967). It constitutes the only contribution to the hearer's knowledge-store at the time of the utterance and, therefore, is the only part of the sentence that cannot be omitted. The focus of the sentence is operationally identified by context with the usual mechanisms about givenness/newness and thanks to being intonationally prominent.

The Ground is the complement of the Focus and is equivalent to the presupposition or the background in previous proposals. Vallduví describes the ground as a 'vehicular frame' for the focus, in that it guarantees that information enters into the hearer's knowledge-store in the appropriate manner, indicating to the hearer when and how the information must be entered. Unlike the Focus, the ground does not contribute to the hearer's knowledge-store, as it contains knowledge that the speaker assumes that the hearer already possesses. The

sentence might not have a ground (all-focus sentence). The ground is further divided into the Link and the Tail.

The Link is equivalent to the sentence-initial topiclike expression (Sentence Topic) in previous proposals (e.g. Theme-Rheme, Topic-Comment). It performs the task of 'address pointer' with the informative part of the sentence. Links are sentence initial. The Tail is the complement of the Link within the Ground. It performs a more specific task regarding the exact way in which information is retrieved and entered under a given address. According to Vallduví, the tail "may be viewed as an element that acts as a signaling flag to indicate exactly how the information carried by the sentence must be entered under a given address" (p. 61).

Before concluding the description of IS, we need to address a crucial point for the purposes of the present dissertation: in the formal analysis of the notion of information, a distinction has to be made between discourse entities or referents and propositional content, that is, the *information* about these entities (Beyssade et al., 2004; Lambrecht, 1994). Lambrecht (1994) addresses this distinction by pointing out that the notion of 'new information' (or informative content) should not be confused with that of 'new Discourse Referent'. He argues that "what gives a Focus constituent its flavor as a 'new' element is not the status of its denotatum in the Discourse but its relations to the asserted proposition at the time of the utterance. Focus and inactiveness are independent information-structure parameters" (p. 261). Regarding the discourse status of discourse referents (henceforth DR), Lambrecht distinguishes between three activation states (adapted from Beyssade et al., 2004):

1. **Active** DRs are inferable from the Given content. The Given content (G) is conceived of as an open proposition. A DR x associated with the predicate Q is active if (1.18) is verified, where CL(G) denotes the existential closure of this proposition.

(1.18) $CL(G) \Rightarrow \exists x\, Q(x)$

2. **Accessible** DRs are DRs that are introduced in one of the propositions (P_i) making up the discourse topic (DT) or inferable from the discourse topic. A DR is accessible if (1.19) is verified.

(1.19) $\bigcap_i \in DT\ P_i \Rightarrow \exists x\, Q(x)$

3. **Inactive** DRs are DRs that are not present in the context shared by the interlocutors, that is, they have not been introduced. They are part of the Focus part of propositional content of an utterance.

Putting together the information articulation of the utterance –Ground/Focus –with the discourse status of DRs –active, accessible, inactive –, the clear prediction is that active and accessible DRs will be part of the Ground, while inactive DRs will be contained in the informative part of the utterance, i.e. the Focus.

3.2.2. Working definitions of topic and focus

In order to be consistent with the psycholinguistic literature and for presentational purposes, in the remainder of the present dissertation we will be talking about *topic – focus* and *topic referents – focus referents.* However, it should be kept in mind that when we talk about propositional content, the notion of topic corresponds to Vallduví's Ground, while when we refer to the information status of DRs, a topic referent would be equivalent to Vallduví's Link.

Below, we provide working definitions of topic and focus summarizing their main characteristics that will be useful for the discussion of previous experimental studies on their role in pronoun resolution.

The topic of a sentence is what the sentence is about (Krifka, 2008; Lambrecht, 1994; Reinhart, 1981). In other words, the topic of an utterance is that part which has information added to it, what that information is about. While this "aboutness" feature is the most important characteristic in the definition of topichood, being *given* or *discourse-old* or *presupposed* are also usually associated with the topic status. These features refer to the fact that a topic entity is available in the current discourse representation of the speaker or hearer. Thus, there are two key properties concerning the mental status of topics: *aboutness* and *accessibility*, in other words, the mental status of a topic is one in which it is perceived to be what the current proposition is about and, thus, is highly accessible. These facts have clear implications in the choice of referential expressions in discourse (cf. the theories discussed in section Section 2): the reference form of a discourse entity can reflect its current mental status, which in turn can reflect its information status. Summarizing, the information status of topic corresponds to a referent that has the following properties in terms of its status in the

mental representations of interlocutors: it is easily accessible, presupposed to exist, and it is seen as what the proposition expressed by the utterance is about.

Topic expressions appear to be strongly associated with syntactic subject function (in preverbal position) in languages like English. However, they should not be confounded as there is evidence in favor of a separate grammatical topic position, like, for instance, the fact that in an utterance it is possible to have a grammatical subject without having a topic. Moreover, there are languages with a specific topic position (e.g. Hungarian) or with a specific topic marker (e.g. Japanese). A test to identify topic is, for example, that a paraphrase of the sentence with "speaking of X", "as for X", or "about X" must be felicitous if X is the topic of the utterance. We will come back to the issue of topic marking in Chapter 3 where we provide a more detailed description of the structures used to operationalize topichood in our experiments.

The focus of a sentence corresponds or contributes to the assertion made about the topic. Focus can be realized via prosody in languages like English and German, but also in French (Beyssade et al., 2009) and in Spanish (Hualde, 2005). However, while a single word or part of a word carries the main prosodic stress of a sentence, the focus constituent can be much larger than that word. Focus elements can be easily identified in the answer to a preceding wh-question. Additionally, there are certain syntactic constructions that have been argued to mark particular constituents as focus: clefts –pseudo-clefts and it-clefts –are among such structures (Prince, 1978; Chafe, 1976). We will come back to this in Chapter 3 where we provide a more detailed description of the structures used to operationalize focus in our experiments.

3.2.3. The role of the information status in pronoun resolution: Evidence from psycholinguistic studies

Keeping in mind these working definitions of topic and focus, in this section, we discuss experimental work done on the role of information status (topic and focus) of discourse referents on reference resolution. The notion of topichood has attracted a great deal of attention in the psycholinguistic literature, as many of the factors commonly associated with prominence are also associated with topicality: the entity the utterance is about, i.e. the topic, is usually the subject of the sentence, the agent of the action, and it is, especially in languages like English, often mentioned first in the utterance. Not surprisingly, given the information articulation of the sentence discussed above, research on the effects of topic on pronoun resolution has inevitably led to the investigation on the role of focus in pronoun interpretation,

in particular, on whether focus brings about comparable effects on antecedent salience than topic.

The studies we review below investigate, on the one hand, the effects of topic and focus on pronoun resolution, and on the other hand, whether discourse prominence can be partially or completely accounted for in terms of topicality.

3.2.3.1. Topic and focus contribute to antecedent prominence

Arnold (1998) provides evidence for the special cognitive status in discourse of topic and focus antecedents in two experiments. In a first experiment participants were asked to read three-sentence discourse sequences, as in (1.20)-(1.22), and to rate them for naturalness on a seven-point scale. In these sequences, two referents are introduced in the second sentence, in two different conditions: topic (1.21a) and focus (1.21b). This sentence was followed by a third sentence in four different versions according to whether the sentence refers back to the topic (1.22c,d) or the focus (1.22a,b) antecedent in the previous sentence, and to whether this is done by means of a pronoun or a repeated proper name. Arnold's prediction is that, given that topic antecedents are usually referred back to by means of a pronoun, the condition where the topic (*Ann*) is realized as a repeated name (1.22d) should be rated less natural than when this is done by means of a pronoun (1.22c). Crucially, if focus also contributes to antecedent prominence, the same pattern should be observed in the focus conditions (i.e. 1.22b rated less natural than 1.22a). If not, no difference between the two focus conditions should be observed.

The results of the experiment confirmed Arnold's predictions showing that participants rated more natural continuations that included a pronoun when this referred to both the topic (*Ann*) and the focus (*Emily*) antecedents in the previous sentence than continuations that included a repeated name. When the third sentence referred to the non-topic or the non-focus in the preceding sentence, they preferred continuations with a full name to continuations with a pronoun (i.e. participants rated more natural when (1.21a) was followed by (1.22b,c) to (1.22a,d), and, likewise, they rated more natural when (1.21b) was followed by (1.22a,d) to (1.22b,c)).

(1.20) *Introductory sentence:*

The guests were nervously standing around in the living room, trying to decide which person to talk to.

(1.21) *Second sentence:*

a. **Ann** decided to say hi to Emily first.

b. The one Ann decided to say hi to first was **Emily**.

(1.22) *Third sentence:*

a. She looked like the friendliest person in the group.

b. Emily looked like the friendliest person in the group.

c. She hated to be in a room full of people where no-one was talking.

d. Ann hated to be in a room full of people where no-one was talking.

In a second experiment, Arnold investigated whether topic and focus have the same effect on pronoun resolution in contexts where there is a clearly established discourse topic. Participants were asked to read short texts like those in (1.23) and, at the end of each text, to add a naturally sounding continuation sentence. In the sequence, the discourse topic (*Ron*) is introduced in the first two sentences, followed by a third sentence where a second referent (*Kysha*) is introduced as the subject of a pseudo-cleft construction (1.23c)[6] or as the object of a canonical SVO construction (1.23c').

The results show that participants gave continuations with pronouns almost always to refer to the discourse topic (*Ron*). In contrast, they used full names mainly to refer to the focus referent (*Kysha*), both when it was the object (1.23c') and when it was the subject of the cleft construction (1.23c).

(1.23) a. **Ron** was looking through his address book, trying to make up his mind.

b. **He** had an extra ticket to the opera, but he didn't know which friend to invite.

c. The one **he** decided on at last was Kysha.

c'. At last **he** decided on Kysha.

Put together, the results of both experiments suggest that topic and focus contribute to antecedent salience. In other words, topic and focus referents enjoy a special cognitive status in the interlocutor's mental model and they are preferentially taken as antecedent of pronominal expressions. However, Arnold's results also suggest that topichood might have different effects at the utterance level and at the discourse level: while the effects of sentence

[6] The analysis of the subject function in this type of cleft constructions is subject to debate. This, however, has no bearing on the study under discussion.

topics seem to be on a par with those of focus, in contexts containing a clearly established discourse topic, the focus referent does not seem to be as prominent as the topic referent. Arnold concludes that "salience is a competitive property, such that the salience of one referent is sensitive to the salience of other competing referents in the discourse" (Arnold, 1999: 30).

Cowles (2003) and Cowles et al. (2007) obtained somewhat similar results to those reported in Arnold (1998). Cowles and colleagues presented participants with spoken passages consisting of 3 sentences, as in (1.24)-(1.26). These passages included a "more prominent" subject referent (*Anne*) that could be the discourse topic (1.24), the sentence topic (1.25), or the focus of a (pseudo-)cleft constructions (1.26), and that could appear in initial position (conditions shown in b) or later in the sentence (conditions shown in b'), and a second "less prominent" object referent (*Sarah*). Both referents were syntactically and semantically plausible antecedents of an ambiguous pronoun that appeared in the final sentence (c). After encountering the pronoun, participants were asked to name a visually presented target that was related to one of the two referents. Reaction times were collected as a measure of antecedent activation in the participants' mental model of the discourse sequence.

(1.24) *Discourse Topic*

a. **Anne** wanted to see the new movie with Sarah.

b. So, **Anne** called Sarah.

b'. When Sarah came home, **Anne** called.

(1.25) *Sentence Topic*

a. A new movie opened in town.

b. So, **Anne** called Sarah.

b'. When Sarah came home, **Anne** called.

(1.26) *Focused subject*

a. A new movie opened in town.

b. It was **Anne** who called Sarah.

b'. The one who called Sarah was **Anne.**

c. *Final sentence:* But later that night, she couldn't go to the movie after all.

Their results show that targets related to the "more prominent" subject antecedent *Anne* were named faster than those related to the "less prominent" object antecedent *Sarah*,

and this was regardless of whether it was a discourse topic, a sentence topic or a clefted focus, and of whether it was a first- or second-mention. These results suggest that, while order of mention does not seem to affect antecedent accessibility, the discourse status of the antecedent (topic/focus) seems to have a major effect. In particular, despite their semantic/pragmatic differences, discourse/sentence topic and focus seem to have similar effects of boosting antecedent salience.

Summarizing so far, the results reported in Arnold (1998), Cowles (2003) and Cowles et al. (2007) suggest that both topic and focus seem contribute to antecedent prominence. Furthermore, Arnold's results indicate that there might be a difference in how topic exerts its effects at the level of the utterance and at the level of the discourse: discourse topics seem to be more prominent than sentence topic.

3.2.3.2. Cross-linguistic evidence

The studies reviewed in the previous section (and most of the studies in the literature) investigate the role of information structure in pronoun resolution in English and they find that topic and focus, regardless of their informational structural differences, render discourse entities cognitively more salient in the participant's discourse model making them the preferred antecedent for a subsequent pronoun. In this section, we review a series of studies that investigate how topic and focus affect pronoun resolution in languages other than English.

Ellert (2013) uses two Visual-World eye-tracking studies to investigate the role of topic and focus and word order in the resolution of the German personal pronoun *er* and demonstrative pronoun *der*. In Experiment 1, the experimental items followed a canonical comparative structure, where the subject is mentioned first and constitutes the topic of the sentence, as in (1.27). In Experiment 2, the experimental items followed a non-canonical comparative structure, where the subject is the focus of the sentence and appears in a second position, as in (1.28). Participants listened to the sentences while they look at a visual display containing images of the two objects mentioned in the sentence and of a third unmentioned object. Eye movements to these images at the moment participants hear the pronoun are taken as an indicator of resolution preferences.

The eye-movement data for Experiment 1 show that the two pronominal forms serve different functions when they follow canonical topic-first structures (1.27), in that the personal pronoun *er* prefers first-mention topical antecedents and d-pronouns *der* second-mentioned non-topical antecedents. However, after non-canonically marked topic-focus

structures (1.28), both pronouns had similar functions, namely an overall preference towards the second-mention focused entity.

(1.27) [Der Schrank]$_{TOP}$ ist schwerer als der Tisch. Er/Der stammt aus einem Möbelgeschäft in Belgien.
'The cupboard is heavier than the table. It [p/d] comes from a furniture store in Belgium'

(1.28) Schwerer als der Tisch ist [der Schrank]$_{FOC}$. Er/Der stammt aus einem Möbelgeschäft in Belgien.
'Heavier than the table is the cupboard. It [p/d] comes from a furniture store in Belgium'

From these results Ellert concluded that, as was previously found for English, topic and focus contribute to antecedent salience equally. Interestingly, this seems to be true even when the focus antecedent is a second-mention in a non-canonical structure (note that in most of the studies in English reviewed above focus is marked by means of clefting).

Frana (2008) and Runner and Ibarra (in press) also tested the effects of topic and focus on the resolution of different types of pronoun and obtained similar results to those in Ellert (2013). Specifically, both studies investigate whether Carminati's *Position of Antecedent Hypothesis* can be better explained in terms of the antecedent's syntactic function, as Carminati defends, or of its information status. Frana ran a questionnaire study with sentences like those in (1.29) in Italian where there is an introduction sentence that states the discourse topic *la signora Rossi* (a), followed by another sentence that introduces a second referent *Maria* and also makes referent to the topic through an object clitic pronoun (b) or a repeated name (b'). Participants were instructed to read the sentences and answer a question asking for their interpretation of the (null/overt) pronoun.

The results of the experiment show that participants chose the subject (Spec-IP) antecedent *Maria* for *pro* only 35% of the time in the clitic condition, but 71% of the time in the repeated name condition. Overt pronouns, on the other hand, were preferably interpreted as referring to the name in the object position *la signora Rossi* in both conditions, as predicted by Carminati's PAH. Frana argues that these data show that the preference for Spec-IP (subject) antecedents exhibited by *pro* is due to a more general preference for prominent discourse entities: when Spec-IP does not host the current Topic, the preference for this position is significantly reduced. The overt pronoun, however, showed a general preference

for the object antecedent (repeated name in the lower syntactic position), as generally predicted by Carminati's PAH.

(1.29) a. **La signora Rossi** è una persona molto maleducata che non merita alcun riguardo.

b. Quando Maria **la** incontra per strada, (*pro*/lei) fa sempre finta di non vederla.

b'. Quando Maria incontra **la signora Rossi** per strada, (*pro*/lei) fa sempre finta di non vederla.

'Mrs. Rossi is a very rude person who does not deserve any regard. When Maria sees her/Mrs. Rossi in the street, *pro*/she always pretends not to see her.'

Runner and Ibarra's results also constitute evidence both in favor Carminati's PAH but only for null subject pronouns, as other studies have found before. In a questionnaire study they tested participants' antecedent preferences for null and overt subject pronouns in Spanish. For that, they employed question-answer pairs, like those in (1.30)-(1.32), where they manipulated the syntactic function and the information status of the first-mention referent in the answer (b), which could be given (topic) or new (focus) information. Participants read the short dialogs and then had to decide who the (null/overt) pronoun in the final sentence made reference to.

The results show that participants preferred the topic antecedent *Elena* 65% of the time with *pro,* and 50% of the time with the overt pronoun. The difference between both types of pronouns disappeared in the other two conditions where there was a general preference for the focused antecedent, regardless of their syntactic function. The results of the subject-given condition are in line with previous findings in Spanish that find that Carminati's PAH seems to make the right predictions for null subject pronouns but not for overt subject pronouns where preferences are usually at the chance level (cf. Alonso-Ovalle et al., 2002; Filiaci, 2010). Taken together, these results show that pronouns prefer antecedents that enjoy a certain discourse prominence, regardless of their syntactic function. Note, however, that syntactic function was not manipulated in the topic condition, where topic antecedents were always the subject (and first-mention) of the sentence.

(1.30) *Subject-given (topic):*

a. ¿Dónde encontró Elena a María?
'Where did Elena find María?'

b. Elena la encontro en la calle.
'Elena found her in the street.'

(1.31) *Subject-new (focus):*

a. ¿Quién encontró a María?
'Who found María?'

b. Elena la encontró.
'Elena found her.'

(1.32) *Object-new (focus):*

a. ¿A quién encontró Elena?
'Who did Elena find?'

b. A María encontró.
'María (she) found.'

Final sentence: Ella/*pro* estaba saliendo de la tienda.
'She/pro was getting out of the store.'

Summarizing, the studies discussed in the section constitute cross-linguistic evidence for the antecedent-enhancing effects of topic and focus in pronoun resolution. These results are in line with results from previous studies on English (cf. Arnold, 1998; Cowles, 2003; Cowles et al., 2007). Furthermore, the results of studies on Italian and Spanish suggest that the division of labor in the processing of null and overt subject pronouns according to which null pronouns prefer "more prominent" subject antecedents, while overt pronouns prefer "less prominent" non-subject antecedents (cf. Carminati's PAH), might be better explained in information structural terms.

3.2.3.3. Back to basics: teasing apart syntactic function and information status

The psycholinguistic studies reviewed so far provide evidence that topic and focus contribute to antecedent prominence. This is true for English as well as for other languages like German and Spanish. Note, however, that, although order of mention was manipulated as a variable in some of the studies reviewed above, topic (and for the most part also focus) antecedents were always the subject of the utterances. While this does not necessarily question the finding that

topic contributes to antecedent prominence, the results of the studies above cannot answer the question of whether this effect is independent from syntactic function, or if it is in fact a combination of both factors, or, in those context where topichood and subjecthood are differentiated, which one contributes to prominence to a greater extent. The studies below address these questions.

Kaiser (2011) uses two Visual-World eye-tracking experiments to test the effects of topichood and subjecthood (Experiment 1) and of contrastive focus (Experiment 2) in pronoun interpretation. Kaiser operationalizes topichood by means of two factors that are closely related to the notion of topic: givenness and pronominalisation. As we already discussed, topic entities constitute given or discourse-old information, and they tend to be subsequently realized as pronouns, as evidenced by the Repeated Name Penalty observed in some of the studies discussed above.

In Experiment 1 participants listened to narratives like those in (1.33)-(1.34), while they were shown a visual display in relation to those narratives. The narratives consisted of four sentences and appeared in two conditions, according to the syntactic function (subject/object) and nature (full name/pronoun) of the antecedent in the second sentence for an ambiguous pronoun in the third sentence. In one condition (1.33), the topic of the first sentence (*Greg*) is the subject of the second sentence and it is realized as a pronoun. The discourse-new object antecedent (*John*) is realized as a full name. In the other condition (1.34), the topic of the first sentence (*Mike*) is the object of the second sentence and it is realized as a pronoun. The discourse-new subject antecedent (*John*) is realized as a full name. Participants were instructed that some of the statements made in the narratives did not match the picture, in which case they were to click on the region of the picture that contained the error. Picture selections for error detections were taken as an offline measure of participants' final interpretations of the ambiguous pronoun. Eye movements at the point in which participants encountered the ambiguous pronoun in the third sentence were recorded and taken as a measure of their interpretation preferences.

While the offline data revealed an overwhelming subject-antecedent preference across conditions, this pattern was only observed in the condition in (1.33) where the subject antecedent (*Greg*) is discourse-old and pronominalized. Interestingly enough, however, the eye movement results for the condition in (1.34) showed competition between the subject antecedent (*Mike*) that is subsequently pronominalized in object position and the subject, non-pronominalized, discourse-new antecedent (*John*), suggesting that, at least at a certain point

during processing, both factors (givenness/pronominalisation and subjecthood) seem to be equal in strength.

(1.33) *Subject=pronoun, Object=name*

a. **Greg** is always very supportive of others.

b. **He** congratulated John enthusiastically yesterday.

(1.34) *Subject=name, Object=pronoun*

a. **Mike** did very well in last month's tennis tournament.

b. John congratulated **him** enthusiastically yesterday.

c. The prizes for the best-ranked tennis players were about to be announced, and he was holding a new yellow tennis racket.

d. Everyone was in a good mood that day.

Experiment 2 investigated how contrastive (or corrective) focus interacts with subjecthood and givenness/pronominalisation. Using the same experimental paradigm as for Experiment 1, the experimental materials for Experiment 2 were narratives, like those in (1.35), where the potential topic (*Greg*) and focus (*John*) antecedents for the ambiguous pronoun could be the subject or the object of the sentence, be realized as a full name or as a pronoun, and be embedded in a canonical structure or in a cleft structure.

(1.35) a. Speaker A: I heard that **Greg** congratulated Mike enthusiastically yesterday.

b. Speaker B: No, that's not quite right.

(i) **He** congratulated John. [*Canonical-Object=focus*]

(ii) John congratulated **him**. [*Canonical-Subject=focus*]

(iii) It was John that **he** congratulated. [*Cleft-Object=focus*]

(iv) It was John who congratulated **him**. [*Cleft-Subject=focus*]

c. The prizes for the best-ranked tennis players were about to be announced, and he was holding a new yellow tennis racket.

d. Everyone was in a good mood that day.

Both the offline and the eye-movement data from Experiment 2 show a clear preference for the subject antecedent of the preceding sentence regardless of whether it is a full name, a pronoun, focused in a canonical structure or in a cleft structure. In other words, in those conditions where the focus entity is also the subject, (ii) and (iv), it is preferred as

antecedent over the given, discourse-old, pronominalized topic antecedent. Likewise, in those condition where the focus entity is the object, (i) and (iii), the preferred antecedent is the (given, discourse-old, pronominalized) subject antecedent.

Kaiser concludes that subjecthood, givenness/pronominalisation (=topichood), and focus all contribute to antecedent prominence, and thus, affect pronoun resolution. Kaiser's crucial finding is that subjecthood exerts an effect on antecedent prominence independent from that of topichood in contexts where both factors are teased apart. About this, she argues that "the finding that subjecthood and pronominalisation have separable effects means that the discussions of topicality need to keep its multifactorial nature in mind" (Kaiser, 2011: 1659). Furthermore, she claims that the finding that topic and focus have similar cognitive underpinnings rendering antecedents more salient for subsequent referential expressions despite their information structural differences suggests that salience needs to be conceptualized "as a phenomenon that emerges from a wealth of diverse ingredients" (Kaiser, 2011: 1659).

Colonna et al. (2012, 2014) ran a series of questionnaire and Visual-World eye-tracking studies where they investigated the role of syntactic function and information status in pronoun resolution in French and German and obtained somewhat different results from the studies reviewed so far. Their experimental materials manipulated the information status of the antecedents (topic, which was operationalized by means of left-dislocation vs. focus, which was operationalized by means of it-clefts) and their grammatical function (subject vs. object) in sentences like those in (1.36). Contrary to the studies reviewed so far in this section (with the exception of Frana, 2008), these materials constitute a change in the domain of resolution, as they investigated intra-sentential pronoun resolution, that is, the antecedent and the pronoun were in two different clauses within the same sentence.

Both the offline and eye-tracking results yielded interesting cross-linguistic differences in the baseline conditions: a general subject-antecedent preference in German, and a general object-antecedent preference in French. Colonna and colleagues argue that these differences might have to do with the existence of alternative non-ambiguous constructions, such as the participial construction in French (*Pierre a giflé Jean étant jeune*). Crucially, these baseline preferences were significantly altered as a consequence of the manipulations of topic and focus structures: in both languages there was a significant increase in the number of choices of and fixations on the NP1-antecedent when it was a left-dislocated topic, and irrespective of its syntactic function (subject or object). Crucially, however, choices of and fixations on the NP1-antecedent were significantly reduced in the cleft constructions with

respect to the baseline conditions. In other words, there was a general dispreference for focused antecedents –what the authors refer to as an *anti-focus effect* –opposed to the general preference for left-dislocated topics.

(1.36) a. *Baseline:*
Pierre a giflé Jean quand il était jeune.
'Pierre slapped Jean when he was young.'
b. *NP1 subject and topic:*
Quant à Pierre, il a giflé Jean quand il était jeune.
'As for Pierre, he slapped Jean when he was young.'
c. *NP1 object and topic:*
Quant à Jean, Pierre l'a giflé quand il était jeune.
'As for Jean, Pierre slapped him when he was young.'
d. *NP1 subject and focus:*
C'est Pierre qui a giflé Jean quand il était jeune.
'It was Pierre who slapped Jean when he was young.'
e. *NP1 object and focus:*
C'est Jean que Pierre a giflé quand il était jeune.
'It was Jean who Pierre slapped when he was young.'

In line with previous experiments, the results of this experiment indicate that the information status of the antecedent influences the choice of antecedent and that French and German speakers also prefer to interpret a pronoun as co-referential with the topic of the utterance. Critically, the results for focus do not concord with previous results that find a strong preference for focus antecedents. This seems to be true at least in intra-sentential contexts (recall that all the studies reviewed above that investigated the role of focus in pronoun resolution did so inter-sententially). Colonna and colleagues argue that these results show that, in a dynamically updated discourse representation, at the moment the pronoun is processed, the information status of the clefted antecedent might not be the same between and within sentences. This *anti-focus effect* in intra-sentential pronoun resolution attested by Colonna and colleagues will be of central importance in the present study and we will come back to it in the following sections.

Summarizing, the results of the studies reviewed above constitute further evidence that topic and focus contribute to antecedent prominence. In addition to this, these studies yield

two major findings: the first finding is that syntactic function (subjecthood) can exert its effect on antecedent prominence independently from topichood. In fact, Kaiser's results show that a focus antecedent that is the subject of the sentence is preferred as the antecedent of an ambiguous pronoun over the topic antecedent. This finding suggests that multiple factors do indeed contribute to antecedent prominence and that these factors will exert their effects differently in different contextual circumstances. In relation to this last claim, the second crucial finding from these studies is that the domain of resolution is a key factor in the investigation of pronoun interpretation. Evidence for this comes from the observed divergent effects of focus by clefting in these studies: while participants preferred focus antecedents in a previous sentence, that is, across sentence boundaries (cf. Kaiser's results), they seemed to generally dispreferred focus antecedents in the same sentence (cf. Colonna et al.'s results). This second finding will be of central importance for the purposes of the present dissertation.

3.2.4. Interim discussion

Studies on the role of information status in pronoun resolution suggest that factors like syntactic function and order of mention on their own cannot explain the observed patterns of results, contra the predictions of the purely syntactic accounts that guided the studies reviewed in the preceding section. The information status of a discourse entity, i.e. being the topic or the focus of the utterance, also contributes to antecedent prominence rendering them more accessible in the interlocutors' mental representation of the discourse. However, while topic and focus antecedents seem to enjoy a special status in the participants' discourse model, information status alone cannot explain all the interpretation patterns in the studies above either. In particular, we observe that, when we take the domain of resolution into account, focus antecedents do not enjoy the same prominent status when resolution occurs within a sentence as when it occurs across two sentences. These results are compatible with a scenario where multiple factors contribute to antecedent prominence and where the effects they exert vary as a function of the domain of resolution.

The theories on the choice of referential expression and antecedent accessibility discussed in section 2 agree that prominent antecedents tend to be subsequently referred back to by means of pronouns, and likewise, that pronouns prefer prominent referents as their antecedents. From the point of view of psycholinguistic experimentation, we have seen that many factors have been claimed to contribute to antecedent prominence. These factors, which for the most part fall at the level of the utterance, pertain to syntax, semantics, and information structure.

Crucially, however, the notion of antecedent prominence, where prominence comes from the multiple factors we have discussed thus far, cannot explain all the facts out there. Consider, for example, the sentences in (1.37) taken from Winograd (1972).

(1.37) a. The city council denied the demonstrators the permit because they feared violence.

b. The city council denied the demonstrators the permit because they advocate violence.

In these examples the pronoun *they* can refer to either of the two potential antecedents *the city council* and *the demonstrators*. Most of the accounts and studies discussed so far would predict a general preference for the subject/first-mention/topic antecedents that would lead readers to interpret *they* as co-referential with *the city council* in both sentences. Crucially, however, while this preference seems to work with sentence (a), the same strategy renders sentence (b) semantically inappropriate: any reader would have no problem in understanding that it is the demonstrators who advocate violence and that is the reason why the city council denies them the permit. We discuss these facts in more detail in the following section.

4. Coherence relations

The examples in (1.37) are evidence in favor of a coherence-driven account whereby, beyond notions like subjecthood or topicality, the mechanisms supporting pronoun interpretation are driven predominantly by semantics, world knowledge and inference, focusing on how these are used to establish the coherence of a discourse (Hobbs, 1979). Note that the study of the role of coherence relations in pronoun resolution constitutes a major change of paradigm: while most of the factors discussed so far fall at the level of the utterance, coherence relations pertain to the level of the discourse.

The coherence-driven account is based on the fact that, when we comprehend a discourse, we do not merely interpret each utterance within it but we also attempt to recover ways in which these utterances are related to one another. Kehler (2002) uses the examples in (1.38) to illustrate this point.

(1.38) a. John took a train from Paris to Istanbul. He has family there.
b. John took a train from Paris to Istanbul. He likes spinach.

In most discourse situations, we will likely infer that John's having family in Istanbul is the reason for his taking the train there. We have inferred a cause-effect relationship between both sentences. This relationship is not as obvious in sentence (b). However, as Hobbs (1979) suggests, one could also come up with a scenario that would make sentence (b) coherent (e.g. Istanbul is known for having the best spinach in the world). The fact that people infer such relationships when interpreting passages, and that they can come up with assumptions that would render such inferences for passages like (b) felicitous, illustrates that the need to establish coherence is a central mechanism in language comprehension (Hume, 1748).

From the point of view of dynamic semantic/pragmatic approaches to meaning, which analyze meaning at a dialogue/discourse level (e.g. Ginzburg, 2012; Roberts, 1998, 2012; Stalnaker, 1978), the source of discourse coherence is explained by the fact that discourses are functionally structured by accommodating question/answer relations, or Questions Under Discussion (QUDs) (Carlson, 1983; Ginzburg, 1996, 2012; Kehler, 2012; Roberts, 1996). The notion of QUD is based on Collingwood's (1940) proposal that "every statement that anybody ever makes is made in answer to a question". QUD tells you what the discourse is 'about' at a given point and "where the discourse is going" (Roberts, 2012). Understanding a discourse, therefore, requires that interpreters not only understand the particular utterances in the discourse, but also situate them in the underlying *Strategy of Inquiry*. In other words, to understand the coherence relations among utterances, we infer and accommodate the QUD to which an assertion is relevant. The QUD can be the general goal proposed by Stalnaker (1978): to discover "the way things are", in cases where there is no specific domain question. This would explain why discourse-initial utterances that constitute all-new information can be felicitous. In the examples in (1.38) the interpreter has no problem accommodating the QUD {Why?} to establish the coherence relation between both sentences.

Regarding the role of coherence relations in pronoun resolution, Hobbs (1979) puts forward a coherence-driven account that claims that pronoun resolution is not governed by an independent mechanism but comes rather as a by-product of more general reasoning processes about the most likely interpretation of an utterance during the establishment of coherence relations. Based on Hobbs' proposal, Kehler (2002) argues for a more moderate coherence-driven theory of discourse processing and argues that the pronoun resolution

preferences and strategies commonly encountered in the psycholinguistics and computational linguistics literatures are epiphenomena of the strategies by which discourse coherence is established. Based on Hobbs' (1990) proposal, Kehler (2002) proposes a typology of the coherence relations that belong to one of three classes or exemplars: an Occasion relation, a Parallel relation, and an Explanation relation. According to Kehler, these categories differ in two main aspects: the type of arguments over which the coherence constraints are applied, and the types of inference processes used to establish them.

In the *Occasion* relation (1.39), the reader infers a change of state for a system of entities from the assertion in the second clause/sentence, establishing the initial state for this system from the final state of the assertion in the first clause/sentence. In the *Parallel* relation (1.40), the reader infers $P(a_1, a_2, \ldots)$ from the assertion of the first clause/sentence and $P(b_1, b_2, \ldots)$ from the assertion of the second clause/sentence, for a common P and similar a_i and b_i. Other types of Parallel relations are Contrast (*but*), Exemplification (*for example*), Generalization (*in general*), Exception (*however, nonetheless*), Elaboration (*that is*). Finally, in the *Explanation* relation (1.41), the reader infers P from the assertion in the first clause/sentence and Q from the assertion in the second clause/sentence, where normally Q → P. Other types of Cause-Effect relations are Result (*and (as a result), therefore*), Violated Expectation (*but*), Denial of Preventer (*even though, despite*). As these examples show, the establishments of these coherence relations affects the way pronouns are interpreted.

(1.39) **Occasion**: Bush narrowly defeated Kerry, and special interests promptly began lobbying him. [=Bush]

(1.40) **Parallel**: Bush narrowly defeated Kerry, and Romney absolutely trounced him. [=Kerry]

(1.41) **Explanation**: Kerry quickly demanded a recount because Bush narrowly defeated him. [=Kerry]

4.1. Testing the coherence-driven account against other interpretation biases

4.1.1. Coherence-driven account vs. syntactic biases

Wolf et al. (2004) and Kehler et al. (2008) provide empirical evidence for Kehler's (2002) theory by evaluating this coherence-driven analysis with respect to previously proposed pronoun interpretation biases and argue that the coherence-driven analysis can explain the underlying source of the biases and predict in what contexts specific biases will surface.

Wolf et al. (2004) test the predictions of the coherence-driven hypothesis against both the syntactic subject and the syntactic function parallelism preferences. For that, they run a reading time experiment that manipulated the coherence relation holding between propositions (Parallel 'and similarly' vs. Result 'and so') and the gender of the pronoun (masculine vs. feminine) in sentences like those in (1.42).

(1.42) a. Fiona complimented Craig and similarly James congratulated her/**him** after the match, but nobody took any notice.
b. Fiona defeated Craig and so James congratulated **her**/him after the match, but nobody took any notice.

In the Parallel conditions, faster reading times (RTs) were elicited when the antecedent was in a parallel grammatical role than when it was not. In the Result conditions (where stimuli where semantically biased towards a non-parallel antecedent), faster RTs were elicited for non-parallel antecedents. These results confirm that the manipulation of coherence relations between propositions can reverse preferences for pronoun interpretation.

Kehler and colleagues (2008) provide empirical evidence from three experiments in which they also test the validity of the coherence-driven account against several preferences that we have discussed in previous sections, such as the syntactic role preference (that includes the well-known syntactic subject preference and the syntactic role parallelism preference), and against some interpretation biases that we discuss in the following sections: the thematic role and the event-structure biases, and the implicit causality effect.

With Experiment 1, a paper-and-pencil questionnaire, Kehler and colleagues address the conflict between well-attested structural preferences, namely the syntactic subject preference and the syntatic role parallelism preference, with the predictions of the coherence-driven analysis. In a 2x2x2 design, the authors manipulated the position of the pronoun (subject vs. object), the sentence structure (fully vs. partially parallel), and the coherence relation (Parallel vs. Result), as shown in (1.43). Participants read the sentence and answer the comprehension question. Answers were taken to indicate the antecedent selected for the ambiguous pronoun.

The prediction of the syntactic subject preference is that pronouns, regardless of their syntactic function, will be interpreted as coreferential with the preceding subject. The prediction of the syntactic role parallel preference is that subject pronoun will be interpreted as coreferential with the preceding subject antecedent, and the object pronoun as coreferential

with the preceding object antecedent. The coherence hypothesis predicts a syntactic role parallelism preference in the Parallel conditions, but an interpretation bias towards syntactically non-parallel referents in the Result conditions.

As shown in Table 1.3, answers to the questions confirmed the predictions of the coherence hypothesis, showing the expected interaction between pronoun position and coherence relation, but were not consistent with the predictions of the other hypotheses.

(1.43) Samuel threatened Justin with a knife, and
   a. Erin blindfolded him (with a scarf). [Parallel]
   b. Erin stopped him (with a pepper spray). [Result]
   c. he blindfolded Erin (with a scarf). [Parallel]
   d. he alerted security (with a shout). [Result]

   Comprehension question: Who did Erin blindfold?

Table 1.3: Antecedent choices in Kehler et al.'s (2008) Experiment 1

Coherence	Structure	Pronoun position	Subject antecedent	Object antecedent
Parallel	Parallel	Subject	64	0
		Object	5	59
	Non-parallel	Subject	61	3
		Object	8	56
Result	Parallel	Subject	2	62
		Object	59	5
	Non-parallel	Subject	4	60
		Object	61	3

4.1.2. Coherence-driven account vs. semantic biases

Two other interpretation biases put forward in the literature are the thematic-role bias and the event-structure bias, proposed, *inter alia*, by Stevenson et al. (1994). Stevenson and colleagues find that in transfer-of-possession sentences, like that in (1.44), occupants of some thematic roles are systematically preferred to others as antecedents. In particular, Goal antecedents (*Bob*) are generally preferred over Source antecedents (*John*). Stevenson and colleagues provide two potential explanations for these results: the first one is a thematic-role bias that would work as a heuristic that ranks Goal antecedents above Source antecedents; the second explanation is an event-structure bias for focusing on the end state of the previous event, under the assumption that the Goal antecedent is more salient to the end state than the Source antecedent.

(1.44) John handed a book to Bob. He…

In Experiment 2, Kehler and colleagues tested these two biases against the predictions of the coherence-driven analysis. In a continuation task, participants read sentences like those used by Stevenson et al. in two conditions: perfective and imperfective, as shown in (1.45), and were asked to provide an appropriate sentence continuation.

(1.45) a. John handed a book to Bob. He…
b. John was handing a book to Bob. He…

The prediction of the thematic-role bias is that a preference for the Goal antecedent (*Bob*) should arise regardless of the aspect of the verb. According to the event-structure hypothesis, a greater preference for Source antecedents (*John*) should be elicited in the imperfective condition than in the perfective condition. Finally, the coherence-driven analysis predicts that the end-state bias will be an epiphenomenon of establishing Occasion relation, which should result in more Goal antecedent choices. The predictions for other coherence relations vary as a function of the coherence relation established between sentences.

The results provided evidence in favor of the event-structure hypothesis: participants provided continuations about the Source antecedent significantly more often in the Imperfective condition than in the Perfective condition (70% vs. 51%), suggesting that pronoun interpretation is sensitive to verbal aspect. These results go against the thematic-role bias, which predicted no difference in the choices of antecedents across conditions.

A more detailed analysis of the continuations indicates that there was also a clear effect of coherence in line with the predictions of the coherence-driven analysis. In particular, Occasion relations were dominated by continuations about the Goal antecedent, while Elaborations and Explanations elicited a stronger Source antecedent preference. Kehler and colleagues conclude from these results that, while the thematic-role bias for Goal antecedents seems to be an epiphenomenon of a more general bias towards focusing on end states, the event-structure (end-state) bias seems to be, in turn, an epiphenomenon of the inferences used to establish coherence between sentences, specifically Occasion relations. When other coherence relations are established (e.g. Elaborations, Explanations), this preference for Goal antecedents disappears.

4.2. Implicit causality and pronoun resolution

4.2.1. What is Implicit causality?

In their third and last experiment, Kehler and colleagues test the predictions of the coherence-driven analysis against the Implicit Causality (henceforth IC) effect. IC is perhaps the best-studied phenomenon concerning the interaction between coherence relations and pronoun interpretation. Before we discuss Kehler et al.'s experiment, we will provide some background on the IC effect and some examples of empirical studies on this topic. Kehler et al.'s take on this phenomenon will become apparent and relevant later on in the discussion.

Garvey and Caramazza (1974) note that another kind of semantic information inherent in verbs can be related to grammatical processes that assign pronouns to antecedents[7]. In particular, they observe that "a number of verbs when used, at least, with nouns referencing human or animate beings import an implicit attribution of the cause of the action or attitude indicated by the verb. One or the other of the noun phrases is implicated as the assumed locus of the underlying cause of the action or attitude" (p. 460). For example, in the sentence in (1.46a), the speaker has the intuition, and expects the listener to have it too, that there is something about John that causes admiration in Mary. Likewise, in the sentence in (1.46b), there is an implicit assumption that there is something special about Mary that produces amazement in John. The cause of the state (i.e. *admire*, *amaze*) is attributed to the referent that is considered to be responsible for the situation that leads to the event.

(1.46) a. Mary admires John.
b. Mary amazes John.

Garvey and Caramazza (1974), Garvey et al. (1976), and Au (1986) ran a series of studies to test the IC effect. In these studies, participants were asked to write completions for fragments such as (1.47). In line with the predictions of the IC effect, the analysis of the continuations showed a general pattern whereby certain verbs, e.g. *admire*, elicited primarily continuations about the second NP (NP2) *John,* while others, e.g. *amaze*, elicited primarily continuations about the first NP (NP1) *Mary.*

(1.47) a. Mary admires John because…
b. Mary amazes John because…

[7] See also Dowty (1991) and his proposal on proto-role entailments.

Using these previous studies as norming studies to create their stimuli, Caramazza et al. (1977) and McKoon et al. (1993) ran a series of self-paced reading experiments where they tested the prediction that certain IC verbs make the referent on which the bias falls relatively more accessible in a listener's discourse model. This increased accessibility should bias the identification of the referent of a pronoun in a subsequent because-clause. Violations in IC biases should, therefore result, in processing difficulty. For that, Caramazza and colleagues constructed sentences in which pronoun assignment was either congruent (1.48a) or incongruent (1.48b) with IC biases. The verb *scold* makes the object referent *Bill* more salient because it is assumed that Bill must have done something for Tom to scold him, in this case, be annoying. The predicate "was annoyed" most likely refers to Tom, the referent that is less salient with regards to the IC bias of the verb. The prediction is, thus, that a sentence like (1.48b) should take longer to read than a sentence like (1.48a). The results confirmed this prediction: sentences where pronoun interpretations were incongruent with IC biases took longer to read than those where pronoun interpretations were congruent with IC biases.

(1.48) a. Tom scolded Bill because he was annoying.
b. Tom scolded Bill because he was annoyed.

McKoon et al. (1993) ran a series of similar reading time experiments (Experiments 1-4) in which they tested this same prediction. In their experiment they employed short texts that consisted of three sentences and where the critical manipulation of IC bias violations was achieved by varying the gender of the pronoun. In (1.49), James is the instigator of the event (infuriate) and, in theory, the most salient and accessible referent. Likewise, in (1.50), *Sam* is the cause of the event (something about him makes *Diane* value him) and the most salient referent. A continuation about the subject referent in (1.49) and about the object referent in (1.50), like (1.49a) and (1.50a) should be, therefore, easier to process than a continuation about the other referents *Debbie* in (1.49b) and *Diane* in (1.50b). The reading time pattern elicited in these experiments confirmed these predictions: sentences with a pronoun assignment incongruity in terms of IC, (1.49b) and (1.50b), elicited higher RTs than their congruent counterparts, (1.49a) and (1.50a).

(1.49) *Introductory sentence:* James and Debbie were working on a political campaign together.

Introductory sentence: They were both planning on pursuing careers in politics.

Critical sentence: James infuriated Debbie because

a. he leaked important information to the press.
b. she had to write all the speeches.

(1.50) *Introductory sentence:* The boss had been giving Diane and Sam a hard time lately.

Introductory sentence: Finally the two of them decided to do something about it.

Critical sentence: Diane valued Sam because

a. he always knew how to negotiate.
b. she never knew how to negotiate.

The results of both types of studies, production studies like continuation tasks and comprehension studies like reading-time experiments, are evidence for the role of IC verbs in pronoun interpretation in comprehension and in the likelihood of the re-mentioning of a given entity in production. The tight correspondence between the results of both types of experiment in these and many other studies provide empirical confirmation of the IC effect. However, there are many other questions related to this phenomenon that remain unanswered: Where does this effect come from, i.e. is it driven primarily by linguistic structure or by general-knowledge and non-linguistic cognition? What is its time-course, i.e. is it used incrementally or only during sentence-final clausal integration? Is this effect due to the presence of the connective *because* or can it also arise without it? We will briefly review a few studies that try to provide an answer to the first two questions (Garnham, 2001 for a review). A more detailed analysis of the last question will be necessary for the purposes of the present study.

4.2.2. The source of the IC effect

Two opposed views seem to prevail in the literature regarding the source of the IC effect: the linguistic structure view vs. the general knowledge/non-linguistic-cognition view. Probably one of the first and best-known studies that advocate for high-level social cognition being the locus of Implicit Causality is Brown and Fish (1983).

Brown and Fish make use of a causal attribution task where participants have to judge on a scale how likely a given referent is to have caused the event under discussion, as in (1.51). Results are analyzed by subtracting the answer for (1.51b) from the answer for (1.51a). Positive numbers reflect greater causal attribution to the subject, while negative numbers reflect greater causal attribution to the object. Brown and Fish argue that, although their stimuli are linguistic in nature, the results of this task reflect high-level social cognition.

(1.51) Sally frightened Mary. How likely is it that this was because:

a. Sally is the kind of person who frightens people.

Not likely 1 2 3 4 5 6 7 8 9 Definitely likely

b. Mary is the kind of person people frighten.

Not likely 1 2 3 4 5 6 7 8 9 Definitely likely

c. Some other reason.

Not likely 1 2 3 4 5 6 7 8 9 Definitely likely

Hartshorne (2013), however, argues that Brown and Fish wrongly assumed that the sentences they employed did not directly encode causality. For that reason, it was necessary to explain how causation was inferred, which motivated recourse to theories of high-level cognition. Hartshorne addresses this shortcoming with a series of experiments combining different tasks (including Brown and Fish's causal attribution task) with the goal of investigating whether IC biases are mainly driven by linguistic structure or rather by general world-knowledge and non-linguistic cognition. Although we will not discuss this study in detail, Hartshorne's results are evidence in favor of both argument structure accounts, which assert that how a verb encodes causation is a core feature of verb meaning that drives verb argument structure and its syntactic realization (Levin & Rappaport Hovav, 2005), and of discourse structure accounts, which argue that IC effect is a microcosm of a more general tendency to establish coherence in discourse (Kehler, 2002; Kehler et al., 2008). From these results, Hartshorne concludes that his findings are evidence for an account whereby IC is driven primarily by linguistic structure and only minimally by general world-knowledge and non-linguistic cognition.

4.2.3. The time-course of IC

Regarding the time-course of the IC effect, here, too, we find two opposed accounts: the immediate focusing account (e.g. Greene & McKoon, 1995; Koornneef & van Berkum, 2006,

inter alia), on the one hand, argues that IC information can be brought to bear on comprehension very rapidly in an incremental manner; the clausal integration account (e.g. Stewart et al., 2000), on the other hand, argues that verb-based IC information is used during sentence-final clausal integration only. Steward and colleagues present empirical evidence for the causal integration account from a self-paced reading experiment where participants had to read sentences like (1.52). Sentences were presented in two regions. The first went to and included the pronoun; the second region was the remainder of the sentence (as shown by the slashes in the example below). IC (in)congruity was, once again, manipulated by varying the gender of the pronoun.

(1.52) a. David praised Lisa because she / had done well.
b. David praised Lisa because he / was very proud.

Their results showed higher RTs in the incongruent condition (1.52b) relative to the congruent one (1.52a) for both regions, although this difference was more robust and reached significance only with RTs on the second region. These results, and similar results from parallel studies, are enough evidence for the authors to strongly support the sentence final clausal integration account, in which IC information only becomes relevant "at the point where the two clauses are integrated into a single representation for the sentence as a whole" (p. 424).

Koornneef and van Berkum (2006) tested the validity of both accounts with a word-by-word self-paced reading task and an eye-tracking during reading task in Dutch. Participants were instructed to read short texts that feature complex sentences with an IC verb in the matrix clause and an IC-bias (in)congruent pronoun in a *because*-clause, in two experimental conditions shown in (1.53) and (1.54).

(1.53) *NP1-biased verb, bias-congruent condition*
David and Linda were both driving pretty fast. At a busy intersection they crashed hard into each other. David apologized to Linda because he, according to the witnesses, was the one to blame.

(1.54) *NP1-biased verb, bias-incongruent condition*
David and Linda were both driving pretty fast. At a busy intersection they crashed hard into each other. Linda apologized to David because he, according to the witnesses, was the one to blame.

In the self-paced reading task, readers showed a clear slow-down right at the bias-incongruent pronoun, with a significant main effect of congruency emerging at the first two words after this pronoun. Similarly, the eye-movement data revealed that pronouns that were inconsistent with the IC bias of the preceding verb perturbed the reading process at or shortly after the pronoun (at the pronoun this effect was clearest in regression path duration data, while in first fixation and first gaze duration data the incongruency effect emerged three words after the critical pronoun). Taken together, the results of both experiments suggest that, contra the sentence final clause integration account, the IC information is available at a very early stage and used incrementally in sentence processing, in line with the predictions of the immediate focusing account. Interestingly, Koornneef and van Berkum further argue that the observed early effects of IC are also compatible with a 'forward-looking' mechanism. As it has been already mentioned, in e.g. "David praised Lisa because…" the IC of the verb "supplies information about whose behavior or state is the more likely immediate cause of the event. As such, and particularly when combined with the connective *because*, it can also support specific expectations or predictions about how the unfolding utterance and wider discourse might continue" (p. 459).

4.2.4. The role of the connective *because* in IC

Related to this last claim is the third question we advanced above: how much of the IC effect is due to the presence/absence of the connective *because*? Ehrlich (1980) ran an experiment where participants had to read sentences like those in (1.55) and release a button when they had decided who the referent of the pronoun in the subordinate clause or coordinated sentence was. The critical manipulation here is the replacement of the connective *because* for other connectives like *but* and *and.*

(1.55) a. Steve blamed Frank because he spilt the coffee.
b. Steve blamed Frank but he spilt the coffee.
c. Steve blamed Frank and he spilt the coffee.

The results of this experiment (both latency and "correct" answers according to IC biases) show that when the connective *because* was replaced by the other connectives the choices of referent for a pronoun changed accordingly and participants even preferred to connect a pronoun to the nonbiased argument of the verb. Ehrlich argues that while the claims

for IC are supported for *because,* they do not generalize to other connectives. In his proposal, IC verbs elicit the expectations that a sentence will continue with information about the biased more salient referent (cf. Koornneef & van Berkum, 2006), yet the connective *but*, which is used to deny the listener's expectations, shifts the focus to the other nonbiased less salient referent.

Similar results were elicited by Koornneef and Sanders (2013) in an eye-tracking study in Dutch where participants were presented with similar short texts to those used in Koornneef and van Berkum (2006), shown in (1.53) and (1.54), but where the connective *want* ('because') was replaced by the connectives *maar* ('but') and *en* ('and'). Their results, in line with Ehrlich's, showed that connectives modulate the strength of the IC effect as a cue in pronoun resolution, as this effect emerged rapidly when the connective *because* linked the two clauses but it was absent with the other two connectives.

The results of the studies discussed above show that the presence of the connective *because* contributes to the IC effect and that the presence of other connectives attenuates the effect or even makes it disappear. These results are in accordance with those of McKoon et al. (1993) who, in a second series of experiment (Experiments 5 and 6), investigated IC effects in the absence of a connective. For that, they ran two reading time experiments using the same stimuli they used for Experiments 1-4, shown in (1.49) and (1.50), but replacing the connective *because* for a full stop, turning the two-clause sentences into two separate sentences. Their results showed that this difference eliminated the IC effect completely, as response times were not affected by whether or not the referent matched the intended referent of the pronoun that preceded it. From this McKoon and colleagues conclude that the presence of the connective *because* contributes to the IC bias in pronoun resolution in a subordinate clause that follows an IC verb.

Kehler and colleagues (2008) observe that the use of the connective *because* in the stimuli of the IC literature restricts the operative coherence relation between clauses to Explanations. They hypothesize that the IC effect observed in studies that used stimuli with *because* should align with results for similar cases with a full-stop when only passages that participate in an Explanation relation are considered. According to the authors, this correlation would suggest that "IC effects are a microcosm of a more general set of biases that apply in all contexts, distinguishing themselves only with respect to the strength of their bias towards a particular referent when an Explanation relation is operative" (p. 32). The authors' hypothesis was confirmed in a continuation study where participants had to provide appropriate continuations to prompts like those in (1.56) that feature both IC verbs and non-

IC verbs. An analysis of continuations featuring an Explanation relation in the full-stop condition revealed that the IC biases elicited in this condition were highly consistent with those found in the *because*-condition. The same pattern of results was observed in the non-IC verb condition where preferences for a given referent were identical in the *because* and in the full-stop conditions.

(1.56) a. Tony disappointed Courtney. …
b. Tony disappointed Courtney because …

An interesting result of Kehler and colleagues' study is that IC verbs are significantly more likely to evoke Explanation continuations than non-IC verbs. This finding is in line with the observation that causal relations seem to enjoy a special status in discourse processing: as the example (1.38) in the beginning of this section exemplifies, even in the absence of an explicit connective, speakers tend to relate the two events as one being the preceding cause of the other (i.e. the reason why John travels to Istanbul is that he has family there). This tendency has been captured by formal discourse representation approaches with a principle of *Maximize Discourse Coherence*, according to which a 'rich' causal relation is to be preferred over others (Asher & Lascarides, 1998). Empirical evidence supporting these claims has also been obtained (e.g. Mak & Sanders, 2010; Sanders, 2005; Townsend & Bever, 1978) leading to processing proposals like Sander's (2005) *Causality-by-default hypothesis* that defends the claim that "because readers aim at building the most informative representation, they start out assuming the relation between two consecutive sentences is a causal relation (given certain characteristics of two discourse segments). Subsequently, causally related information will be processed faster, because the reader will only arrive at [another relation] if no causal relation can be established (Mak & Sanders, 2010 p. 181). As we discussed for coherence relations in general, these proposals are in line with accounts that claim that discourses are functionally structured by QUDs (Carlson, 1983; Ginzburg, 1996, 2012; Hendriks, 2004; Kehler, 2012; Roberts, 1996) and that, to understand the coherence relations among utterances, we infer and accommodate the QUD to which an assertion is relevant (in these particular cases e.g. {Why?}).

Taken together, all the facts discussed above suggest (i) that there is nothing special about the combination of IC verbs with the connective *because*: the connective brings about an Explanation relation, and the bias for a given referent is adjusted according to the IC bias or lack thereof; (ii) that IC biases are an epiphenomenon of a more general system of

coherence-driven biases that drive pronoun interpretation; (iii) that, in addition to the well attested biases towards a particular referent, IC verbs also generate stronger-than-usual expectations for upcoming explanations. These results are "evidence in favor of proposals that assume that there is nothing special about the semantics of IC verbs and the referential biases they bring about" (Koornneef & Sanders, 2013 p. 1189). According to these proposals, "IC arises as a side effect of more global linguistic and cognitive tendencies" (Koornneef & Sanders, 2013 p. 1189).

4.2.5. IC and discourse expectations: Bott & Solstad's (2014) account

In line with the idea that IC verbs create expectations for an explanation, Bott and Solstad (2014) propose a novel semantic account of IC that connects verb semantics, discourse structure, and coreference. Using a typology of explanations developed by Solstad (2010), exemplified in (1.57), Bott and Solstad show how these explanation types interact with missing semantic content of IC verbs. This approach allows them to treat the idiosyncratic coreference preferences of verbs with different IC biases as an epiphenomenon of the expected explanation type. Their analysis is essentially a coherence-based theory in line with the proposals of Hobbs (1979) and Kehler (2002).

(1.57) a. **Simple cause**: John disturbed Mary because he was making lots of noise.
b. **Externally anchored reason**: John disturbed Mary because *she* had damaged his bike.
c. **Internally anchored reason**: John disturbed Mary because *he* was very angry at her.

Bott and Soltad's account, however, can provide a plausible explanation for previous findings that were left unexplained. Recall that Kehler et al. (2008) find that IC verbs are more likely to evoke explanation continuations than non-IC verbs arguing that the lexical semantics of IC verbs provide a stronger-than-usual expectation for an explanation. Bott and Solstad's account for this finding in the following terms: if there is causal content that can be specified by an explanation in the form of a *because*-clause or an independent sentence, then providing this explanation should be the default strategy in language processing. Otherwise, interpreters would be forced to accommodate the missing information, a cognitively taxing operation that should be dispreferred (*avoid missing information,* Altmann & Steedman, 1988). Bott and Solstad argue that their account is a cognitively more plausible model of

coherence driven processing because, instead of having to assume computationally difficult abstract inference as the driving force of discourse interpretation, it assumes a much easier operation, namely specification of yet unspecified content, similar to the cataphoric justification of a presupposition.

Contra the predictions of focusing accounts that defend a direct activation of some argument role via IC, Bott and Solstad defend the claim that IC activates an event participant only indirectly via the prediction of a particular explanation type. They argue that this view is advantageous over direct activation/focusing accounts since an explanation constitutes a relation between something propositional in nature, and not individuals. Moreover, since explanations are taken to relate propositions or facts, not only the verb but also the linguistic realization of the arguments should matter. Bott and Solstad tested this prediction in a number of continuation studies and showed that IC bias can be manipulated in a predictable way if extra material is added to the matrix clause. In the example in (1.58), the PP *with his aggressive play* elaborates on the bias referent in similar manner as a *because*-clause and it also constitutes a bias towards NP1.

(1.58) Peter impressed Mary *with his aggressive play*…

According to Bott and Solstad's account, the PP in example (1.58) provides the missing information triggering the bias in the first place, filling the empty slot. They predict that, as a result of this, interpreters can choose a different discourse relation altogether. However, if they still provide an explanation relation, the prediction is that this can be a different kind of explanation, which should in turn lead to a bias shift. Their data confirmed this prediction. Bott and Solstad argue that their data corroborates the claim that "in order to properly understand the phenomenon of implicit causality we need a compositional theory that is able to take into account the lexical semantics of the verb, the semantic properties of its arguments, interactions with (adverbial) modifiers, the semantics of the explanation relation, and contextual influences" (p. 244).

4.3. Interim discussion

The studies reviewed above constitute evidence in favor of a coherence-driven account whereby the mechanisms supporting pronoun interpretation are cued by coherence relations established through the semantics of certain linguistic elements (e.g. connectives and verbs),

world knowledge, and inference. These accounts claim that the pronoun resolution preferences and strategies commonly encountered in the psycholinguistics and computational linguistics literatures, such as the preference for subject or topic antecedents, are epiphenomena of the strategies by which discourse coherence is established.

However, taking into account previous findings in the literature, we notice that a purely coherence-driven proposal falls short in explaining all the observed facts. This is the case, for example, of the differences found in the role of focus in pronoun resolution. Recall that, while some studies find that focusing an antecedent by different means (clefting, fronting, etc.) results in a general preference for focus antecedents inter-sententially (cf. Arnold, 1998; Cowles et al., 2007; Ellert, 2013; Runner & Ibarra, in press), other studies find that focusing by means of clefting does not increase (or even decreases) the preference for focus antecedents intra-sententially (Colonna et al., 2012).

In a follow-up study, Colonna and colleagues (2015) investigated further the effects of focus by clefting in pronoun resolution in German by performing a direct comparison of intra- and inter-sentential pronominal dependencies. In a questionnaire study and a Visual World eye-tracking study, they presented participants with the same kind of sentences used in the Focus conditions in their previous experiments, and with their inter-sentential counterparts, as in (1.59). The results of both tasks confirmed the previously observed patterns: a general dispreference for focus/clefted antecedents in the intra-sentential conditions and a general preference for focus/clefted antecedents in the inter-sentential conditions.

(1.59) a. It was Peter who slapped John when he was a student.
b. It was Peter who slapped John. At the time, he was a student.

Given that, in their materials, both the temporal subordinate clause and the independent second sentence provide (temporal) background information for the event described in the matrix clause (1.59a) or in the first sentence (1.59b), respectively, a purely coherence-driven account cannot explain the differences observed[8]. Instead, as we argued before, these facts suggest that, besides coherence-relation, other factors are at stake in the

[8] Temporal relations have never been included in previous analyses of coherence relations. In a personal communication, Kehler suggested treating them as Background relations but admitted that there is a certain gap in previous coherence-driven accounts concerning this type of relation. Furthermore, as we will discuss later on, according to some accounts on Discourse Units (DU), by definition, the function of coherence relations is to link units together and, thus, it does not make sense to speak of coherence *relations* within a DU (1.59a). Regardless of whether temporals are considered a coherence relation or not, this does not change the fact that the propositions in the examples in (1.59) express the same kind of information.

resolution process and, crucially, that these factors do not have the same weight in all contextual circumstances, in this case in intra-sentential pronoun resolution and in inter-sentential pronoun resolution. The present dissertation constitutes an attempt to explain these facts.

5. Conclusions

In Chapter 1 we have discussed a number of theories that claim that the choice and interpretation of referential expressions, like pronouns, are closely related to the prominent status of the antecedent in the discourse model of the speaker/hearer. We have then focused our discussion on a series of psycholinguistic studies that investigate a number of factors that are claimed to contribute to the "special" status of discourse antecedents. In particular, these studies put the emphasis on parameters that fall within the dimension of the utterance, such as the syntactic function, the order of mention, and the information status of the antecedent. The combined results of these studies suggest that these factors by themselves cannot explain all the resolution patterns observed but rather that antecedent prominence comes from a combination of these parameters. Finally, in the last section of the chapter, we reviewed a series of studies that show that antecedent prominence is not enough to explain the whole spectrum of results either. Indeed, other factors at the level of discourse, such as the coherence relations established between propositions, also play an important role in the resolution process.

While the identification of these parameters (summarized in Table 1.4) is paramount for our understanding of the mechanisms and strategies that intervene in sentence processing, a crucial finding emerges from these studies: the role of these factors varies as a function of (i) the domain of resolution, and (ii) the language under study. Indeed, the results of the studies reviewed above show that the various factors investigated weigh in differently in different contexts. An optimal approach to the study of pronoun resolution will, therefore, take into account not only the factors that affect interpretation, but also the contextual circumstances where they operate. Likewise, the investigation of languages other than English has shown the cross-linguistic validity of some of the identified parameters but, crucially, it has also challenged the validity of others in different languages. These two features –the domain of resolution and a cross-linguistic approach –will be central aspects of the present dissertation.

In Chapter 2, we discuss some theories of pronoun resolution that try to account for the fact that the factors discussed in Chapter 1 do not constrain pronoun resolution in the same manner in all contexts. Taking these proposals as a starting point, we redefine the domain of resolution with a new framework of analysis that accounts for previously observed patterns. We then test empirically the validity of our proposals in Chapters 3, 4, and 5 in English, French, and Spanish.

Table 1.4: Summary of factors affecting pronoun resolution (only the parameters in bold are discussed in more detail in Chapter 1)

Perspective	Nature of parameter	Parameter	Representative studies	Main findings
Utterance	Syntax Linear precedence	Order of mention	Gernsbacher & Hargreaves, 1988	General preference for first-mention antecedents regardless of their syntactic function
	Syntax Dominance relation	**Syntactic function**	Carminati, 2002; Crawley et al., 1990; Gordon et al., 1993; Kaiser, 2011	General preference for subject antecedents regardless of their order of mention. In null-subject languages this preference applies to null pronouns.
		Parallelism	Stevenson et al., 1993, 1995	General preference for antecedents with the same syntactic function than the pronoun.
	Information structure	**Topic**	Arnold, 1998; Colonna et al., 2012; Cowles, 2003; Cowles et al., 2007; Ellert, 2013; Frana, 2008; Kaiser, 2011; Runner & Ibarra, in press.	General preference for topic antecedents, especially when they are clearly established discourse topic or embedded in certain structures, such as HTLD
		Focus		General preference for focus antecedents. When focus is established by means of a cleft structure, this preference depends on the domain of resolution: preference for focus antecedents inter-sententially, dispreference intra-sententially.
	Semantics	Thematic role	Ferreira, 1994; Stevenson et al., 1994	General preference for agent antecedents. In transfer-of-possession sentences, Goal antecedents are more salient to the end state than Source antecedents
Discourse	Coherence factors	**Discourse relations**	Kehler et al., 2008; Wolf et al., 2004	Previous interpretations preferences are epiphenomena of the strategies by which discourse coherence is established. The manipulation of coherence relations can reverse some of these preferences.
		Implicit causality	Bott & Solstad, 2014; Brown & Fish, 1983; Ehrlich, 1980; Garvey & Caramazza, 1974; Hartshorne, 2013; Koornneef & van Berkum, 2006; Koornneef & Sanders, 2013; McKoon et al., 1993	Preference for specific referents as a function of certain verbs that carry an implicit attribution of the cause of the action or attitude they describe. The IC information is available at a very early stage and used incrementally in sentence processing. IC verbs generate stronger-than-usual expectations for upcoming explanations.

Chapter 2

Reshaping the domain for the study of pronoun resolution

Introduction

In Chapter 1, we reviewed a number of theories that argue that the prominent status of a discourse referent in the mental representation of the speaker/hearer is paramount in discourse processing, in general, and in reference resolution, in particular. This is claimed to be true both in comprehension (i.e. the interpretation of a referential expression) and in production (i.e. the choice of a referential expression). We subsequently discussed a series of experimental studies whose results suggest that multiple factors pertaining to syntax, semantics/pragmatics, and information structure contribute to the more or less prominent status of discourse referents. Additionally, in Chapter 1, we discussed another aspect of discourse processing, namely, the computation of coherence relations established between the eventualities described in the proposition(s), which have also been claimed to play an important role in pronoun resolution. We could think *a priori* that coherence relations are computed after coreference relations have been established. However, the psycholinguistic studies reviewed in the previous chapter show that these two processes are not necessarily independent and that coreference relations often occur within the establishment of coherence. Crucially, we argued that the combined results of the studies reviewed in Chapter 1 suggest that, while these factors can account for a great deal of the elicited results, not one of them by itself can explain all the resolution patterns observed. We claimed that this is because, beyond these factors, other aspects, such as the domain of resolution and the comparison of various languages, must also be taken into account in order to fully understand the phenomenon under study.

Indeed, as Chapter 1 illustrates, until relatively recently, the typical psycholinguistic approach to pronoun resolution was to identify the factors that render this process easier or more difficult. However, little attention has been paid to synthetizing those factors into a coherent theory of pronoun resolution. Critically, while most of the studies reviewed in the previous chapter adhere to what Kehler (2008) refers to as the SMASH algorithm of reference interpretation, illustrated in (2.1), an optimal approach to the study of pronoun resolution is not one that proposes a series of these 'soft constraints' (or preferences or heuristics) that play a role in this process –after all, as Kehler argues, this list of preferences would only be a mere reflection of the statistical generalizations found in the data. What we need instead is a detailed explanation for those patterns, and for why different preferences seem to prevail in different contexts.

(2.1) The SMASH algorithm of pronoun resolution:

a. **Search**: Collect possible referents within some contextual window

b. **Match**: Filter out those referents that do not meet 'hard' morphosyntactic constraints (number, gender, person, binding)

c. **And Select using Heuristics**: Select a referent based on some combination of 'soft' constraints (syntactic role, grammatical parallelism, thematic role…)

Chapter 2 represents a change of perspective from Chapter 1 as it deals with proposals that try to integrate previously observed preferences or heuristics as well as factors like the domain of resolution into a single theory of pronoun interpretation. It is important to point out, however, that the goal of this chapter is not to propose one such theory, but rather to put forward some elements that, we argue, any future theories or models should take into account in their formulation. We begin by reviewing Miltsakaki's (2002) theory –a proposal that, in our view, reunites some key elements of a comprehensive theory of pronoun resolution, as it synthetizes previous observations from the literature, such as the importance of the contextual circumstances where resolution takes places (i.e. the domain of resolution), and that factors affecting resolution do not exert their effects to the same extent in all contexts. It, moreover, tests its predictions cross-linguistically in two typologically different languages, English and Greek. In particular, as we shall see later on, Miltsakaki proposes a theory based on the opposition of inter- vs. intra-sentential pronoun resolution that is rooted in the notion of discourse unit (henceforth DU). According to this theory, pronoun resolution across DUs is better accounted for in structural terms following the constraints proposed by Centering Theory, while resolution within units comes about from the establishment of coherence through the semantics of certain elements in the utterance.

Taking as a starting point Miltsakaki's proposal as well as previous observations, we will also argue that the DU represents an optimal domain (or framework) for the study of pronoun resolution. Whereas providing a definition of the basic DU is beyond the purposes of the present dissertation, we review two widespread proposals –the sentence as DU and the tensed clause as DU –and argue that these syntactic-based accounts cannot explain all facts. Based on previous analyses of subordinate adverbial clauses, we propose that, in the context of a matrix clause and a subordinate adverbial adjunct, there can be different DU configurations as a function of the type of adjunct. We conclude by claiming that the DU configuration of the sentence will have an effect on pronoun interpretation and that factors

affecting resolution will not exert their effects to the same extent within a DU as across two DUs.

1. Miltsakaki's (2002) theory of pronoun resolution

Miltsakaki argues that despite significant progress made in the field of pronoun interpretation, the fact that no single model is capable of accounting for all the cases is mainly due to a failure of these models to acknowledge that inter- and intra-sentential pronoun resolution are not subject to the same mechanisms.

She argues that Centering Theory (CT) is one of those models. Recall from Chapter 1 that CT was proposed as an algorithm that accounts for the relationship between the interlocutors' attentional state and the form of referring expression. In particular, CT proposes different types of transitions between two adjacent utterances, according to whether and in which position the highest-ranked entity in the list of evoked discourse entities of an utterance (U_{i-1}) is retrieved in the following one (U_i). While CT allows for a variety of factors to influence this ranking, the one that is most commonly appealed to is syntactic role (subject > object > other). Crucially, CT predicts that not all transitions are equally easy to process and that discourses that maintain the same topic across adjacent utterances (i.e. the "continue" transition, where $Cb(U_i)=Cp(U_i)$ and $Cb(U_i)=Cb(U_{i-1})$) are more coherent and easier to process than discourses where the topic changes (i.e. the "shift" transitions), which are less coherent and, thus, harder to process. This algorithm gives the correct interpretation for the pronoun *he* in the example (2.2).

(2.2) a. Max is waiting for Fred.
Cf: Max > Fred
Cb: None
b. He invited him for dinner. [he=Max]
Cf: Max > Fred > dinner
Cb: Max

However, Miltsakaki argues that the Centering algorithm cannot account for cases like (2.3) where, based on a preference for a Continue transition, the pronoun *he* would be preferentially resolved to *Dodge* and not *the ex-convict*, resulting in a semantically infelicitous interpretation.

(2.3) a. Dodge was robbed by an ex-convict.
b. The ex-convict tied him up
c. because he wasn't cooperating.
d. Then he took all the money and ran. [?he=Dodge]

Miltsakaki reviews alternative approaches that have been proposed to account for cases like the example above, namely the Coherence-driven account proposed by e.g. Hobbs (1979) and Kehler (2002). As we have seen before, this proposal tries to account for the facts on pronoun resolution preferences in sentences like (2.4) by arguing that certain elements in the sentence like verbs and connectives also have focusing properties affecting the preferred interpretation of pronouns.

(2.4) John criticized Bill, so he tried to correct the fault. [he=Bill]

Miltsakaki tries to reconcile the contradicting facts presented above by proposing an "aposynthetic" theory (or model) according to which inter- and intra-sentential pronoun resolution are not subject to the same mechanisms. She argues that the main shortcomings of other models are due to a homogenous treatment of two distinct processes, namely, topic continuity and the internal structure of sentences. She claims that inter-sentential pronoun resolution is subject to structural factors, namely, topic continuity as proposed by CT, whereas intra-sentential pronoun resolution is subject to syntactic as well as semantic/pragmatic constraints, that is, within the sentence, pronoun resolution is performed locally and is constrained by the syntactic and semantic properties of the predicates.

An important contribution of Miltsakaki's model is the definition of the boundaries of an utterance, which is left unspecified in CT (a major potential shortcoming given that the whole theory is based on this notion). Miltsakaki refers to utterances as centering update units (CUU[1]), which she defines as consisting of a matrix clause and all dependent clauses associated with it. Therefore, in Miltsakaki's model inter-sentential pronoun resolution is performed across (two or more) CUUs, whereas intra-sentential pronoun resolution is performed within a CUU. In the second part of the present chapter, we will see that this notion is also crucial for our own proposal.

Miltsakaki presents two empirical studies to test the two main claims of her model,

[1] This term is equivalent here to the term we have used thus far *discourse unit* (DU).

namely (i) that pronoun interpretation across units is determined structurally in lines with the predictions of CT, and (ii) that subordinate clauses do not form independent processing units but are rather part of the same unit as the matrix clause and, therefore, preferences within the unit will be guided by semantic/pragmatic content. In the first experiment, a sentence-continuation task in English, participants were asked to form natural-sounding sentences by completing the sentence onsets provided. Two experimental factors were manipulated, namely, the domain of dependency (intra- vs. inter-sentential) and semantic type of connection (concessive vs. temporal). The sentences in (2.5) are examples of the experimental materials.

(2.5) a. The groom hit the best man violently although he…
b. The groom hit the best man violently. However, he…
c. The groom hit the best man violently when he…
d. The groom hit the best man violently. Then, he…

The results of this experiment yielded a significant main effect of domain of dependency. In the inter-sentential conditions, there was a robust preference to continue with a sentence about the subject antecedent of the preceding sentence. In the intra-sentential conditions, the interpretation of the pronoun varied, with significantly more subject interpretations in the concessive condition than in the temporal condition. These results were further corroborated with a second study on a Greek corpus. Miltsakaki takes the results of these two studies as evidence in favor of her proposal.

The results discussed in Chapter 1 from studies that investigate the role of information status in pronoun resolution could be taken *a priori* to be evidence in favor of Miltsakaki's proposal, too, as they elicit clear differences between inter- and intra-sentential pronoun resolution. Recall that, while all of these studies find that focus enhances antecedent accessibility when antecedent and pronoun are in two different sentences (e.g. Cowles et al., 2007), other studies find that, when the anaphoric dependency is established within the sentence, focusing an antecedent by means of clefting seems to have the opposite effect, resulting in a general dispreference for the clefted antecedent (or *anti-focus effect* cf. Colonna et al., 2012, 2015).

A closer look into these results, however, suggests that Miltsakaki's model fails to account for the full variety of observed patterns. In particular, Miltsakaki predicts that pronoun interpretation across units (across sentence boundaries) is determined structurally in line with the predictions of CT (i.e. a preference for topic continuity where topic entities are

equated to the subject function). Yet, the results of the experiments reviewed in Chapter 1 show that salience-based preferences cannot be reduced to syntactic function. Recall that these studies show that topic constructions (e.g. HTLD) significantly increased choices for the topicalized antecedent within the sentence as they did across sentence boundaries. On the other hand, while it-cleft focusing also increased choices for the focus antecedent between sentences, it reduced the number of choices of the clefted antecedent within the sentence. It could be argued that, while the lack of accessibility enhancing effects of clefting within a sentence is compatible with a modified version of Miltsakaki's account (where factors other than syntactic function also contribute to salience), the increased accessibility of topicalized antecedents within the sentence is not. Additionally, the results of the studies on implicit causality discussed in Chapter 1 show that the semantics of these verbs can affect resolution both within and across sentences, which constitutes further evidence against the general predictions of Miltsakaki's model.

We will argue against the claim that inter- and intra-sentential pronoun resolution are subject to different mechanism. Indeed, the results discussed in Chapter 1 as well as those presented in the present thesis indicate that syntactic, semantic/pragmatic, and information structural factors are at stake in pronoun resolution within and across sentences, although their relative weight differs from one context to the other. Furthermore, the results on the role of focus by clefting do show that sentence boundaries can have an important effect on pronoun resolution, thus stressing the importance of DUs (or Centering Update Units). In line with Miltsakaki, we claim that the DU is the optimal framework of observation for the study of pronoun resolution. However, we will argue that Miltsakaki's conception of a DU as a matrix clause and all dependent subordinate clauses falls short in accounting for many of the observed resolution patterns in the literature. We discuss DUs in more detail in the following section.

2. The DU as the domain of resolution

There is a general consensus in discourse theories that discourse is hierarchically structured (e.g. Grosz & Sidner, 1986). It is assumed that a string of discourse is made up of a series of smaller 'building blocks' that relate to one another in a coherent way. Less clear, however, is what these 'building blocks' actually look like, as definitions of discourse units (DUs) usually change from one theory to the next.

DUs have been defined as the minimal elements that are linked together by coherence relations (e.g. Bateman & Rondhuis, 1997), as processing update units (Van Dijk, 1999), and as multifactorial entities defined in terms of different criteria: the realization of an illocutionary force, a conceptual content, syntactic dependency relations, and a prosodic contour (Degand & Simon, 2005). Defining DUs has proved to be the locus of much disagreement. However, numerous proposals have been put forward within the framework of a given theory of pronoun resolution. In this chapter, we focus on two of these proposals –the clause as a DU, and the sentence as a DU –that we discuss in the following sections. This discussion is followed by our own proposal concerning DUs. While providing a definition of the basic DU goes beyond the scope of the present dissertation, we do provide evidence against these two purely syntactic definitions of DUs. Instead, we argue for a more "relational" conception of the DU according to which a DU can take the form of both a sentence and a clause as a function of certain factors like the syntax and semantics of the subordinate clause itself and the type of relation established between matrix and subordinate clause.

2.1. The tensed clause as a Discourse Unit

Equating the notion of DU to the tensed clause is one of the most widespread approaches in the pronoun resolution literature. This view is defended, for example, by different accounts based on coherence relations. As was already mentioned in the previous chapter, coherence relations represent a semantic linkage between units. Therefore, if coherence relations relate events or situations and such events are usually introduced through verbs, as some authors argue (e.g. Asher, 1993; Hobbs et al., 1993), considering clauses to be the appropriate size for elementary DUs has become a standard practice.

This conception, however, is not restricted to the coherence relation literature. A number of authors that try to apply the Centering algorithm to intra-sentential pronoun resolution have also adopted this view. Kameyama (1993, 1998), for example, was one of these authors concerned with the problem of intra-sentential centering who made an attempt to provide a definition of the minimal update unit when complex sentences are processed. Kameyama suggested that complex sentences are broken up into a set of centering update units that correspond to the "utterances" in (inter-sentential) Centering. This process of splitting up complex sentences is performed according to the following hypotheses (taken from Miltsakaki, 2002: 329):

1. Conjoined and adjoined tensed clauses form independent units.
2. Tenseless subordinate clauses, report complements, and relative clauses belong to the update unit containing the matrix clause.

Kameyama provides evidence for her proposal from backward anaphora. She argues that the tensed adjunct hypothesis predicts that the pronoun in the subordinate clause in (2.6c) is dependent on an entity already introduced in the immediate discourse (Kern) and not on the subject of the matrix clause to which it is attached (Jim).

(2.6) a. Kern began reading a lot about the history and philosophy of Communism
b. but never 0 felt there was anything he as an individual could do about it.
c. When he attended the Christina Anti-Communist Crusade school here about six months ago
d. Jim became convinced that an individual can do something constructive in the ideological battle
e. and 0 set out to do it.

Di Eugenio (1990, 1998) applies Centering to pronoun resolution in Italian and provides empirical evidence in favor of Kameyama's hypothesis on subordinate clauses as independent processing units. She proposes that the alternation of null and overt pronominal subjects in Italian could be explained in terms of centering transitions: null subject pronouns typically signal a Continue transition, while overt subject pronouns signal a Retain or a Shift transition. Di Eugenio's proposal is illustrated in examples like (2.7), in which the use of a strong pronoun in the main clause cannot be explained if the preceding adjunct is not treated as an independent update unit.

(2.7) a. Prima che i pigroni siano seduti a tavola a fare colazione,
'Before the lazy ones sat down at the table to have breakfast,
b. lei è via col suo calessino alle altre cascine della tenuta.
'she was off with her carriage to the other farms on the estate.'

2.2. The sentence as a Discourse Unit

Above we showed that Miltsakaki's model of pronoun resolution is based on the notion of centering update unit (CUU), which she defines as a matrix clause and all dependent clauses associated with it. We already saw that she provided evidence in favor of this model from a sentence continuation task in English and from a corpus study in Greek. Miltsakaki additionally argues that treating subordinate clauses as independent units results in counterintuitive Centering transitions, as shown in (2.8) and (2.9).

(2.8) a. John had a terrible headache.
Cb = ?
Cf = John > headache
Transition = none
b. When the meeting was over,
Cb = none
Cf = meeting
Transition = Rough shift
c. he rushed to the pharmacy store.
Cb = none
Cf = John
Transition = Rough shift

(2.9) a. John had a terrible headache.
Cb = ?
Cf = John > headache
Transition = none
b. He rushed to the pharmacy store
Cb = John
Cf = John > pharmacy store
Transition = Continue
c. when the meeting was over,
Cb = none
Cf = meeting
Transition = Rough shift

In (2.8), taking the subordinate clause as an independent update unit yields a sequence of two Rough Shifts, which constitutes a highly discontinuous discourse. Although reversing the order of the clauses causes a slight improvement, with one Rough Shift transition replaced by a Continue transition, this is not an ideal sequence of transitions according to Centering Theory. Miltsakaki notes, however, that the introduction of a new discourse entity (*meeting*) in the subordinate temporal does not interfere with topic continuity, nor does it signal a topic shift, as it is usually the case when the Cp constitutes an entity different from the current Cb. Miltsakaki defends that, if we process subordinate clauses and matrix clauses as being part of the same unit, "we compute a Continue transition independent of the linear position of the subordinate clause, as the entities introduced in the main clause rank higher than the entities introduced in the subordinate clause" (Miltsakaki, 2002: 332). She shows this computation with the example in (2.10).

(2.10) a. John had a terrible headache.
Cb = ?
Cf = John > headache
Transition = none
b. When the meeting was over, he rushed to the pharmacy store.
Cb = John
Cf = John > pharmacy store > meeting
Transition = Continue

2.3. Redefining the domain of resolution

We try to contribute to the debate over the boundaries of DUs by analyzing the syntax and semantics of adverbial subordinate clauses, which are typically employed in experimental studies on pronoun resolution. We take as a starting point two main assumptions: (i) that DUs are not fixed and bounded entities, and that a variety of (syntactic, semantic, etc.) factors can contribute to their formation (e.g. Degand & Simon, 2005); and (ii) that the syntactic and semantic characteristics of adverbial clauses (or adjuncts) that have been captured by various theoretical accounts (that we discuss below) are necessarily going to play a role in the establishment of DUs in the context of a complex sentence consisting of a matrix clause and a subordinate adverbial clause. Against the two syntactic-based accounts reviewed above, we propose a more "relational" definition of DU, according to which the shape of the unit (e.g.

sentence, clause) depends on the semantic content of the subordinate clause itself and the relation established between matrix and subordinate clause. We do, however, assume that a DU never includes more than one sentence. We start out by going over these theoretical analyses on adverbial clauses to provide the foundations for our proposal that we subsequently spell out.

2.3.1. The syntax and semantics of adverbial subordinate clauses

Adverbial clauses are subordinate clauses that modify their superordinate (matrix) clauses at various syntactic levels (VP, IP, TP) and in various dimensions (such as times and worlds). We can categorize adverbial clauses according to these dimension variations (temporal, locative, modal) and sub-categorize them according to a range of relations within these dimensions, depending on the connective that links them to the matrix clause (Haegeman, 2003, 2009; Sæbø, 2011). For example, within the modal category, we can distinguish between causal, conditional, purpose, result, and concessive clauses. All kinds of adverbial clauses share the same function of supplying additional information about the eventuality described in the matrix clause. In addition to this, they all share the property of being syntactically optional. In the literature they are often referred to as clause-modifying adverbial adjuncts.

To build our claim that the definition of DUs cannot be solely based on syntactic terms, such as the sentence or the clause, we are going to focus our analysis on two types of adverbial subordinate clauses: temporal and causal adjuncts. We begin by giving a brief description of each followed by accounts that justify this choice and by our proposal relating these accounts with the notion of DU.

Temporal adjuncts

Temporal clauses, like non-clausal temporal adverbials, situate events or states temporally, as in (2.11). In (2.11a) the event described is placed within the timeframe of the year 2015, while in (2.11b) it is placed within the timeframe of the duration (in this case a year's time too) of the event described by the verb in the temporal clause.

(2.11) a. He finished his dissertation in 2015.
b. He finished his dissertation when he was 29.

When the eventuality described by the verb of the temporal clause and that of the matrix clause is a state, the two clauses are symmetrical, as the temporal interpretation is preserved if both clauses change roles, as in (2.12). In such cases, the temporal clause receives an existential reading.

(2.12) a. He became a lawyer when he was 27.
b. He was 27 when he became a lawyer.

The term "existential" for *when*-clauses is used when they serve to relate single eventualities temporally, that is, when there is one maximal instantiation of the eventuality of the described type. However, as Sæbø points out "in the general case, the set of past times included in or including the runtime of some eventuality of the described type must be assumed to be restricted to a contextually determined time interval with room only for one eventuality" (Sæbø, 2011: 8). In other words, the semantic contribution of *when*-clauses is a description of a temporal frame, which consists of the runtime and the aftermath of a maximal eventuality described by the proposition described in the subordinate clause (Johnston, 1994). When the eventuality described in the proposition has more than one maximal instantiation, the *when*-clause can be interpreted as a universal quantifier over times. An analysis of this reading is beyond the scope of this dissertation.

When the verbs in the matrix and in the *when*-clause describe events in the perfective aspect, the symmetry can disappear, in which case the *when*-clause can introduce a new referent time located after the event, that is, it moves the event forward in time (Sæbø, 2011). In this case, the eventuality of the *when*-clause precedes (as a possible cause) the event described by the matrix clause, as in (2.13).

(2.13) John was deeply saddened when Mary insulted him.

Causal adjuncts

Causal clauses fall within the group of modal adverbial clauses. They relate to the superordinate clause proposition through some accessibility relation between possible worlds. Causal clauses provide an answer to "why" questions. The basic piece of meaning conveyed by causal clauses is that the proposition expressed (or the eventuality described) in the

subordinate clause is the cause of, or reason for, the proposition expressed (or event described) in the main clause, which is the effect, or consequence, as the example in (2.14) shows.

(2.14) They cannot return to their homes because the village has been destroyed.

The dominant assumption of causality was long based on a cause-effect implication according to which the cause is, given a set of premises, a sufficient condition for the effect. Some authors, however, do not agree with this assumption and advocate for a counterfactual analysis of causality, where "q because p" is reduced to "not q if not p", whereby the relation between the two propositions p and q is such that (i) both are true in a world w and (ii) in the closest world to w where p is false, q is false too (Sæbø, 2011).

Structural conjecture: Embedded root transformations

The choice of temporal and causal adjuncts is justified by the observation that these two types of adjuncts present an important difference in their syntactic behavior. Compare the English sentences (2.15a) and (2.15b). While left dislocation is allowed within the causal subordinate clause in (2.15a), the same operation is not allowed in the temporal subordinate clause in (2.15b). These phenomena are commonly referred to as Embedded Root Transformations (or Embedded Root Phenomena – ERP), and can be defined as syntactic transformations that are normally limited to unembedded (=root) clauses, but which occur in embedded clauses.

(2.15) a. Mary got a very good deal because her son, he was the owner of the company.
b. *Mary got a very good deal when her son, he was the owner of the company.

That causal clauses can undergo ERP whereas temporal clauses resist them has been attested crosslinguistically (for an overview see Haegeman, 2003; Heycock, 2005; Sawada & Larson, 2004). For example, in German, temporal connectives (*als* 'when'*, nachdem* 'after'*, bevor* 'before') can only introduce a verb-final clause, as the examples in (2.16) illustrate. Causal and concessive connectives, on the other hand, can introduce both verb-final and verb-second (V2) clauses, as in (2.17) (examples taken from Antomo, 2010, 2012).

(2.16) a. Die Kommissarin erreichte den Tatort, als/nachdem/bevor die Leiche gefunden **wurde**.

b. *Die Kommissarin erreichte den Tatort, als/nachdem/bevor die Leiche **wurde** gefunden.

'The detective reached the scence when/after/before the body was found'

(2.17) a. Die Ärztin bestellt ein Bier, weil sie Durst **hat**.

b. Die Ärztin bestellt ein Bier, weil sie **hat** Durst.

'The doctor ordered a beer because she was thirsty'

Relational vs. non-relation adverbial adjuncts

In relation with the facts presented above, Hooper and Thompson (1973) point out an interesting correlation between the syntax and pragmatics of these two types of adjuncts: temporal adjuncts, which resist ERP, constitute presupposed content, whereas causal adjuncts, which allow ERP, constitute asserted content, not presupposed. An explanation for the correlation above can be found in the proposal on the semantics of these types of clauses by Johnston (1994).

Johnston (1994) proposes a classification of several subtypes of adverbial adjuncts as *relational* and *non-relational*. Relational adverbial adjuncts, on the one hand, introduce higher-order relations that take the eventualities or propositions described by the matrix and subordinate clauses as their arguments. Causal adjuncts fall within this category. Non-relational adjuncts, on the other hand, do not introduce higher-order relations but, rather, they are descriptions of objects in the ontology. Temporal adverbial clauses (*when*-clauses, *before*-clauses, and *after*-clauses) are examples of non-relational adjuncts. One of the criteria that Johnston uses to establish this classification of adjuncts as relational or non-relational concerns their interaction with adverbs of quantification[2].

Temporal connectives combine with an open event sentence to create a time-interval description. The example in (2.18) (adapted from Larson & Sawada, 2012, and Sawada &

[2] Frey (2003) also provides a classification of adverbial adjuncts. He claims that in German and English five major classes of adjuncts have to be distinguished syntactically: (i) sentence adjuncts, (ii) frame adjuncts, (iii) event-external adjuncts, (iv) event-internal adjuncts, (v) process-related adjuncts, according to their base position with respect with the position of other elements of the sentence. For example, temporal clauses can either be frame adjuncts whose base position c-commands the base positions of all arguments and of all remaining adjunct types, or event-internal adjuncts whose base position is minimally c-commanded by the base position of the highest ranked argument. Causal clauses, on the other hand, are event-external adjuncts because their base position minimally c-commands the base position of the highest ranked argument. Going further into this analysis is beyond the scope of the present dissertation.

Larson, 2004) shows that *Maria was at the library* denotes an open event description – the eventuality of Maria being at the library (2.18b). *When* is analyzed as taking an open event description with the result of an interval description, namely, the interval that is the temporal "run-time" of the maximal event that it combines with (2.18c). In this case, *when Maria was at the library* denotes the interval i that is the temporal runtime of the maximal event of Maria being at the library (2.18d).

(2.18) a. when Maria was at the library

b. *Maria was at the library* => **at'**(Maria, the library, e)

c. *when* => λϕλi[∃e[MAX(φ)(e) & i = f(e)]

d. *when Maria was at the library* => λi[∃e[MAX(**at'**(Maria, the library, e))(e) & i = f(e)]

λi[∃e[MAX(**at'**(Maria, the library, e))(e) & i = f(e)] ⇔ **when'** $_{\mathbf{e}}$(**at'**(Maria, the library, **e**))

Johnston assumes that temporal clauses always restrict a (covert or overt) adverb of quantification (AoQ). The example (2.19) shows a case of a *when*-clause that restricts an implicit AoQ. In (2.20) the example illustrates a case where the adverb is overt. Given that quantifier-restrictions are presupposed to be non-empty, this explains the presuppositional nature of temporal clauses that some authors defend (Hooper & Thompson, 1973). However, below we will see that this is not the only source of the presupposition in temporal clauses proposed in the literature.

(2.19) Maria read a book when she was at the library. [Episodic *when*]

∃**when'** $_{\mathbf{e1}}$(**at'**(Maria, the library, **e1**))) [**read'**(Maria, the library, **e2**)]

(2.20) Maria **always** reads a book when she is at the library. [When+Overt AoQ]

∀**when'** $_{\mathbf{e1}}$(**at'**(Maria, the library, **e1**))) [**read'**(Maria, the library, **e2**)]

In the case of causal clauses, however, the connective *because* takes a closed event sentence as its complement creating a binary relation between closed event sentences, as shown in the examples in (2.21) and (2.22) (taken from Sawada & Larson, 2004).

(2.21) Truth-conditions: If X and Y are propositions, then **because'**(X,Y) is true iff X is true as a result of Y being true.

(2.22) a. Marty sold his bike because the gears broke.

b. **because'**(∃e1[**sold'**(Marty, his bike, e1)], ∃e2[**break'**(Marty, his bike, e2)])

Given the truth-conditions in (2.21), the existential quantifier over events is not provided by *because.* Moreover, given that *because* and its complement do not create a description of events or intervals, it cannot restrict an adverb of quantification, and therefore, they do not presuppose the existence of the complement event, but merely assert it (Larson & Sawada, 2012).

Explaining Embedded Root Transformations

The previous section states that, according to some authors, the temporal connectives *when, before* and *after* apply to a smaller semantic domain than the causal connective *because* (e.g. Larson & Sawada, 2012): while temporal connectives combine with open eventuality descriptions, causal connectives combine with a closed eventuality, that is, an open eventuality description plus a quantifier, as shown in (2.23).

(2.23) a. *when Maria was at the library*

when' + **at'**(Maria, the library, e)

b. *because Maria was at the library*

because' + ∃e + **at'**(Maria, the library, e)

If a temporal clause combines with a projection YP, as shown in (2.24a), it could be argued that *because* combines with some larger projection XP, which includes YP and the existential quantifier ∃ as the head of the projection, as in (2.24b). This extra layer of structure will bring with it an extra specifier position [Spec, XP] absent in the syntactic configuration of the temporal clause. The presence or absence of this position explains the (im)possibility of syntactic phenomena like argument fronting in the examples in (2.15) (Geis, 1970; Haegeman, 2003, 2010; Larson & Sawada, 2012; Sawada & Larson, 2004)[3].

[3] In line with this movement analysis, Haegeman (2010), who distinguishes between *peripheral* (e.g. causal) and *central* (e.g. temporal) adjuncts, explains the restriction of the occurrence of ERP in central adverbial adjuncts in terms of an intervention effect.

(2.24) a. **when/before/after** [$_{YP}$…]

b. **because** [$_{XP}$ [$_{X'}$ ∃e [$_{YP}$…]]]

c. **because** [$_{XP}$ her son[$_{X'}$ ∃e [$_{YP}$ he owns the company]]]

As an alternative to what was proposed before, the occurrence of ERP is also explained in terms of presupposition and assertion: only non-presupposed embedded clauses can undergo root transformations (e.g. Hooper & Thompson, 1973; Kiparsky & Kiparsky, 1970; Wechsler, 1991). Hooper and Thompson argue "as a positive environment we can say that [root] transformations operate only on Ss that are asserted [...] some transformations are sensitive to more than just syntactic configurations. It does not seem possible to define the domain of an RT in terms of syntactic structures in any general way. However, […] even if it were possible to define in syntactic terms the conditions under which RTs can apply, […] the question of why these transformations can apply in certain syntactic environments and not others would still be unanswered" (Hooper & Thompson, 1973: 495).

Coming back to the issue of the source of the presupposition in temporal adjuncts, it is important to note that not all authors agree with the proposal that this feature comes from the (overt/covert) adverb of quantification that temporal adjuncts restrict. Haegeman (2003), for example, notices that conditional clauses are also quantifier restrictions, and nevertheless, they can undergo ERP. Antomo (2011) proposes a pragmatic derivation of the presupposition according to which the presuppositional nature of temporal clauses would be derived conversationally. A temporal clause anchors the main clause temporally. The interpretation of the proposition is dependent of the time with respect to which it is evaluated, that is, the truth-value of the main clause depends on that temporal parameter. If this parameter is not given, the sentence has no truth-value. In order to define this temporal parameter, the proposition expressed in the adverbial clause must already have a place in the temporal order and hence must be presupposed. Since the whole sentence is only an appropriate utterance if this proposition is presupposed to have occurred, the hearer can derive the presupposition conversationally, even if the proposition is not part of the shared knowledge.

2.3.2. Back to discourse units: our proposal

Let us now go back to the issue of the boundaries of discourse units, the 'building blocks' that make up discourse, which we claimed to be the optimal domain for the study of pronoun

resolution. In previous sections, we discussed the fact that there seems to be no consensus in the literature as to where to draw the boundary between one DU and the next, and in those cases where an attempt is made to try and provide a definition for this notion, this is usually done in order to accommodate certain parameters specific to the model in question. The spectrum of accounts goes along a continuum that ranges from accounts that defend that DUs are relatively fixed and bounded units to others that defend that DUs are defined in terms of multiple criteria. Focusing on accounts proposed within the domain of pronoun resolution (based for the most part on Centering), we reviewed the two most recurrent proposals – the sentence as a DU and the clause as a DU.

We argue that the syntactic-based definitions of DUs that uniquely equate them to either the sentence or the clause fall short in accounting for all the facts. Against these proposals, we claim that certain factors, such as the syntactic and semantic characteristics of the utterance itself will play a role in the establishment of DUs. Our proposal focuses on the case of complex sentences consisting of a matrix clause and a clause-modifying adverbial adjunct. We propose that a DU can take the form of both a sentence and a clause as a function of the type of adverbial clause itself, although it cannot be a multi-sentence unit. In other words, a complex sentence consisting of a matrix and a subordinate clause can constitute a single DU in itself or two separate DUs depending on the type of subordinate clause in question –a prediction based on Johnston's (1994) analysis of adverbial adjuncts.

Recall that, according to Johnston, temporal clauses, which situate events or states temporally, that is, locate the eventuality in time with respect to some other eventuality, are an example of non-relational adjuncts. Non-relational adjuncts restrict an overt/covert adverb of quantification and, therefore, their content is always presupposed. Causal clauses, on the other hand, are a type of relational adjunct because they introduce higher-order relations that take the eventualities or propositions described by the matrix and subordinate clauses as their arguments. Relational adjuncts do not restrict an adverb of quantification, which means that their content is not necessarily presupposed. One of the syntactic consequences of these syntactic and semantic differences is that relational adjuncts admit Embedded Root Phenomena, while non-relational adjuncts do not, a restriction that is explained both in syntactic terms and as a consequences of the semantic and pragmatic (e.g. presuppositional/assertive) nature of the adjuncts.

Based on Johnston's analysis, we argue that just like the syntactic, semantic, and pragmatic characteristics of adverbial clauses have consequences for the licensing of Embedded Root Phenomena, they also affect the construction of DUs. In particular, we

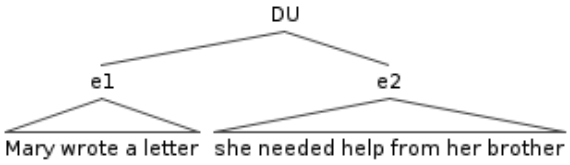
propose the following for complex sentences consisting of a matrix clause and a clause-modifying (causal and temporal) adverbial adjunct:

1. Non-relational temporal subordinate clauses (introduced by connectives *when, before, after*) are processed as part of the same DU as the matrix clause.
2. Relational causal subordinate clauses (introduced by the connective *because*) are processed as a DU independent from the matrix clause[4].

The examples in (2.25) and (2.27) and the trees in (2.26) and (2.28) illustrate these predictions[5].

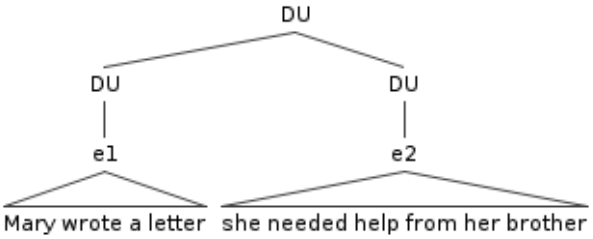
(2.25) [Mary wrote a letter **when** she needed help from her brother.]$_S$

(2.26)



(2.27) [[Mary wrote a letter] [**because** she needed help from her brother.]]$_S$

(2.28)



Providing a definition of DU that is fine-grained enough to accommodate the variety of discourse configurations available and that is adequately formalized would require a comprehensive modeling of discourse that is beyond the scope of this dissertation. It is

[4] We argue that, while causals undeniably constitute two DUs where matrix and subordinate clause are separated by a comma (a pause) (e.g. Mary wrote to Jenny, because she needed a friend), this is also true in cases where the comma is absent, regardless of the scope ambiguity that such a construction entails.

[5] As (2.26) and (2.28) shows, the DU conforms to the sentence boundary, which means that a new sentence is always a new DU. What we are discussing in this section is the DU configuration that occurs within sentence boundaries.

sufficient to say here that DUs in the present proposal retain some of the main properties proposed by previous accounts. These properties are:

- DUs correspond to or contain a tensed clause.
- They denote an eventuality (i.e. not a property).
- They are the argument of a higher-order discourse relation or a speech-act.

To sum up, we have put forward a proposal on the notion of DU that goes against previous purely syntactic accounts. Based on previous analyses of adverbial adjuncts, we have defended a "relational" account where the syntactic, semantic, and pragmatic characteristics of the matrix and subordinate clause contribute to the establishment of DUs: non-relational adjuncts (e.g. temporal clauses) are predicted to be processed as part of the same DU as the matrix clause, while relational adjuncts (e.g. causal clauses) are predicted to be processed as a separate DU from the matrix clause. These predictions should apply to other kinds of subordinate clauses with similar semantic/pragmatic characteristics e.g. subordinate complement clauses introduced by factive verbs like *know,* which, like temporal clauses, also constitute presupposed content might also be processed as part of the same DU as the matrix clause. We strongly believe that this proposal puts forward key elements that are necessary for a finer-grained definition of the basic DU, some of which will have to be tested in future work.

Importantly, going back to the phenomenon under study in the present dissertation, a crucial consequence of this proposal is its interaction with referential resolution processes. We discuss the implications of our proposal on DUs in pronoun interpretation in the following section.

3. Predictions for pronoun resolution

Miltsakaki's (2002) theory of pronoun resolution tries to explain why various resolution preferences affect pronoun interpretation differently in different contextual circumstances. Specifically, Miltsakaki's model predicted that structural and semantic/pragmatic factors constrain pronoun interpretation in a different manner according to whether the pronominal dependency is established within or across DUs, which she defines as consisting of a matrix clause and all subordinate clauses dependent on it. Her model predicts that structural factors, in line with the predictions of Centering Theory –i.e. a preference for topic continuity –will

account better for preferences computed across units, while the focusing properties of the semantics of certain elements of the proposition (in line with the predictions of Coherence Relations accounts) are predicted to account for preferences computed within the unit.

Based on results from previous studies and in line with Miltsakaki's model, we also predict differences in how syntactic, semantic/pragmatic, and information structural factors affect the interpretation of pronouns as a function of the specific configuration of the DUs within the sentence. Crucially, however, our predictions differ from Miltsakaki's in two respects. First, unlike Miltsakaki, we do not advocate for different mechanisms constraining inter- and intra-unit resolution, rather we claim that these mechanisms (or factors) have a different weight in different contexts. Second, contrary to Miltsakaki's, our predictions are based on our proposal on DUs, according to which certain features, like the syntactic and semantic characteristics of (adverbial) clauses, can have an effect on the construction of DUs. We hypothesize that this difference in the conception of a DU will result in major differences in resolution preference patterns.

In particular, we propose that pronoun resolution aims for a maximum of discourse coherence: pronoun interpretation preferences will come about in the process of establishing or maintaining coherence. The specific predictions for contexts consisting of a matrix clause and a subordinate adverbial adjuncts that we have focused on extensively in the present dissertation are the following: When the matrix and the subordinate clause are processed as a single DU, as it is the case of non-relational temporal adjuncts, the adverbial clause provides the run-time of the eventuality described in the matrix clause. Thus, coherence has already been established between both clauses, and the tendency will be to *maintain* it. Empirical and cross-linguistic evidence for this prediction comes from previous studies on the role of information status in pronoun resolution (e.g. Colonna et al., 2012; 2015), which find a general preference for (left-dislocated) topic antecedents, a general dispreference for focused antecedents in a cleft structure. We argued that this so-called *anti-focus effect* can also be seen as a general preference for antecedents that constitute or are part of given, old, presupposed information, which are characteristics associated with topic and topic-like entities.

In those contexts where the matrix clause and the subordinate clause constitute two separate DUs, as it is the case with relational causal adverbial clause, we predict that resolution preferences will come about within the process of *establishing* coherence between units, which will be done through the focusing effects of the semantics of certain elements in the proposition, such as verbs and connectives. Empirical and cross-linguistic evidence for this prediction comes from previous studies on Implicit Causality effects that find (i) that

some verbs when used with animate nouns carry an implicit attribution of the cause of the action indicated by the verb that is associated with one of the two nouns (e.g. Garvey and Caramazza, 1974; Kehler et al., 2008; McKoon et al., 1993, *inter alia*), and (ii) that these biases can change when the verb interacts with different discourse connectives (e.g. Koornneef & Sanders, 2013; Koornneef & van Berkum, 2006).

Summarizing, against the predictions of Miltsakaki's model, our account predicts that within a single DU (e.g. matrix and temporal adjunct), interpretation preferences will be guided by a tendency to maintain coherence within the DU, which can be manifested by a general preference for topic-like entities (or clearly established sentence topics), that is, entities that constitute old/backgrounded/presupposed information; across two DUs (e.g. matrix and causal adjunct), we hypothesize that pronoun interpretation will occur within the process of establishing coherence between units, which can be determined by the semantic/pragmatic information of certain linguistic elements (e.g. verbs, connectives) in interaction with factors affecting the salience of potential antecedents. These predictions are summarized in Table 2.1.

Table 2.1: Summary of predictions for pronoun resolution

	Interpretations depend on	**Achieved through (e.g.)**	**Example**
1 DU	***maintaining*** coherence	Preference for topic or topic-like entities	*It was Peter who slapped John when* ***he*** *was a student.* [he=John]
2 DUs	***establishing*** coherence	Semantic/pragmatic content of verbs, connectives, etc.	*Peter amazes John because* ***he****…* [he=Peter]

Conclusions

We started the chapter with the claim that the typical psycholinguistic approach to pronoun resolution, which consists in putting forward factors that affect this process, is not enough. A complete theory of pronoun resolution must also take into account other aspects of this phenomenon such as the domain of resolution and the cross-linguistic comparison of the results. We reviewed Miltsakaki's (2002) theory of pronoun resolution, which constitutes one of the few proposals that take these two aspects into account.

Based on previous observations and in line with Miltsakaki's model, we argued that the discourse unit (DU) is the optimal framework (or domain) for the study of pronoun resolution. We claimed that previous syntactic-based definitions of DU that uniquely equate this notion to either the sentence or the clause fall short in accounting for all the patterns observed in the literature. We proposed a "relational" definition of DU according to which multiple (syntactic, semantic, pragmatic) factors can contribute to their construction. In particular, based on Johnston's (1994) analysis of (temporal and causal) adverbial adjuncts, we hypothesized that the syntax and semantics/pragmatics of a subordinate clause in a construction consisting of a matrix clause and an adverbial adjunct will have consequences for the establishment of DU, as a function of the type of subordinate clause: non-relational temporal adjuncts are processed as part of the same DU as the matrix clause, while relational causal adjuncts are processed as separate DUs from the matrix clause. We do, however, agree with most accounts provided in the literature, that sentence boundaries, marked prosodically or by punctuation, are a cue to closing the current DU. This will affect temporal adverbial clauses in comparison to similar temporal information given in a separate clause but not causal adverbials clauses. While a fully developed definition of DU is clearly needed, we claimed that this proposal contributes key elements that any future description of DUs must take into account.

Finally, we predicted that the distinction inter- vs. intra-unit resolution has major consequences for pronoun interpretation: within a single DU, interpretation preferences will be guided by a general tendency to *maintain* coherence within the DU; across two DUs, preferences will come about within the *establishment* of coherence between units. Furthermore, the factors that affect resolution will not exert their effects in the same manner as a function of the domain of resolution.

The next three chapters present a series of experimental studies that test all these predictions and hypotheses empirically.

Chapter 3

The role of information status in pronoun resolution

Chapter 3 revolves around the role of information status in pronoun resolution. In the first part of the chapter, we present a series of questionnaire studies that investigate the role of two syntactic constructions traditionally associated with the information status of an entity– *hanging topic left-dislocation* (to mark topic) and *it-clefting* (to mark focus)–in the intra-sentential resolution of null subject and object clitic pronouns in Spanish. In line with previous research on French and German (Colonna et al., 2012; Hemforth et al., 2010), the manipulation of these constructions will tease apart the effects of previously confounded factors (i.e. syntactic function, order of mention, and information status) on pronoun resolution in Spanish. In the second part of the chapter, we put the emphasis on the investigation of the so-called *anti-focus effect* (i.e. a dispreference for focus antecedents in a cleft construction), attested in French and German, and, as we shall see, also in Spanish. We present three questionnaire studies that manipulate two types of *it-clefts* –narrow and contrastive –and a different focusing device –*focus-sensitive particles* –to investigate subject pronoun resolution from a cross-linguistic perspective, in Spanish and in English.

Chapter 3 is organized as follows: in Part 1, building up on the notions pertaining to the information dimension given in Chapter 1, we give a brief theoretical introduction on *hanging topic left dislocation* and *it-clefts* and on the two types of Spanish pronouns investigated in the present study (null subject pronouns and object clitic pronouns), followed by the research questions that guided this part of the study, and by Experiments 1, 2, and 3. At the end of Part 1 we discuss the implications of the results obtained so far. In Part 2, we provide a brief theoretical introduction on *focus-sensitive particles,* followed by research questions, and by Experiments 4, 5, and 6. We discuss the results obtained and we draw some general conclusions about how the results from these 6 experiments fit into the account on DUs and their role in pronoun resolution proposed in Chapter 2.

Part 1:
The role of topic and focus in intra-sentential pronoun resolution in Spanish

1. Topic and focus structures

1.1. Topic structures: Hanging Topic Left Dislocation

Cinque (1990) identifies three constructions that are used for marking topic by means of placing the topic element in a peripheral position in the sentence. These constructions, exemplified in (3.1) to (3.3), are Hanging Topic Left Dislocation (henceforth HTLD), Clitic Left Dislocation (henceforth CLLD), and Clitic Right Dislocation (henceforth CLRD). They all share a core property: the presence of a dislocated element in a peripheral position that is connected to some anaphoric element –the resumptive element –within the sentence (e.g. Alexiadou, 2005; Fradin, 1988, 1990; Hernanz & Brucart, 1987; Olarrea, 1996, 2012; Zubizarreta, 1999). Analyzing these constructions in detail is beyond the scope of the present study. Below, however, we enumerate the main syntactic characteristics of the construction that we used to operationalize topicality in our experiments in Spanish, namely HTLD. The main reason behind the choice of HTLD over CLLD and CLRD is the similarity between this construction in Spanish and its French and German counterparts that were used in previous studies (Colonna et al., 2012; Hemforth et al., 2010)[1].

(3.1) Bowie, me encanta ese cantante. [HTLD]
'Bowie, I love that singer'

(3.2) El postre lo preparé ayer por la tarde. [CLLD]
'Dessert I prepared it yesterday afternoon'

(3.3) María lo dejó ayer, su trabajo. [CLRD]
'María quit it yesterday, her job'

[1] Note that the distinction between HTLD and CLLD in French is controversial, with accounts that claim that this taxonomy is not pertinent (e.g. Fradin, 1988, 1990), and others refuting this view (e.g. Doetjes et al., 2002). This lack of agreement does not concern the relation between left-dislocation and topichood and, thus, does not have any bearings on the purposes of the present chapter.

Some of the main syntactic characteristics of HTLD constructions are (adapted from Olarrea, 2012)[2]:

1. The dislocated element can only be a Noun Phrase (NP).
   a. **María**, mi hermano la conoce desde hace mucho tiempo.
      María, my brother her knows for a long time
   b. ***A María**, mi hermano la conoce desde hace mucho tiempo.
      To-DOM María, my brother her knows for a long time
2. The resumptive (anaphoric) element can be a NP or a pronoun, clitic or tonic.
   a. María, **esa chica** sí que es inteligente.
      'María, that girl is indeed very intelligent'
   b. María, **ella** sí que es inteligente.
      'María, she is indeed very intelligent'
   c. María, todo el mundo **la** considera muy inteligente.
      María, everybody her considers very intelligent
3. The dislocated constituent can be preceded by topicalizing expressions such as *en cuanto a* 'as for'*, por lo que afecta a* 'concerning/regarding'*, hablando de* 'speaking of'.
   a. **Hablando de** María, el otro día la vi por la tele.
      Speaking of María, the other day (I) her saw on TV
4. HTLDs cannot be embedded, they must always appear in first position[3].
   a. *Todos sabemos que María, esa chica es muy inteligente.
      '*We all know that Mary, that girl is very intelligent.'
5. Agreement between the dislocated NP and the resumptive anaphoric element in terms of case, gender and subcategorization is not obligatory with HTLD. In (a), the left-dislocated NP and the anaphoric element agree in gender and number, but not in case.
   a. **María**, siempre pensamos en **ella**.
      'María, we always think of her.'

[2] This list was proposed to account for HTLD in Spanish, which is the language of the experiments we present in the first part of this chapter. Nevertheless, most of these features also apply to the other two languages under study –French and English (see Doetjes et al., 2002; Prince, 1998; Zwart, 1998). When this is not the case, it will be explicitly indicated.
[3] This is possible in (spoken) French (*Nous savons tous que Marie, cette fille est très intelligente*).

6. Under certain conditions (e.g. conjoined phrases), more than one constituent can be dislocated[4].
   a. **En cuanto al gato y al ratón**, éste odia a aquél.
      'Regarding the cat and the mouse, the latter hates the former.'
7. HTLD constructions are insensitive to both strong and weak islands.
   a. En cuanto a esa mansión, no me creo el rumor de que la hayan comprado.
      'As for that mansion, (I) don't believe the rumor that (they) it bought.'
   b. Hablando de 'El Quijote', mi padre que ha leído ese libro muchas veces me ha dicho que es una obra maestra.
      'Speaking of 'Don Quixote', my father who has read that book many times has told me that it is a masterpiece.'
   c. Por lo que se refiere a tu tesis, te vas una semana de vacaciones y seguro que la terminas después.
      'With regard to your thesis, (you) go on holidays for a week and sure that (you) it finish after.'

To conclude, there seems to be general consensus that the HTLD element is base-generated in the left-peripheral position and not the result of movement (there is evidence both in favor and against both proposals in the case of CLLD and CLRD). Crucially, the base-generation hypothesis provides a good explanation as to why HTLD is insensitive to syntactic islands. Additionally, Olarrea (2012) argues that, since there is no direct grammatical link between the dislocated element and the rest of the sentence in HTLD constructions, other facts such as the overt resumptive element, and the lack of connectivity between this element and the dislocated phrase, can also be accounted for.

1.2. Focus structures: it-clefting

Cleft constructions, like the ones shown in (3.4) to (3.6)[5], which are generally analyzed as marking some sort of focus, exist in a variety of typologically different languages. As with topic constructions, there are different types of clefts: it-clefts (3.4), wh-clefts (or pseudo-clefts) (3.5), and reverse wh-clefts (3.6). Once again, analyzing all these types of clefts is

[4] In French there is no theoretical restriction on the number of left dislocated constituents in HTLD.
[5] For clarity purposes, most of the examples given in this section are in English. It should be noted, however, that this discussion applies to the three languages under study in the present dissertation (English, French, Spanish), unless stated otherwise.

beyond the scope of the present study. Instead, we will put the emphasis on the construction that we used to operationalize focus in our experiments, namely *it-clefting*.

(3.4) a. It was Peter who broke the window.
b. C'est Pierre qui a cassé la fenêtre.
c. Fue Pedro quien rompió la ventana.
(3.5) What Peter broke was the window.
(3.6) The window was what Peter broke.

It-clefts consist of two parts, a "matrix" clause containing the expletive (*it* in English, *ce* in French, and a null expletive in Spanish), the copulative verb, and the clefted element/phrase, on the one hand, and, on the other hand, a relative-like clause starting by the complementizer/relative pronoun (*that/who, qui/que, quien/el que/etc.)*. The clefted constituent can either be a Noun Phrase (NP) or a Prepositional Phrase (PP), as in (3.7). Verb Phrases (VP) and Adjectival Phrases (AP) cannot be clefted by means of an *it-cleft* construction in English (Zimmermann & Vasishth, 2010) but they can in French and in Spanish (VP not AP). Furthermore, in English, the complementizer/relative pronoun in the cleft is obligatory when a subject is clefted but it is optional when a non-subject element is clefted, as in (3.8).

(3.7) a. It was the boy who stole the money.
b. It was in Venice that he proposed to her.
(3.8) a. It was Mary *(that/who) called Sarah.
b. It was Sarah (that/who/whom) Mary called.

The syntactic structure of *it-clefts* is an ongoing debate in the literature. Some proposals claim that *it-clefts* are the result of movement, while others claim that the clefted phrase is base-generated (see Haegeman et al., 2014 for a review). Among the movement accounts there are also multiple views: one proposal claims that the cleft phrase (pronoun *it* + NP) constitutes a complex DP as part of a specificational copula clause and that, at some point in the syntactic derivation, the cleft (relative-like) clause has been extraposed to the right periphery and adjoined to IP (Hedberg, 2000; Percus, 1997); a second account proposes that the clefted constituent and cleft clause form a constituent and that the clefted constituent (NP/PP) is moved to the left periphery (according to this account the pronoun *it* is a

semantically empty expletive subject) (É. Kiss, 1998, 1999); a third account claims that the cleft construction is a complex structure that consists of a matrix clause headed by a copula and a relative(-like) clause whose complementizer/relative pronoun is coindexed with the argument of the copula. According to this third account, in a cleft construction, there has been an extraction operation by which the clefted constituent has moved to a VP-peripheral focus position where it can receive the main stress and be interpreted as the focus of the sentence (Belletti, 2005; Lambrecht, 2001). In opposition to the movement accounts, other proposals claim that the cleft sentence consists of two structurally independent propositions and that the second proposition is base-generated as right-adjoined to IP. In this account, the focused constituent is directly merged in a position where it is assigned stress (Clech-Darbon et al., 1999; Hamlaoui, 2007).

Irrespective of these opposing accounts, there seems to be agreement upon the fact that "clefting results in the placement of syntactic constituents and prosodic accents in cognitively preferred positions from which the grammar of the language normally bans them, without causing ungrammaticality" (Destruel, 2013: 37). Or in words of Jespersen "a cleaving of a sentence by means of *it is* (often followed by a relative pronoun or connective) serves to single out one particular element of the sentence and very often, by directing attention to it and bringing it, as it were, into focus, to mark a contrast" (Jespersen, 1937/1969: 147-148).

As the example (3.9) shows, *it-clefts* convey the same meaning as their canonical counterpart in terms of truth-conditions (Lambrecht, 2001; Zimmermann & Vasishth, 2010). However, *it-clefts* convey an additional meaning: exhaustiveness, as in (3.9c). Interestingly, while this exhaustive reading of *it-clefts* seems generally accepted, the source of this exhaustivity has also been the locus of disagreement in the literature, with accounts that analyze it as truth-functional (É. Kiss, 1998, 1999), as a conventional (exhaustiveness) implicature (Halvorsen, 1976, 1978), or as a generalized conversational implicature (Horn, 1981) (see Drenhaus et al. (2011) for a discussion of these proposals).

(3.9) a. It was Peter who bought a house.
b. Peter bought a house.
c. Nobody else bought a house.

It-clefts are usually employed to mark focus, and different types of focus can occur under different discourse conditions (Prince, 1978). Thus, depending on the discourse status of the information in the cleft phrase and in the cleft clause, we can distinguish between

narrow/identificational focus, contrastive/corrective focus, and broad/presentational focus (Beyssade et al., 2001; de Cat, 2002; Doetjes et al., 2004; Katz, 2000; Zimmermann, 2008, *inter alia*). The question-answer pairs given in (3.10) to (3.12) are examples of each type of focus[6]. In a cleft construction marking narrow/identificational focus (3.10) the focalized information in the cleft phrase, which receives prosodic prominence, is brand-new and, thus, unknown to the addressee, whereas the information in the cleft clause is given and presupposed. In a contrastive/corrective cleft (3.11) the information in the cleft phrase, which receives prosodic prominence, is also brand-new and, thus, unknown to the addressee, whereas the information in the cleft clause is given and presupposed. In this construction, the clefted/focused element negates the value that has been assigned to a given variable, introducing an alternative value for that a variable, which brings about an explicit contrast between the clefted element and a number of alternatives (de Cat, 2002; Lambrecht, 2001; Zimmermann, 2008). Finally, in broad/presentational focus cleft (3.12), the focus is not restricted to the cleft phrase but rather it extends over the whole sentence. In this type of focus, there is no presupposed information, as the information given is all unknown and unpredictable by the addressee. Interestingly, while the use of *it-clefts* to encode broad focus is common in e.g. French (Beyssade et al., 2004), the same is not true for other languages like English or Spanish, where this type of focus is encoded by different means. The main characteristics of the three types of focus presented above are summarized in Table 3.1 (adapted from Destruel, 2013).

(3.10) a. Qui vient juste d'arriver ?
C'est Pierre qui vient juste d'arriver.
b. Who just arrived?
It is Peter who just arrived.
c. ¿Quién acaba de llegar?
Es Pedro quien acaba de llegar.

[6] Clefts are not the only or most frequent forms of focus in the context of a question-answer. Other forms of focus, such as emphatic stress or placing the focus element at the end of the sentence (in Spanish), are also available.

(3.11) a. Est-ce que Jean est déjà parti ?
Non, c'est Pierre qui est déjà parti.
b. Did John already leave?
No, it was Peter who already left.
c. ¿Se ha ido ya Juan?
No, es Pedro quien se ha ido ya.

(3.12) a. Que s'est-il passé ?
'What happened?'
b. C'est Pierre qui est arrivé ce matin.
'It was Pierre who arrived this morning.'

From the point of view of processing, focusing by means of clefting has been shown to confer certain processing advantages (Almor, 1999; Foraker & McElree, 2007). The studies reviewed in Chapter 1, for example, provide experimental evidence suggesting that clefting enhances the availability and accessibility of the clefted entity, which is systematically chosen as the antecedent for a subsequent pronominal expression (Colonna et al., 2012, 2015; Cowles, 2003; Cowles et al., 2007; Hemforth et al., 2010), at least when they are in two different sentences (Colonna et al., 2012, 2015).

An interesting question in the study of clefts is what motivates the choice of this construction, which is syntactically more complex over a more economical canonical construction if both convey the same meaning? Is it semantics (i.e. exhaustiveness), information structure (i.e. focus), discourse-semantics (i.e. new/old information), processing advantages (e.g. enhancing antecedent accessibility), or a combination of factors? While recent evidence points towards the hypothesis that clefting is motivated by a combination of the factors enumerated above, further research is still in order.

Table 3.1: Characteristics of three focus types marked via *it-clefts*.

		It is X…	**…who/that Y.**
Narrow / Identificational	**Informational status**	Focus	Presupposed
	Mental state	Unknown/unpredictable by addressee	Activated in discourse/retrievable by addressee
	In discourse	Brand-new or discourse referent already present in the preceding discourse	Strictly given in preceding discourse or situationally/contextually evoked
	Prosody	Prominent	Non prominent
	Pragmatic	Exhaustive reading	Common ground knowledge
Contrastive / Corrective	**Informational status**	Focus	Presupposed
	Mental state	Unknown/unpredictable by addressee	Activated in discourse/retrievable by addressee
	In discourse	Brand-new or discourse referent already present in the preceding discourse	Strictly given in preceding discourse or situationally/contextually evoked
	Prosody	Prominent	Non prominent
	Pragmatic	Contrastive or corrective + exhaustive	Common ground knowledge
Broad / Presentational	**Informational status**	Focus	Focus
	Mental state	Unknown/unpredictable by addressee	Unknown/unpredictable by addressee
	In discourse	Brand-new or discourse referent already present in the preceding discourse	Brand-new or discourse referent already present in the preceding discourse
	Prosody	Unmarked	Unmarked
	Pragmatic	Often answers the QUD "What happened?" or is uttered as an out-of-the-blue sentence	

2. The choice of pronominal expressions: Null subject pronouns and object clitics in Spanish

Most of the studies reviewed in Chapter 1 investigate the resolution of subject pronouns in non-null-subject languages like English, French, and German. Moreover, with the exceptions of Frana (2008) and Runner and Ibarra (in press), most of the studies that investigate null subject pronoun resolution in languages like Italian or Spanish do not tease apart subject from topic and first mention. Crucially, however, studies on the role of information structure on

pronoun resolution show that the informational status of the antecedent might provide a better account of the patterns reported in the literature. The fact that pronouns prefer topic antecedents seems to be unquestionable by now. The goal of the experiments that follow is not only to contribute further to the body of research on this phenomenon by investigating the role of HTLD and *it-clefting* in pronoun resolution in Spanish; it also aims at investigating the effects of these two constructions on the resolution of two types of pronominal expressions that are not so commonly looked into: null subject pronouns and object clitic pronouns.

We focus on the resolution of third person singular null subject and object clitic pronouns. Depending on their syntactic constellation, third person pronouns can be interpreted via binding constraints (Principle B of Binding Theory, Chomsky, 1981) or via co-reference. There are certain contexts, however, where binding alone cannot account for the interpretation of pronouns. That is the case, for example, of sentences where more than one referent constitutes a syntactically possible antecedent for a subsequent pronoun, as it is always the case with our experimental items. The interesting question is, then, what factors contribute to establishing co-reference between the pronoun and one of the antecedents over the other.

2.1. Null Subject pronouns

Most of the literature on pronoun interpretation focuses on the resolution of overt subject pronouns, mainly in English. However, as we saw in Chapter 1, the explicit/implicit nature of the pronominal expression might also have bearings on how it is interpreted. Carminati's (2002) experiments on Italian and her *Position of Antecedent Hypothesis* (henceforth PAH) suggest that null subject pronouns will be preferentially interpreted as referring to a preceding entity that is in the subject position, while the overt subject pronoun prefers an antecedent that is in a lower syntactic position, such as the object position.

Spanish, like Italian, allows for both null and overt subject pronouns, which are not in free alternation in the language. According to traditional accounts on this phenomenon, their expression or omission is regulated by both syntactic and discourse-pragmatic constraints, such as topic, focus, contrast or emphasis (e.g. Luján, 1985, 1986, 1987, 1999). For example, when there is no switch in reference between a series of sentences in discourse, overt subjects are pragmatically inappropriate. Similarly, null subjects seem infelicitous when a referent different from the preceding topic (topic-shift) is introduced. Whereas an exhaustive analysis of the nature and distribution of null and overt pronouns in Spanish is beyond the scope of the

present study[7], recall that recent experimental work on pronoun resolution that tried to replicate Carminati's experiments on Italian (cf. Alonso-Ovalle et al., 2002; Filiaci, 2010; Filiaci et al., 2013, see Chapter 1) has shown that the interpretation of null and overt pronouns in Spanish does not always obey these constraints and that other processing strategies might play a role in this domain: in particular these studies show that the PAH seems to make accurate predictions in what concerns the null subject pronoun in Spanish, but it falls short in providing a satisfactory explanation for the behavior of overt subject pronouns. Our choice of pronominal expressions was thus primarily motivated by the robust bias for subject antecedents predicted by the PAH and that has been reported in the literature also for null pronouns in Spanish. Given the lack of a clear bias in previous work, overt subject pronouns were not part of the present study (see, however, Experiment 3 below for a direct comparison between null and overt pronouns independent of information status).

2.2. Object clitics

Studies devoted to object pronoun resolution are rare and, for the most part, they investigate object pronoun resolution in English (Kehler, 2002, 2005; Tavano & Kaiser, 2008; Wolf et al., 2004). Many of them assume a pattern by which object pronouns are preferentially interpreted in a parallel structure, as in (3.13).

(3.13) John hit Harry and then Sarah hit him. (him= Harry)

The *Parallel Function Strategy* (henceforth PFS) (Sheldon, 1974; Smyth, 1994), according to which subject pronouns prefer subject antecedents, and object pronouns prefer object antecedents, tries to account for these facts. However, as we saw in Chapter 1, recent research suggests that this pattern depends on coherence relations between the respective sentences or clauses (Kehler, 2002, 2005; Kehler et al., 2008; Wolf et al., 2004). That is, parallel functions seem to play a role mostly in similar or parallel constructions.

To our knowledge, no previous study has been published that investigated ambiguous object clitic pronoun resolution[8]. Spanish object clitics, which, unlike English object pronouns, are unstressed and appear in preverbal position with finite verbs (i.e. they are

[7] For a more complete account of this phenomenon, see Jaeggli and Safir (1989), Luján (1985, 1986, 1987, 1999), among many others.

[8] Grüter et al. (2012) investigated whether Spanish-speaking children and adults process object clitic pronouns incrementally using a looking-while-listening eye-tracking paradigm. Their stimuli, however, are not ambiguous, as they are interested in the time-course of unambiguous resolution processes.

proclitics – with infinitives, gerunds, and imperatives they attach to the verb as enclitics), represent thus an interesting case in the study of reference resolution.

3. Research questions

In light of the facts reviewed above, the following research questions guided this part of the study:

1. In canonical structures (here a baseline condition), will the same strategies elicited in previous studies be observed in subject and object pronoun resolution in Spanish (i.e. PAH for null subject pronouns; PFS for object clitic pronouns)?
2. Will the manipulation of the informational status of the antecedents (by means of hanging topic left-dislocation and it-clefting) affect the baseline preferences and, if so, in what way?

4. Experiment 1

Experiment 1 tested how ambiguous null subject pronouns are resolved intra-sententially in canonical structures in Spanish consisting of a matrix clause and an adverbial subordinate adjunct. In doing this, we were interested in testing whether previous proposals, like Carminati's PAH, can account for the pattern of results obtained. Additionally, in Experiment 1 we also investigated whether and to what extent two structures that are usually associated with information status, namely HTLD and *it-clefting*, had an effect on the resolution of ambiguous null subject pronouns in Spanish, as was found for other languages such as French and German. The manipulation of these two structures also allowed us to tease apart previously confounded factors like subjecthood, first-mention, and topicality.

4.1. Method

Twenty-two native speakers of Spanish, recruited via Amazon Mechanical Turk, completed a sentence interpretation task (SIT) in the form of an offline questionnaire. They were paid $1.86 for their participation (which took 15-20 minutes). Participants were of different origins (Spain, Mexico, Uruguay). We took care, however, to exclude participants that spoke a Caribbean variety of Spanish, which has been shown to have slightly different principles governing the distribution of null and overt pronouns (Toribio, 2000). One participant was excluded following this selection criterion. Participants completed the questionnaire via the

Internet-based platform *IbexFarm*. They were instructed to read carefully a series of sentences, each of which was followed by a prompt with a gap, and to fill in the gap with an antecedent from the preceding sentence. Items appeared on the screen one by one. Rechecking of earlier items was not allowed.

Twenty-five experimental items were constructed for this experiment. The experimental items were complex sentences consisting of a main clause that contained two human referents of the same gender followed by a subordinate temporal adjunct introduced by *cuando* ('when') featuring an ambiguous null pronoun that could refer to either of the two antecedents in the main clause. The subject of the sentence is always the agent or the experiencer of the action and the object referent is always the patient or the theme. Thirteen items had masculine referents; the remaining 12 items had feminine referents. The critical prompt was the subordinate clause introduced by a gap.

In order to avoid any potential biases towards one of the two antecedents, we explicitly selected verbs in the matrix clause that have been shown to be neutral in previous studies on Implicit Causality (Bott & Solstad, 2014; Ferstl et al., 2011; Goikoetxea et al., 2008), that is, we selected verbs that are equally biased towards both subject and object antecedents. Although we did not use the same verbs in all of the studies presented in this dissertation, the principle of choosing equi-biased verbs was kept constant.

The experimental items were presented in five different conditions: a baseline condition, two HTLD (subject or object) conditions, and two *it-clefting* (subject or object) conditions. The informational status of the antecedents was operationalized following the design of previous studies. HTLD constructions were used to mark topic and were constructed by means of the particle *Hablando de* 'Speaking of'; *it-clefting* structures were chosen for consistency reasons as the prototypical focus structure following previous studies (Colonna et al., 2010, 2012; Cowles, 2003; Cowles et al., 2007). Sample items in the 5 different conditions are given in (3.14). Lists of materials used in the experiments presented in this dissertation are given in Appendix A.

In addition to the experimental items, 50 filler items were included to distract participants from the phenomenon under investigation. Half of the filler items consisted of complex sentences with a main clause that introduced two potential antecedents in a complex NP for a subsequent ambiguous relative clause, as in (3.15). The other half consisted of sentences that contained either a post-verbal subject NP or a direct object NP preceded by the Differential Object Marker *a*, as in (3.16). Five presentation lists with 75 items (automatically

randomized) were constructed by the software following a Latin Square design so that participants would only see each experimental item in one of the 5 critical conditions.

(3.14) a. **Baseline**: Eduardo llamó a Samuel cuando estaba en la oficina.

b. **Disloc Subj.**: Hablando de Eduardo, él llamó a Samuel cuando estaba en la oficina.

c. **Disloc Obj.**: Hablando de Samuel, Eduardo lo llamó cuando estaba en la oficina[9].

d. **Cleft Subj.**: Fue Eduardo quien llamó a Samuel cuando estaba en la oficina.

e. **Cleft Obj.**: Fue a Samuel a quien Eduardo llamó cuando estaba en la oficina.

'Eduardo / Speaking of Eduardo / It was Eduardo who…called Samuel when (he) was in the office'

PROMPT: _____ estaba en la oficina.

(3.15) El profesor habló con el padre del estudiante que se quejaba constantemente.

'The teacher spoke with the father of the student who was always complaining'

(3.16) Como se sentía muy generoso esa noche, invitó (a) Lucas.

'Since he was feeling generous that night, Lucas invited / (he) invited Lucas'

4.2. Results

For the statistical analyses, subject antecedent choices were assigned a 1 and object antecedent choices were assigned a 0 for a log-linear mixed-effects model analysis containing a fixed effect of Condition (with 5 levels), and random intercepts for Participants and Items (Baayen et al., 2008)[10]. All data were analyzed using R (R Development Core Team, 2009) and the R packages *lme4* (Bates & Maechler, 2009) and *languageR* (Baayen, 2008, 2009). In order to compare the different conditions to the baseline, we included Condition as a fixed effect (see Table 3.2 and Figures 3.1 and 3.2). The statistical comparison between the full and the reduced models yielded a highly significant effect ($\chi^2(4)=33.456$, $p<.001$), which indicates that our experimental manipulations had a systematic effect on participants' choices. In

[9] We are aware of the fact that in those varieties of Spanish were the phenomenon of *leísmo* prevails, "le llamó" would be more frequent than "lo llamó". Given the nature of the study and the phenomenon under investigation, this fact should not have any bearings on the results.

[10] All the statistical analyses performed in this chapter were linear mixed models (done using the *lmer* function) that included Items and Participants as random slopes. A recent technical change in the R software, however, does not allow the use of *lmer* with the 'logit' family (used with binary data) anymore. All the remaining analyses had to be performed using general linear mixed models and the *glmer* function. The addition of Items and Participants as random slopes with this new function resulted in errors of convergence and, thus, had to be removed. We reran all previous analyses using the *glmer* function and the results were the same. For consistency reasons, we present the most recent analyses only (with *glmer*). However, as a consequence, all models are so-called intercept-only models, not including maximal random structure.

particular, the results show that clefting subjects and objects (*CleftSubj – CleftObj*) reduced choices of the clefted antecedent significantly compared to the baseline condition. Left-dislocating objects (*DislocObj*) increased choices of the left-dislocated antecedent significantly, whereas left-dislocation of subjects (*DislocSubj*) did not change preferences reliably. Interestingly, in the baseline condition, participants did not show any preference for either antecedent as they selected a subject antecedent 47.62% of the times, and an object antecedent 52.38% of the times. As the statistical values for the Intercept in Table 3.2 indicate, this difference is not statistically significant.

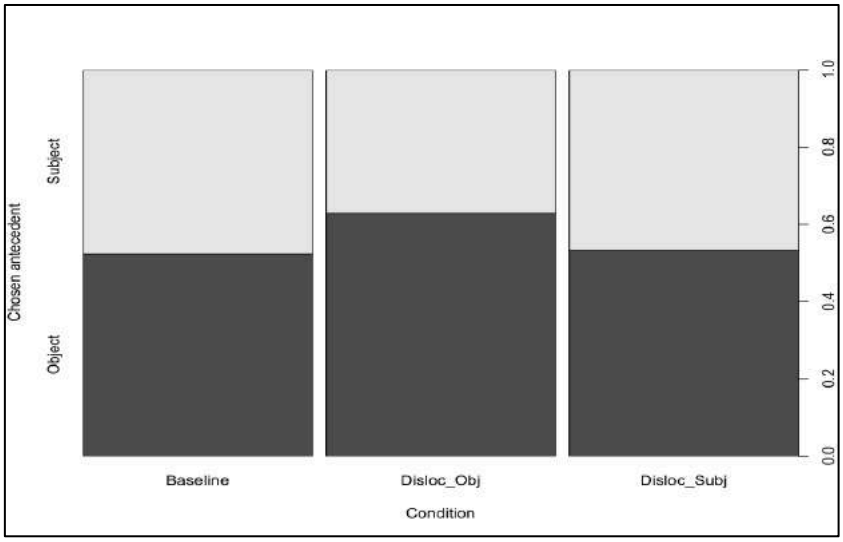
Table 3.2: Fixed effect values of linear mixed-effects model for Experiment 1[11]

m1 = glmer(Response~ Condition+(1|Participant)+(1|Item), family=binomial(link="logit"), data=data)

m0 = glmer(Response~ 1+(1|Participant)+(1|Item), family=binomial(link="logit"), data=data)

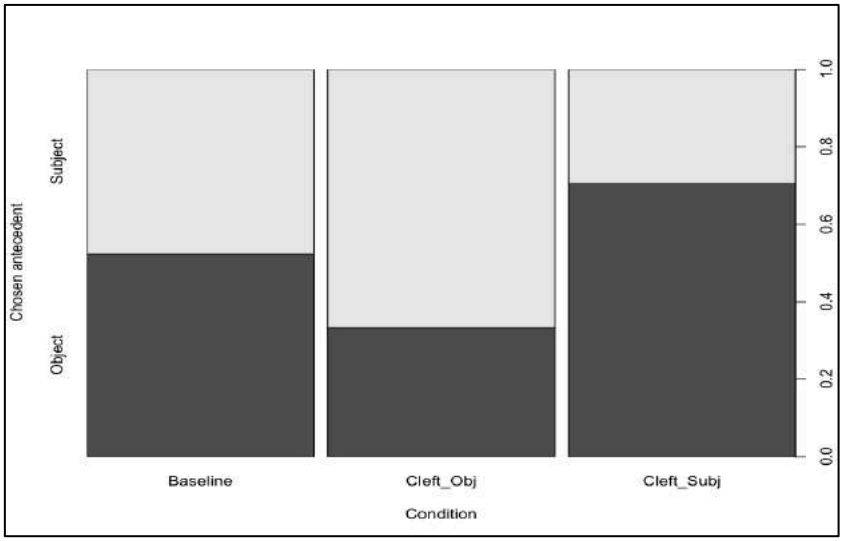
Condition	Estimate	Std. Error	z-value	Pr(>|z|)
(Intercept)	-0.04121	0.26397	-0.156	0.87593
Cleft_Obj	0.75453	0.31314	2.410	0.01597 *
Cleft_Subj	-0.86176	0.31256	-2.757	0.00583 **
Disloc_Obj	-0.64148	0.30773	-2.085	0.03711 *
Disloc_Subj	-0.09460	0.30342	-0.312	0.75521

Figure 3.1: Antecedent choices (subject or object) for null subject pronouns in the HTLD conditions



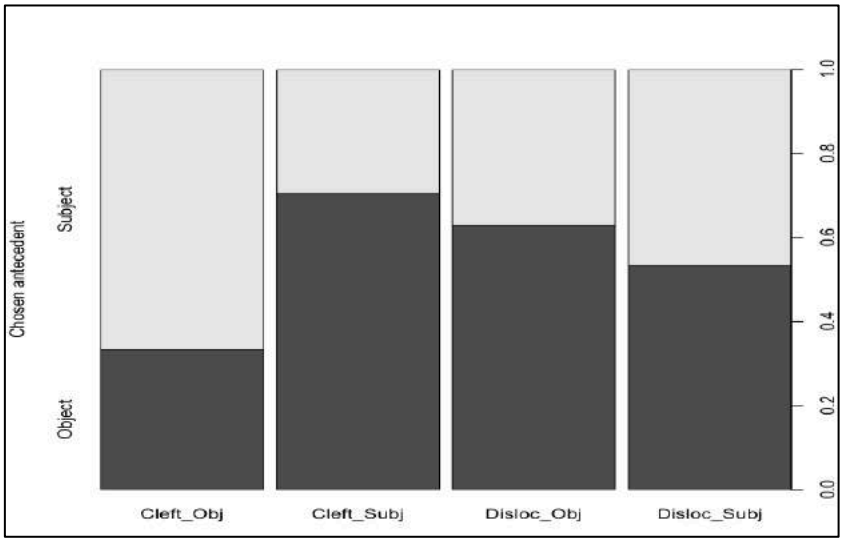
[11] 'm1' corresponds to the full model, 'm0' correspond to the reduced model.

Figure 3.2: Antecedent choices (subject or object) for null subject pronouns in the it-clefting conditions



In order to test the role of the two syntactic constructions affecting the discourse status of the antecedents (HTLD vs. *it-clefting*) and their grammatical function (subject vs. object), we ran a second log-linear mixed-effects model analysis with Subjects and Items as random effects and Syntactic construction and Grammatical function as fixed effects, excluding the baseline condition. Once again, to assess the validity of the mixed-effects analyses, we performed likelihood ratio tests comparing the full models with all fixed effects to reduced models. The analyses revealed no significant effect of Syntactic construction ($\chi^2(1)=2.0936$, $p>.05$). There was, however, a significant effect of Grammatical function ($\chi^2(1)=6.1198$, $p<.05$) as a result of a slight advantage for object antecedents (45.5 % for subject antecedents vs. 54.5 % for object antecedents). The interaction between our experimental factors turned out to be highly significant ($\chi^2(1)=23.882$, $p<.001$). Pairwise comparisons of the factor Syntactic construction for subjects and objects showed that dislocated objects were chosen as antecedents significantly more often than clefted objects (β=-1.5981, SE=0.4772, z=-3.349, $p< .001$). Likewise, dislocated subjects were chosen significantly more often than clefted subjects (β=1.0857, SE=0.3795, z=2.860, $p<.01$). Figure 3.3 shows the interaction of the four conditions without the baseline. Fixed effect values for the complete model with the two experimental factors for this experiments and all experiments presented in Chapter 3 are given in Appendix E.

Figure 3.3: Interaction of four experimental conditions in Experiment 1



4.3. Discussion

To summarize the results of Experiment 1, no clear preference for either the subject or the object antecedent was observed for the ambiguous null subject pronoun in the baseline condition. This pattern changed significantly, however, as a result of the experimental manipulations of the informational status of the antecedents: The number of object antecedent selections increased significantly when the object antecedent was left-dislocated in a HTLD construction and, crucially, the number of subject and object antecedent selections decreased significantly when these antecedents were in a clefted position in an *it-cleft* construction. The number of subject antecedent choices for the null subject pronoun did not increase when the subject was left-dislocated. These results will be discussed in more detail in light of the results from Experiment 2 below.

5. Experiment 2

In Experiment 2, we investigated whether and in how far HTLD and *it-clefting* show comparable effects in the resolution of object clitic pronouns as for null subject pronouns in Spanish. Given that baseline preferences are expected to be different for object clitics if participants follow e.g. a *Parallel Function Strategy,* preference patterns as a result of our experimental manipulations might turn out to be very different from those in Experiment 1.

5.1. Method

Thirty-four native speakers of Peninsular Spanish completed the same type of sentence interpretation task (SIT) employed in Experiment 1. The questionnaire was administered in paper-and-pencil format at the University of Valladolid (Spain). Participants were instructed to read carefully a series of sentences followed by a prompt with a gap and to fill in the gap with an antecedent from the preceding sentence.

As for Experiment 1, 25 experimental items were constructed for this experiment. The experimental items were complex sentences consisting of a matrix clause that contained two human referents of the same gender followed by a subordinate temporal adjunct introduced by *antes de que* ('before') that featured a third human referent of the opposite sex to the two previous referents and an ambiguous object clitic pronoun that could ambiguously refer to either of the two antecedents in the main clause. Thirteen items featured masculine referents; the remaining 12 items featured feminine referents in the main clause. As for Experiment 1, the verbs in the matrix clause did not present an implicit bias towards either antecedent, as evidenced in previous studies. The critical prompt was a paraphrase of the subordinate clause with a gap after the main verb (in the canonical direct object position).

The same critical conditions manipulated in Experiment 1 were used for this experiment. Sample items in the 5 different conditions are given in (3.17).

(3.17) a. **Baseline**: Eduardo vio a Samuel antes de que María lo llamara.

b. **Disloc Subj.**: Hablando de Eduardo, él vio a Samuel antes de que María lo llamara.

c. **Disloc Obj.**: Hablando de Samuel, Eduardo lo vio antes de que María lo llamara.

d. **Cleft Subj.**: Fue Eduardo quien vio a Samuel antes de que María lo llamara.

e. **Cleft Obj.**: Fue a Samuel a quien Eduardo vio antes de que María lo llamara.

'Eduardo / Speaking of Eduardo / It was Eduardo … who(m) saw Samuel before María called him'

PROMPT: María llamó a _____ .

In addition to the experimental items, the same 50 filler items included in Experiment 1 were used in this experiment. Five presentation lists with 75 items and 4 practice items were

constructed so that participants would only see the experimental items in one of the 5 critical conditions. One randomization of experimental and filler items was performed per list.

5.2. Results

As in Experiment 1, in order to compare the different conditions to the baseline, we included Condition as a fixed effect in a log-linear mixed-effects model analysis with Subjects and Items as random effects (see Table 3.3 and Figures 3.4 and 3.5). The statistical comparison between the full and the reduced models yielded a highly significant effect ($\chi^2(4)=46.615$, $p<.001$), which indicates that our experimental manipulations had a systematic effect on participants' choices. In particular, clefting objects (*CleftObj*) significantly reduced choices of the clefted antecedent compared to the baseline condition, whereas clefting subjects (*CleftSubj*) did not change preferences reliably. On the other hand, left-dislocating subjects and objects (*DislocSubj – DislocObj*) significantly increased choices of the left-dislocated antecedents. Contrary to the results of Experiment 1, in the baseline condition, participants showed a strong preference for the object antecedent, which was selected 64.71% of the times. As the statistical values for the intercept in Table 3.3 indicate, the difference between subject and object antecedent selections in the baseline condition was statistically significant.

Table 3.3: Fixed effect values of linear mixed-effects model for Experiment 2

m1 = glmer(Response~ Condition+(1|Participant)+(1|Item), family=binomial(link="logit"), data=data)

m0 = glmer(Response~ 1+(1|Participant)+(1|Item), family=binomial(link="logit"), data=data)

Condition	Estimate	Std. Error	z-value	Pr(>|z|)
(Intercept)	-0.65808	0.23406	-2.812	0.004930 **
Cleft_Obj	0.39535	0.23802	1.661	0.096709 .
Cleft_Subj	-0.07995	0.24243	-0.330	0.741567
Disloc_Obj	-0.93460	0.26619	-3.511	0.000446 ***
Disloc_Subj	0.69297	0.23829	2.908	0.003637 **

Figure 3.4: Antecedent choices (subject or object) for object clitic pronouns in the HTLD conditions

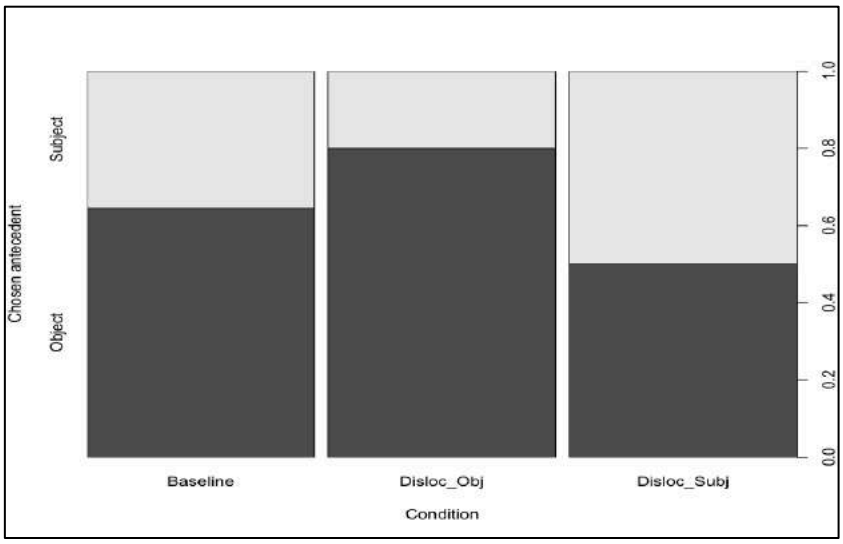
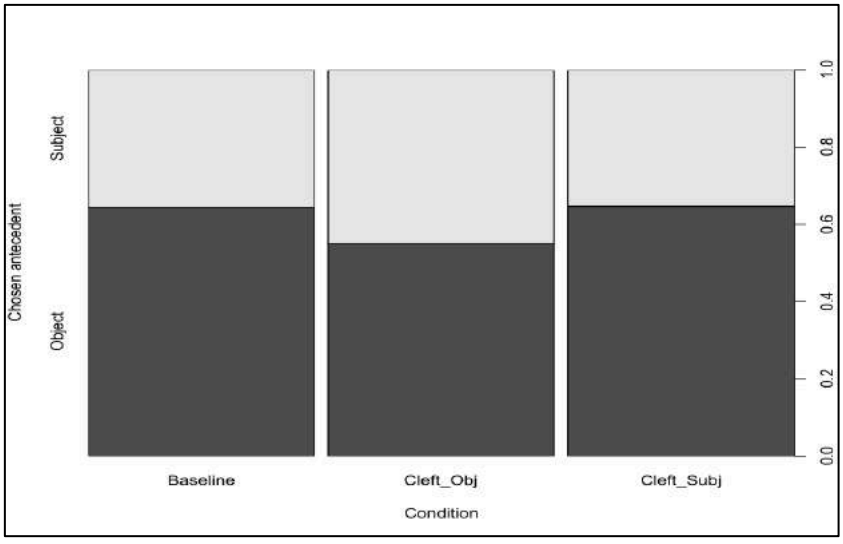


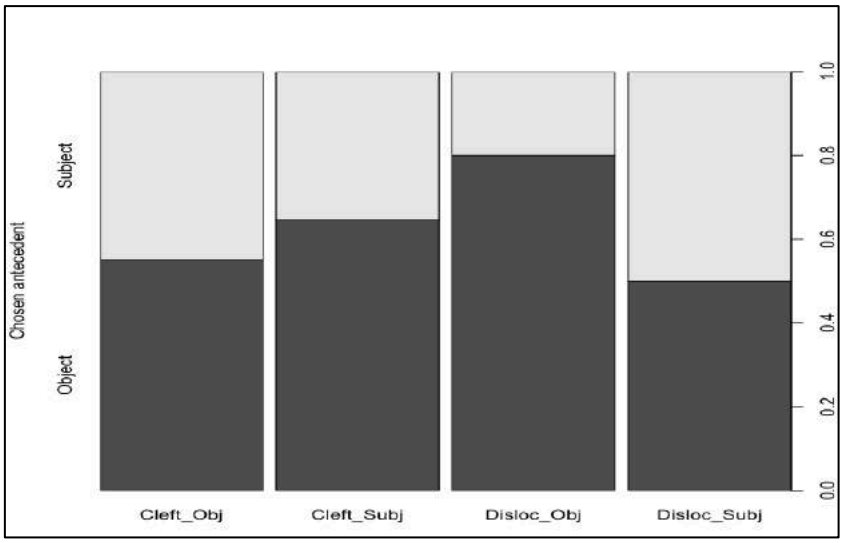
Figure 3.5: Antecedent choices (subject or object) for object clitic pronouns in the it-clefting conditions



In order to test the role of Syntactic construction (HTLD vs. *it-clefting*) and Grammatical function (subject vs. object), we ran a subsequent log-linear mixed-effects model analysis with Subjects and Items as random effects and Syntactic construction and Grammatical function as fixed effects, excluding again the baseline condition, as in Experiment 1. To assess the validity of the mixed effects analyses, we performed likelihood

ratio tests comparing the full models with all fixed effects to reduced models. Like in Experiment 1, the analysis did not reveal a significant effect of Syntactic construction ($\chi^2(1)=1.5047$, $p>.05$), but did reveal a significant effect of Grammatical function ($\chi^2(1)=9.0599$, $p<.01$) as a result of a strong advantage for object antecedents (37.6% for subject antecedents vs. 62.4% for object antecedents). The interaction between our experimental factors turned out highly significant ($\chi^2(1)=35.911$, $p<.001$). Pairwise comparisons of the factor Syntactic construction for subjects and objects showed that dislocated objects were chosen as antecedents significantly more often than clefted objects (β=-1.5046, SE=0.3084, z=-4.879, p< .001). Likewise, dislocated subjects were chosen significantly more often than clefted subjects (β=1.0026, SE=0.3004, z=3.338, p<.001). Figure 3.6 shows the interaction of the four conditions without the baseline.

Figure 3.6: Interaction of four experimental conditions in Experiment 2



5.3. Discussion

To summarize the results of Experiment 2, a strong object antecedent preference was elicited for object clitic pronouns in the baseline condition. This pattern changed significantly, however, as a result of the experimental manipulations of the informational status of the antecedents (operationalized by HTLD to mark topic and *it-clefting* to mark focus): the number of subject and object antecedent selections increased significantly when these antecedents were left-dislocated and, crucially, the number of subject and object antecedent selections remained the same or decreased significantly respectively when these antecedents were in a clefted position.

The significant increase in the number of subject and object antecedent choices of left-dislocated antecedents that was elicited for both types of pronouns is in line with previous experimental results that find that ambiguous pronouns prefer topic antecedents (Arnold, 1999; Colonna et al., 2010, 2012; Cowles et al., 2007). In the case of inter-sentential pronoun resolution, this finding has been related to the notion of *topic-continuity* (Givón, 1983): participants selected the *explicitly* established sentence topic as the antecedent of the ambiguous pronoun because selecting the other available antecedent would break this continuity, affecting, therefore, the coherence of the current discourse. Although strictly speaking the notion of topic continuity was not proposed for intra-sentential environments like the ones in our experimental stimuli, the proposal that participants try to avoid a topic shift that would break continuity and, thus, coherence, can also be applied here. The fact that the number of subject antecedent choices for the null subject pronoun did not increase when the subject was left-dislocated does not necessarily go against these claims: if the subject is interpreted as the default topic of the sentence (cf. Alexiadou & Anagnostopoulou, 1998; Ordóñez & Treviño, 1999; Kato, 1999), assuming a Parallel Structure bias, explicit topicalization via left-dislocation might not make a big difference in the case of subject pronouns, hence the lack of a significant difference between the baseline condition and the dislocated-subject condition (cf. Repp & Drenhaus, 2011 for similar results and claims for German).

Critically, however, the results of the *it-clefting* conditions go against the results from previous studies on the role of focus in inter-sentential pronoun resolution (cf. Cowles et al., 2007) but are, nevertheless, concordant with results for intra-sentential pronoun resolution in French and German (cf. Colonna et al., 2012), where a general dispreference for clefted antecedents is attested. This pattern, which has been referred to as an *anti-focus effect,* is also in line with the notions of continuity and coherence in discourse: focused referents, which constitute brand-new, unknown, and unexpected information (Erteschik-Shir, 1997; cf. Table 3.1), are not good antecedents. However, the focus of a given utterance can often become the topic of the following one (Sgall et al., 1986; Tomlin et al., 1997; Weil, 1844), which means that *it-clefts* can be regarded as a construction that signals a potential change of topic. This view of the cleft structure bears resemblances with what has been labeled "topic shifts" (Erteschik-Shir et al., 2013; Frascarelli & Hinterhölzl, 2007). In a dynamically updated discourse representation, at the moment the pronoun is processed, the informational status of the clefted antecedent is thus not the same between and within sentence: while clefts constitute the focus of the sentence they are part of, they may signal an upcoming topic

change. The expectation then would be that a clefted antecedent co-refers preferentially with a pronoun in a new sentence but not in the same sentence. A topic-shift within sentence boundaries reduces coherence, while a topic-shift across sentence boundaries can occur without affecting negatively discourse coherence (Colonna et al., 2012, 2015).

Summarizing, the results of Experiments 1 and 2 show that the manipulation of the informational status of the antecedent by means of HTLD and *it-clefting* have a systematic effect on participants' choices of antecedents for ambiguous subject and object pronouns in Spanish. However, these effects are not the same for the two syntactic constructions tested: while pronouns in the subordinate clause show an increased preference for left-dislocated antecedents, clefting does not affect or even decreases the accessibility of the clefted antecedent for ambiguous pronouns in the subordinate clause.

To conclude, in line with the predictions of the PFS, the results of the baseline condition in Experiment 2 show a robust object antecedent bias for object clitic pronouns in Spanish. The lack of a clear preference for either antecedent in the baseline condition in Experiment 1 (null subject pronouns), on the other hand, are surprising in light of results from previous studies that reported a robust subject antecedent bias for null subject pronouns in Spanish (cf. Alonso-Ovalle et al., 2002; Filiaci, 2010; Filiaci et al., 2013; Keating et al., 2011). These results suggest that, at least in certain contexts, the null subject pronoun can take an object antecedent as easily as a subject antecedent from a preceding clause.

Before making any claims on the lack of a subject antecedent preference for null subject pronouns, however, some potential methodological issues need to be explored. One possibility could be that our materials were biased against such a preference either semantically or because, for example, our fillers primed an NP2 preference. However, it has to be noted that the items used in the present study where highly parallel to those used in previous studies (e.g. Filiaci, 2010; Jegersky et al., 2011; Keating et al., 2011) and that we additionally controlled for verb biases. The only difference between our study and previous studies is the combination of experimental conditions manipulated: while the present study investigated only null subject pronouns, the other studies investigated the resolution of both null and overt subject pronouns. In other words, in our study participants only "saw" null pronouns embedded in five different conditions, while in the other studies participants were presented with both null and overt pronouns. The question that follows is: could the robust subject antecedent bias for null pronouns be at least partly due to a metalinguistic strategy on the participants' part? Experiment 3 sheds light on this question.

6. Experiment 3

Given that we did not find the subject preference for null subject pronouns repeatedly attested in the literature and predicted by the PAH, we wanted to find out whether our materials might have been biased against such a preference or alternatively whether the lack of a subject preference could be due to the fact that most experiments showing such a bias tested null and overt pronouns at the same time. This combination of factors may have caused metalinguistic strategies on the part of the participants, as they may have, more or less consciously, differentiated the function of null and overt pronouns. In Experiment 1, we only presented null pronouns in different contexts so that no such strategy could have been developed. In Experiment 3, we presented participants with both types of pronouns to test this possibility.

6.1. Method

Twenty-four native speakers of Spanish of various countries (Spain, Mexico, Colombia) completed the same type of sentence interpretation task (SIT) employed in Experiments 1 and 2. The questionnaire was administered via the Internet-based platform *IbexFarm*, as in Experiment 1. Participants were recruited via Amazon Mechanical Turk and paid $1.86 for their participation. They were instructed to read carefully a series of sentences followed by a prompt with a gap and to fill in the gap with an antecedent from the preceding sentence.

Twenty-four experimental items used in Experiment 1 were used for this experiment in two conditions: null subject pronoun and overt subject pronoun. Sample items are given in (3.18). In addition to the experimental items, 48 of the filler items included in Experiments 1 and 2 were used in this experiment to keep the experimental contexts as similar as possible. Two presentation lists were automatically generated so that participants would only see the experimental items in only one of the 2 experimental conditions. Each list was randomized individually for each participant.

(3.18) a. Null: Eduardo llamó a Samuel cuando estaba en la oficina.
b. Overt: Eduardo llamó a Samuel cuando él estaba en la oficina.
'Eduardo called Samuel when (he) was in the office'
PROMPT: _____ estaba en la oficina.

6.2. Results

Just like for Experiments 1 and 2, we ran a log-linear mixed-effects model analysis with Condition as a fixed effect and Subjects and Items as random effects (see Table 3.4 and Figure 3.7). To assess the validity of the mixed effects analyses, we performed likelihood ratio tests comparing the full models with the fixed effect to a reduced model. The analysis revealed a highly significant effect of the type of pronoun ($\chi^2(1)=13.201$, $p<.001$). In particular, the results of Experiment 3 show a clear antecedent bias as a consequence of the nature of the pronoun: with a null pronoun, participants selected a subject antecedent significantly more often than an object antecedent; likewise, with an overt pronoun, participants selected an object antecedent significantly more often than a subject antecedent. The results for null subject pronouns replicate the results from previous studies (cf. Alonso-Ovalle et al, 2002; Filiaci, 2010; Filiaci et al., 2013; Jegerski et al., 2011; Keating et al., 2011) and are in line with the predictions of the PAH: the null subject pronoun prefers a more prominent subject antecedent, while the overt subject pronoun prefers a less prominent object antecedent. Crucially, however, as Figure 3.7 shows, the results of Experiment 3 for null subject pronouns do not replicate those from the baseline condition of Experiment 1, despite the fact that the same stimuli were used in both experiments.

Table 3.4: Fixed effect values of linear mixed-effects model for Experiment 3

m1 = glmer(Response~ Condition+(1|Participant)+(1|Item), family=binomial(link="logit"), data=data)

m0 = glmer(Response~ 1+(1|Participant)+(1|Item), family=binomial(link="logit"), data=data)

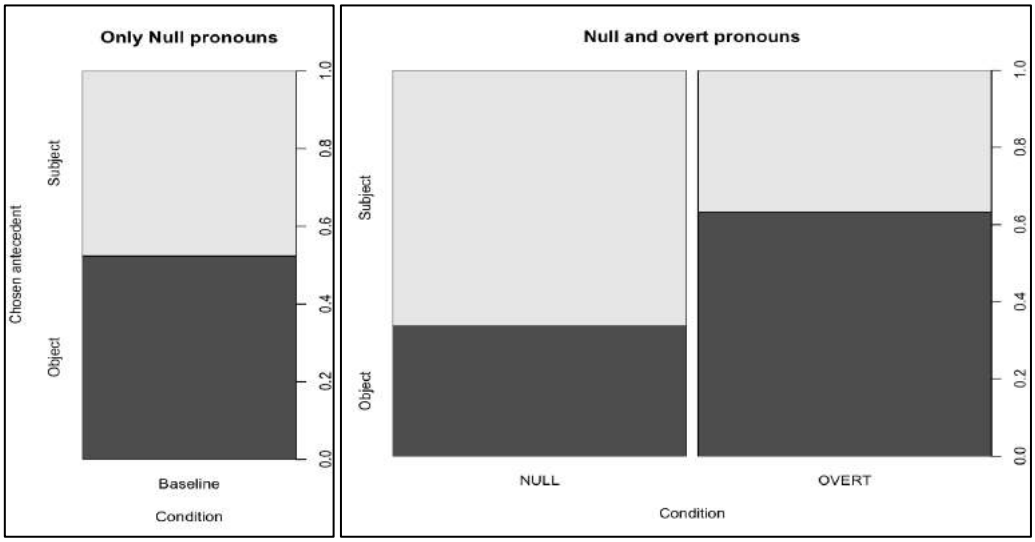
Condition	Estimate	Std. Error	z-value	Pr(>|z|)
(Intercept)	0.7607	0.2046	3.719	2e-04 ***
Overt	-1.4723	0.3571	-4.123	3.74e-05 ***

6.3. Discussion

The same stimuli elicited no antecedent bias when only null subject pronouns were tested (Experiment 1) and a clear antecedent bias (null pronoun-subject antecedent, overt pronoun-object antecedent) when both types of pronouns were tested (Experiment 3). Note that this pattern is similar to what Filiaci (2010) and Filiaci et al. (2013) reported for Italian, but not for Spanish, with respect to the object preference for overt pronouns. These results indicate, first of all, that our materials were not biased for either antecedent. It seems to be more likely that, in previous studies, the presence of both types of pronouns might have resulted in participants being at least to a certain extent aware of the critical manipulation and

consciously differentiating between those stimuli with a null pronoun and those with an overt pronoun. This would be indicative of a metalinguistic strategy contributing to the effect. If this were true, these results would suggest that the bias of null subject pronouns for subject antecedents might be less robust than has been reported in the literature. It should be added, however, that we do by no means deny the existence of a preference pattern consistent with the PAH for null subject pronouns. It just seems to be the case that the strength of the effect may be due, at least to a certain extent, to metalinguistic strategies.

Figure 3.7: Results from the baseline condition of Experiment 1 (only null subject pronouns) and from Experiment 3 (null and overt subject pronouns)



7. General discussion

The following research questions guided this part of the study:

1. In canonical structures, will the same strategies elicited in previous studies be observed in subject and object pronoun resolution in Spanish (i.e. PAH for null subject pronouns; PFS for object clitic pronouns)?

The results of the baseline condition in Experiment 1 do not confirm the predictions of the PAH since there was no subject antecedent bias for null subject pronouns; the frequencies of subject and object antecedent choices did not differ in our experiment. The results of Experiment 3 showed, however, that this "robust" bias reported in previous studies may be due, at least to some extent, to a strategy on the participants' part caused by the experimental

manipulations. The results of both experiments combined suggest that even null subject pronouns in Spanish, like previous studies found for overt subject pronouns, can take object antecedents as well as subject antecedents in certain contexts. In addition to this, these results show that pronoun interpretation does not always obey traditional accounts on the distribution and interpretation of null and overt pronouns in Spanish.

The results of the baseline condition in Experiment 2, on the other hand, are in line with the predictions of the PFS as they show a strong general object antecedent bias for direct object clitic pronouns in Spanish. This outcome is to be expected from Kehler et al.'s (2008) predictions on parallel/similar coherence relations. In most of our materials, the matrix clause and the subordinate clause are fairly parallel at least with respect to argument structure. This finding complements previous work on languages with full pronouns in that we find effects of the PFS even for object clitics, which do not appear in the same position as the post-verbal object antecedent but have, nevertheless, the same grammatical function.

2. Will the manipulation of the discourse status of the antecedents (by means of HTLD and *it-clefting*) affect the baseline preferences and in what way?

The answer to the first part of the question is affirmative: the results of Experiments 1 and 2 show that the baseline preferences, or lack thereof in the case of null subject pronouns, are systematically altered by the experimental manipulations of the informational status of the potential antecedents. This effect, however, is not the same for the two syntactic constructions tested. In particular, HTLD seems to render an antecedent more accessible compared to antecedents in their canonical position. This pattern was found for both types of pronouns irrespective of their baseline preferences. *It-clefting*, on the other hand, seems to render antecedents less accessible for subsequent pronouns for both null subject and object clitic pronouns. These results are in line with previous findings on intra-sentential pronoun resolution in French and German (Colonna et al., 2010, 2012, 2015) but go against previous findings on inter-sentential pronoun resolution in English where both topic and focus served as enhancing mechanisms of potential antecedents for subsequent ambiguous pronouns (Arnold, 1999, Cowles, 2003; Cowles et al., 2007). While the results of HTLD are not surprising, as almost all currently available studies agree that pronouns prefer topical antecedents; the divergent results of clefting require an explanation that we hypothesized might be related to the discourse functions that these two mechanisms serve. As a focused entity usually provides brand-new, unknown, and potentially unexpected information, it is not

a good antecedent for a pronoun. This reasoning goes in line with the notion of information and the distinction between discourse entities and the propositional content (information) about them that we discussed in Chapter 1: a brand-new (inactive) entity that is introduced in the discourse universe is a worse candidate to be an antecedent than an entity that is already part of the discourse (of the Ground) for a certain time. Moreover, the focus of an utterance can serve a presentative function, as it can introduce an entity in the discourse universe that is a potential topic for the upcoming discourse (Huber, 2006). Taking these facts into account, we propose that the *it-cleft* construction signals a potential topic-shift. We thus expect a clefted antecedent to co-refer preferentially with a pronoun in a new sentence but not in the same sentence. A topic-shift within a sentence reduces coherence, whereas a topic-shift may occur in a new sentence and this would not affect negatively discourse coherence (Givón, 1983; Zubizarreta, 1998, 2012). This proposal can account for the differences observed between intra- and inter-sentential pronoun resolution (see Colonna et al., 2015 for a highly similar line of argumentation).

This hypothesis is further supported by the syntactic, semantic, and pragmatic characteristics of *it-clefts* that we discussed at the beginning of Part 1 and that we summarized in Table 3.1. Recall that *it-cleft* sentences are decomposed into an asserted part (the cleft phrase), which constitute brand-new, unknown, and unpredictable information, and a presupposed part (the cleft clause), which constitutes given, retrievable information that is part of the common ground knowledge. What has been referred to as an *anti-focus effect* may, thus, also be a preference for antecedents that are presupposed, known, given, which coincidentally are characteristics that are associated with topic (cf. Chapter 1). We explore this possibility further in the second part of the present chapter.

However, if a preference for topic antecedents is really behind our participants' choices of antecedents for an ambiguous pronoun, we still have to account for the object preference for object clitics in the baseline condition. If avoiding a topic-shift within a sentence does affect antecedent accessibility, subject antecedents should generally be preferred for both subject and object pronouns across languages in canonical sentences. As Experiments 1 and 2 show, this is not the case. Our data are better accounted for by a preference for parallel functions in certain contexts, as well as for topic antecedent that are explicitly established by means of certain constructions such as HTLD.

To conclude, going back to the question of what renders an antecedent salient, the results of the present study show that neither grammatical function, nor order of mention, nor a general preference for antecedents prominently marked for their informational status by

themselves can explain the patterns observed. First mentioned antecedents were not chosen systematically more often than second mentioned antecedents. Preferences for a specific grammatical function seem to depend on the type of pronoun, with no preference (Experiment 1) or, depending on the experimental manipulation, a subject preference (Experiment 3) for null pronouns and a robust preference for object antecedents for object clitics. We can, thus, conclude that the grammatical function of the antecedent seems to play a certain role in pronoun resolution, which may vary across structures and cross-linguistically (e.g. Colonna et al., 2010, 2012; Hemforth et al., 2010). In addition to this, the informational status of the antecedent seems to be a good candidate that can account for the observed results: participants prefer topic antecedents, especially in contexts where topichood is overtly marked by means of certain syntactic constructions (e.g. HTLD), which suggests that it is not prominence per se what makes an antecedent more accessible, but rather explicit topicalization, at least within sentence boundaries. Focusing by means of clefting, on the other hand, either does not affect participants' interpretations or renders antecedents less accessible for subsequent pronouns. We argued that these somewhat surprising results for *it-clefting* complement the results for HTLD: the *it-cleft* construction signals a potential topic-shift. Having a pronoun co-refer with a clefted antecedent is, thus, dispreferred because a topic-shift within a sentence reduces coherence. Instead, there seems to be a preference for the (topic-like – active/accessible) entity contained in the presupposed, known, given part of the cleft construction (Ground). Therefore, while the informational status of the antecedent seems to account better for the resolution patterns observed in these experiments, it seems to be the case that other syntactic, semantic, and pragmatic factors pertaining to the constructions under study also play a role in the interpretation of ambiguous (subject and object) pronouns in Spanish. This claim implies that the information status of a given entity is not necessarily static in the discourse universe, but rather it is determined by the construction where it is embedded. In the case of *it-clefts,* the fact that an entity appears in the clefted part of the construction can potentially make it be seen as new, or reintroduced in the discourse universe, just like a proposition can be reasserted.

Part 2:
Exploring the *anti-focus effect*

In line with previous results for French and German, Experiments 1 and 2 show that focusing by means of *it-clefting* does not seem to increase antecedent accessibility for a subsequent pronoun in a subordinate clause, rather it seems to have the opposite effect. This finding goes against previous results on inter-sentential pronoun resolution that show that clefted entities are preferred over non-clefted ones as the antecedent of a pronoun in a subsequent sentence.

We hypothesized that the so-called *anti-focus effect* in intra-sentential pronoun resolution, which has been claimed to be an effect of focus, that is, of the informational status of the referent, could also be an effect of the syntactic, semantic, and pragmatic characteristics of the cleft construction itself. While these two possibilities are not necessarily mutually exclusive, we wanted to investigate whether the effect of the informational status by itself can account for the observed results. For this, in Experiment 4 we investigate the effects of *it-clefts* in contextualized items in Spanish to see whether the effect observed previously was associated to a specific type of focus (cf. Table 3.1). In Experiment 5 we investigate whether this effect is specific to clefting or whether it shows up with other focusing devices such as the Spanish focus-sensitive particles *solo* 'only'*, incluso* 'even'*,* and *también* 'also'*,* for which we provide a brief theoretical description in the following section. Given the inherently cross-linguistic approach of our research, in Experiment 6 we try to replicate the findings of Experiment 5 in English.

1. Focus-sensitive particles

The so-called Focus-sensitive particles (henceforth FSP) *even, only,* and *also* (*même, seul(ement), aussi* in French, and *incluso, solo, también* in Spanish), also referred to as *associative adverbs,* are traditionally classified as a subgroup of adverbs because of their distributional properties (König, 1991; Quirk et al., 1985): not only can they precede a number of different categories (nouns, adjectives, adverbs, verbs, numerals, sentence), as shown in (3.19), they also can appear in different positions within the sentence, as in (3.20)[12].

[12] According to the position of the Focus-sensitive particle, a distinction can be made between adverbs, which adjoin to a verbal projection, and "constituent-markers", which attach more locally to a DP or PP containing F-marking (Erlewine, 2015).

(3.19) a. Even John thought she had crossed the line.
b. Mary is only smart, not nice.
c. He finished the chapter only partially.
d. He also took a picture of the house.
e. Only five people came to his party.
f. Only, he never showed up.

(3.20) (Only) John (only) read (only) his new novel (only) to Mary (only).

FSPs are called focus-sensitive because their interpretation depends on the placement of focus elsewhere in the utterance. FSPs usually precede the focus element with which they associate. However, particle and associate do not have to be necessarily in adjacent positions. In other words, the linear position of the focus particle cannot determine the focused element on its own, as the example in (3.21) shows.

(3.21) John **only** read his new novel to Mary.

In this example, the focus particle *only* precedes the verb, which means that *a priori* the focused element could be anything within its scope –the entire VP (*read his new novel to Mary*), the verb (*read),* the possessive (*his*), the adjective (*new*), the direct object (*his new novel*), or the indirect object (*to Mary)* –yielding an ambiguous construction. In cases like this, when the focus particle is located between the subject and the verb (pre-VP position), the meaning of the utterance depends on its prosody. The focus particle is thus an operator that, at the semantic level, takes the prosodic focus as an argument, or has it within its scope (Beaver & Clark, 2003; Beyssade, 2013). In other words, 'focus' refers here to the prosodic marking carried by the associate. In English, this marking usually corresponds to the most prominent pitch accent in the utterance. The examples in (3.22) show how the focus particle can associate with the different constituents within its scope (prosodic stress is shown in capital letters).

(3.22) a. John **only** [read his new novel to MARY.]$_{Foc}$
b. John **only** [READ]$_{Foc}$ his new novel to Mary.
c. John **only** read [his new NOVEL]$_{Foc}$ to Mary.
d. John **only** read his new novel [to MARY.]$_{Foc}$

Some authors, however, note that the prosodic configuration of an utterance is not enough to define the focused element, as not any prosodically marked constituent can associate with the focus particle and be the focus of the utterance (Rochemont, 1986). Consider the examples in (3.23) where the FSP *only* appears before the subject. As we said before, FSPs usually precede the focus element with which they associate but they do not have to be in adjacent positions. In the example (3.23a), the subject, which carries the prosodic stress, is the focused element. However, if the prosodic prominence moves further away from the particle, as in (3.23b,c,d), the result is an ungrammatical construction. These examples suggest that, in addition to prosodic prominence, there is an underlying syntactic constraint that determines the focus element (e.g. Reinhart, 1976, 1983), which means that the identification of focus is a complex process that involves both the syntactic and the prosodic structure of the utterance (Kim, 2011). The relation between particle and focused associate falls, therefore, within the syntax-semantic interface.

(3.23) a. Only $[\text{JOHN}]_{\text{Foc}}$ read his new novel to Mary.
b. *Only John [READ] his new novel to Mary.
c. *Only John read [his new NOVEL] to Mary.
d. *Only John read his new novel [to MARY].

The syntactic constraints that apply to FSPs in relation to the position of potential focused associates can be formulated in terms of c-command. This proposal accounts for the scope relation between both elements (Crain et al., 1994; Jackendoff, 1972; König, 1991; Reinhart, 1983, 2006): the scope of the focus particle is restricted to the constituents it c-commands, and only those elements within the scope of the particle are potential focus elements, as the trees in Figures 3.8, 3.9, and 3.10 illustrate (adapted from Kim, 2011, pp. 13-14). In these examples we see that the focused element is within the scope of the particle *only,* which is restricted to the XP in its c-command domain. According to this constraint, the subject and the object elements are the focus of the utterances in Figures 3.8 and 3.9, while in Figure 3.10 the sentence can only be interpreted by means of placing prosodic prominence on one of the three constituents within the c-command domain of the particle. It is important to point out at this point that, given the written nature of the most of our experiments, in order to avoid scope ambiguity in our experimental stimuli, we only manipulated the configurations shown in Figures 3.8 and 3.9.

Figure 3.8: Pre-subject focus particle

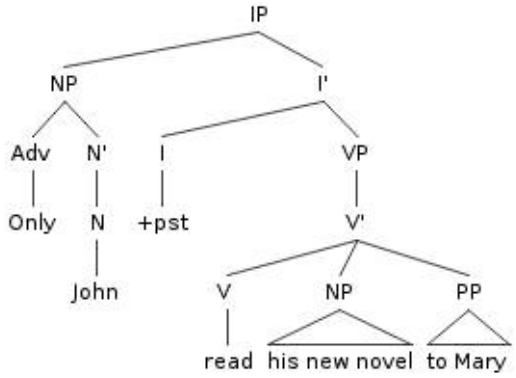


Figure 3.9: Pre-object focus particle

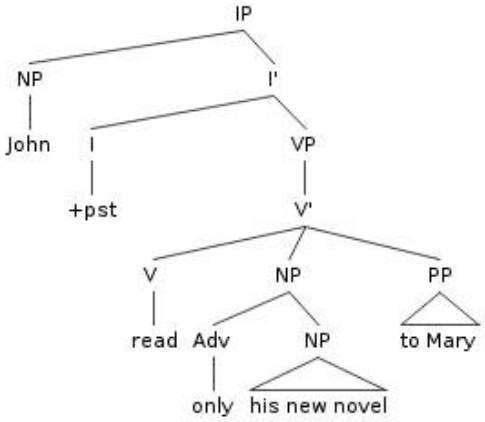
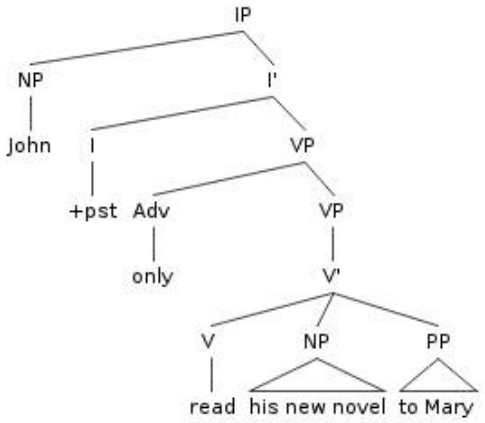


Figure 3.10: Pre-verbal focus particle



From a semantic point of view, the interpretation of FSPs stems from the relation between the focused element and a set of alternatives (Beyssade, 2013; Crain et al., 1994;

Jackendoff, 1972; Jacobs, 1983; Krifka, 2007; Rooth, 1992). In other words, a sentence containing a FSP constructs a discourse representation in which a set of explicit entities (the focus set) is contrasted with an inferred set of alternatives (the alternative set), as in (3.24) and (3.25). The set of alternatives, which are always of the same semantic category as those in the focus set, can be inferred from the common background shared by the interlocutors. This common background is based on world knowledge or on the preceding discourse context (Frazier et al., 1999). Moreover, sentences with FSPs, like *it-cleft* constructions, entail the equivalent sentence without the particle and, as we will see below, they quantify the value of the focus set over the set of alternatives.

(3.24) John ate **only** an apple.

Alts = {x: x ∈ D}

≈ {apple, orange, banana, ...}

(3.25) **Even** John came to the party.

Alts = {x: x ∈ D}

≈ {John, Mary, Paul, ...}

Depending on the relationship between the focus set and the set of alternatives, FSPs have been traditionally subcategorized into three main groups: exclusive or restrictive, additive or inclusive, and scalar (König, 1991). There is general consensus that the core meaning of *only* is exclusive or restrictive (Horn, 1969), that is, the property assigned to the focused entity is not shared by the set of alternatives, a reading that they share with *it-clefts*[13] (Zimmermann & Vasishth, 2010). For example, the sentence in (3.26) means that John and no one else went to the party. A sentence containing *only* gives rise to two propositions, shown in (3.26a) and (3.26b): the presupposition that John went to the party, which enters the truth-conditions of the utterance, and therefore, is always true[14]; and the negative assertion that

[13] Some authors analyze *only* as also being scalar (see Winterstein, 2012; Zimmermann, 2011). Also note that, given that the sequence 'It is only X…' is possible in English, French, and Spanish, one could argue that *it-clefts* and the FSP *only* do not express the same kind of exhaustivity.

[14] While there is a general consensus that the exhaustive reading of *only* enters the semantic representation as part of the asserted truth-functional content, the source of the exhaustivity in *it-clefts,* as we discussed in Section 1.2 in Part 1, is a controversial matter. Drenhaus et al. (2011) provide empirical evidence showing differences in the processing of exhaustivity incongruences with *only* and *it-clefts*. The authors argue that these results suggest that the source of the exhaustive reading in both constructions is not the same, ruling out the truth conditional effects being behind the exhaustiveness effect in clefts.

quantifies the value of the focus set over the alternatives (*nobody else*), which here must be inferred. The asserted proposition gives rise to the possibility that the proposition may be false (Beaver, 2001).

(3.26) **Only** John went to the Party.

a. John went to the party. [Presupposition]

b. Nobody else other than John went to the party. [Assertion]

Even though we have presented example (3.26a) as a presupposition, the status of this proposition (which some authors referred to with the more neutral term *prejacent*) is the locus of ongoing debates (Colinet & Winterstein, 2013; Winterstein, 2012): some authors analyze it as an entailment (Atlas, 1993; Horn, 2002), others as a presupposition of various sorts (Geurts & van der Sandt, 2004; Krifka, 1999; Rooth, 1992), others as a conversational implicature (van Rooij & Schulz, 2004), and others as a complex meaning arising from the interplay of a presupposition and a conversational implicature (Ippolito, 2008). While this debate is theoretically relevant, we will not provide a more detailed discussion of this matter here, nor will we adopt a particular analysis of the prejacent. As will become apparent later on, the definition of the semantics of *only* as exclusive/restrictive in relation with the alternative set suffices for the purposes of the present study.

The additive particles *also* and *even* assert a proposition equivalent to the sentence without the particle (König, 1991; Rooth, 1985). Unlike *only,* they presuppose that someone other than John went to the party (Horn, 1969). In other words, their contribution to the sentence is spelled out by substituting an existential quantifier for the focus particle (*somebody else*). This presupposition has also been analyzed as an existential implicature in the case of *even* (König, 1991; Rooth, 1985). While in (3.27) the presupposition is also true, the sentence with *also* is true if John went to the party and false otherwise. Unlike the sentence with *only,* the truth conditions of sentences (3.27) and (3.28) are determined at the level of the assertion. In other words, focus has an effect on the truth-value of sentences containing *only* and an effect non truth-conditional that concerns presuppositions in the case of *also*.) That is why we can talk about both semantic effects of focus (i.e. effects on the truth-values) and pragmatic effects of focus (i.e. effects concerning the presuppositions) (Beyssade, 2013). Unlike the two other particles, *even* gives rise to a third proposition as it selects a set of alternatives that are ranked on a likelihood scale with respect to the event denoted in the sentence. A sentence with *even* gives rise to a scalar implicature whereby the focus set is

ranked lowest on this contextual likelihood scale (3.28). The focus set is characterized as being unexpected or surprising.

(3.27) John **also** went to the party.

a. John went to the party. [Assertion]

b. Someone other than John went to the party. [Presupposition]

(3.28) **Even** John went to the party.

a. John went to the party. [Assertion]

b. Someone other than John went to the party. [Presupposition/Existential implicature]

c. Of the people under consideration, John was the least likely person to go to the party. [Scalar implicature]

The concept of (un)expectedness is picked up by Zeevat (2009) to provide an alternative analysis of *even* and *only*. Specifically, Zeevat bases his account of the notion of *mirativity,* which he defines as the denial of a weak presupposition. According to this proposal, a sentence like (3.28) states that John went to the party and presupposes an expectation that others but not John would go to the party. The sentence asserts that this presupposed expectation is false. Similarly, a sentence like (3.26) states that John went to the party and presupposes an expectation that more than just John would go to the party. The sentence asserts that this presupposed expectation is false. In the case of *even,* the focus set itself constitutes new information, which is expected to be false. This is, however, not the case of *only* as the information contained in the focus set is expected to be true; that is, the focused element *John* is part of the expectation "John and others".

To conclude, experimental studies on the role of FSPs in online sentence processing have shown that the semantic information associated with these particles is rapidly processed only to guide the resolution of ambiguities sensitive to the contrast between *even* and *only,* with the effects of *even* being delayed compared with *only* (Filik et al., 2009; Paterson et al., 2007). Moreover, FSPs have also been shown to facilitate the recall of mentioned alternatives while inhibiting class competitors (e.g. Spalek et al., 2014). Finally, studies on the role of discourse context in sentence processing have shown that speakers make use of prior lexical content and discourse structure to generate predictions about both upcoming content and implicit alternatives and that these expectations are strengthened by the presence of focus particles like *even* and *only* (Kim, 2012; Kim et al., 2015).

2. Research questions

In light of the results in Experiments 1 and 2 and the facts discussed above, the following research questions guided this part of the study:

1. Is the *anti-focus effect* attested in intra-sentential pronoun resolution in French, German, and Spanish related to a specific type of focus (e.g. narrow, contrastive)?
2. Does this effect arise exclusively with *it-cleft* constructions or is it also present with other focusing devices that share certain syntactic and semantic characteristics with clefts (e.g. focus-sensitive particles)?

3. Experiment 4

In Experiment 4 we investigate whether the dispreference for clefted antecedents is associated with a specific type of focus. In particular, we employed short dialogues to test whether this dispreference was associated with narrow or contrastive (or corrective) focus, which in both cases we manipulate through *it-cleft* constructions. If, on the one hand, we observe differences in the pattern of results between the narrow and contrastive focus conditions, this would be indicative that the dispreference for clefted antecedents is, indeed, an effect of focus, associated with the one specific type of focus. If, on the other hand, there are no significant differences between narrow and contrastive focus, these results would constitute further evidence in favor of the hypothesis that the dispreference for clefted antecedents is not just an effect of focus but also an effect of the *it-cleft* construction itself, that is, its syntactic, semantic, and pragmatic characteristics.

From a methodological point of view, the use of short dialogues allowed us to control for undesired effects that the use of out-of-the-blue sentences in previous studies might have brought about and that may have had bearings on the results.

3.1. Method

Twenty-five participants completed this experiment online via Amazon's Mechanical Turk. After checking their answers on their linguistic background, seven participants were excluded from the analyses, as they were not native speakers of Spanish. The remaining 18 participants were from several Spanish-speaking countries, although, once again, we did not accept participants of any of the Caribbean varieties of Spanish.

Participants completed a sentence interpretation task (SIT) similar to the ones used in Experiments 1, 2, and 3. Twenty-five experimental items were created for this experiment. These items were short dialogues of 2 to 3 sentences uttered by two imaginary characters. All dialogues started with an introductory sentence that presented three characters. Like in previous experiments, the critical sentence, which was always the last sentence of the dialogue, consisted of a matrix clause and a subordinate temporal adjunct introduced by the connective *cuando* 'when'. The matrix clause contained two characters of the same gender, 13 masculine and 12 feminine, who were already introduced in the first sentence. The subordinate clause contained an ambiguous pronoun that could refer to either antecedent in the matrix clause (but never to the third character presented in the first sentence who was of the opposite gender). The critical sentence was followed by a prompt that repeated the ambiguous content of the subordinate clause but with a gap replacing the potential referent. Participants were asked to read the sentences carefully and to fill in the gap by choosing one of the two potential antecedents. Like for previous experiments, verbs in the matrix clause were carefully selected to avoid any biases for either antecedent.

The experimental items were presented in 5 different experimental conditions following a 2x2 design with Focus type (Contrastive*Narrow) and Syntactic position (subject*object) as independent variables, plus an additional Baseline condition. Focus Type was operationalized differently in the Contrastive and Narrow focus conditions: in the Contrastive focus condition, the second sentence was always a question, which is answered by the following (critical) sentence, as shown in (3.29c); in the Narrow focus condition, the second sentence is always an assertion that is refuted by the following (critical) sentence, as in (3.29b). In both cases, the focused entity is embedded in an *it-cleft* construction. The baseline condition is in (3.29a).

In addition to the experimental items, twenty-five distracters were included in order to draw participants' attention away from the phenomenon under investigation. Distracters were also 3-sentence long dialogues. The last sentence of the dialogue was a complex sentence consisting of a main clause that introduced two potential antecedents (already introduced in the first sentence) in a complex NP for a subsequent ambiguous relative clause, as the example in (3.30) shows. All items appeared on the screen one by one and participants did not have the option of going back to change previous choices. Presentation lists were automatically generated by the software and the order of presentation was randomized individually for each participant.

(3.29) A: Al parecer Samuel, Eduardo y Cristina vuelven a llevarse bien.

'It seems that Samuel, Eduardo, and Cristina are getting along well again.'

a. Baseline

B: Sí, Eduardo llamó a Samuel cuando estaba en la oficina.

'Yes, Eduardo called Samuel when he was in the office.'

b. Narrow Focus (Subject/Object)

B: ¿Quién llamó a Samuel?

'Who called Samuel?'

A: Fue Eduardo quien llamó a Samuel cuando estaba en la oficina.

'It was Eduardo who called Samuel when he was in the office.'

B: ¿A quién llamó Eduardo?

'Who did Eduardo call?'

A: Fue a Samuel a quien Eduardo llamó cuando estaba en la oficina.

'It was Samuel whom Eduardo called when he was in the office.'

c. Contrastive Focus (Subject/Object)

B: Lo sé. Cristina llamó a Samuel.

'I know. Cristina called Samuel.'

A: No, fue Eduardo quien llamó a Samuel cuando estaba en la oficina.

'No, it was Eduardo who called Samuel when he was in the office.'

B: Lo sé. Eduardo llamó a Cristina.

'I know. Eduardo called Cristina.'

A: No, fue a Samuel a quien Eduardo llamó cuando estaba en la oficina.

'No, it was Samuel whom Eduardo called when he was in the office.'

PROMPT: _____ estaba en la oficina.

(3.30) A: El doctor, el coronel y su hija se conocían de hace mucho tiempo.

'A: The doctor, the coronel, and his daughter know each other for a long time'

B: ¿De verdad?

'B: Really?'

A: Sí, el doctor salió con la hija del coronel que murió de cáncer.

'A: Yes, the doctor dated the daughter of the coronel who died of cancer.'

PROMPT: _____ murió de cancer.

3.2. Results

For the statistical analyses, subject antecedent choices were assigned a 1 and object antecedent choices were assigned a 0 for a log-linear mixed-effects model analysis containing a fixed effect of Condition (with 5 levels), and random intercepts for Participants and Items (Baayen et al., 2008). As in previous experiments, all data were analyzed using R (R Development Core Team, 2009). The statistical comparison between the full and the reduced models yielded a significant effect ($\chi^2(4)=12.14$, $p<.05$), which indicates that the experimental manipulations had a systematic effect on our participants' antecedent choices. Table 3.5 gives the fixed effects yielded by this analysis.

Table 3.5: Fixed effects for Experiment 4

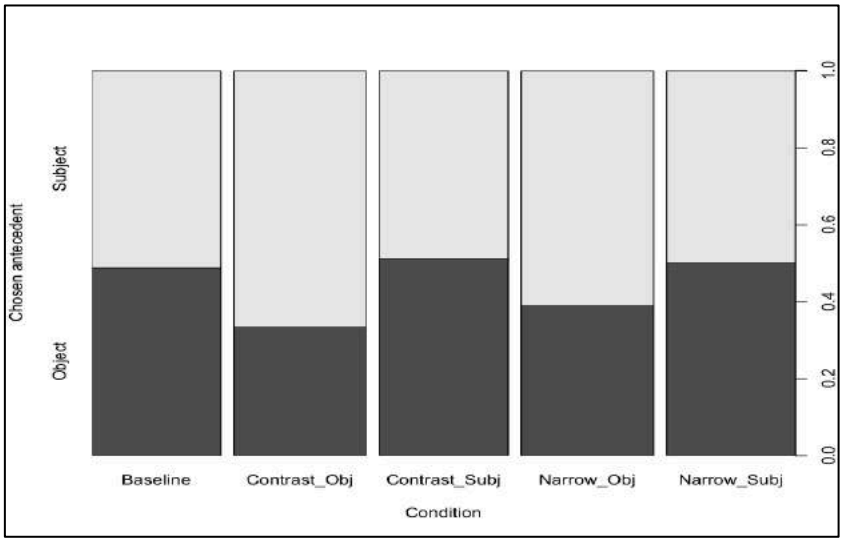
m1 = glmer(Response~ Condition+(1|Participant)+(1|Item), family=binomial(link="logit"), data=data)

m0 = glmer(Response~ 1+(1|Participant)+(1|Item), family=binomial(link="logit"), data=data)

Condition	Estimate	Std. Error	z value	Pr(>|z|)
(Intercept)	0.03892	0.30352	0.128	0.8980
Contrast_Obj	0.80333	0.33583	2.392	0.0168 *
Contrast_Subj	-0.14117	0.32765	-0.431	0.6666
Narrow_Obj	0.50285	0.32894	1.529	0.1263
Narrow_Subj	-0.05229	0.32892	-0.159	0.8737

In particular, as Figure 3.11 shows, the results show no clear preference for either antecedent in the baseline condition, as the results for the Intercept in Table 3.5 indicate, in line with the results of Experiment 1 that also investigated null subject pronoun resolution in Spanish. Interestingly, the results also show that clefting the subject antecedent does not seem to render it more accessible and preferences do not seem to change in the Subject conditions with the respect to the baseline condition. This is true regardless of the type of focus (β=0.0825, SE=0.3376, z=0.244, p> .05). Crucially, however, when the object antecedent is clefted, both as narrow and contrastive focus, participants systematically show a preference for the subject antecedent, replicating the results of Experiments 1 and 2 and previous studies in French and German. Although this difference seems to be more robust for the condition where the object was clefted to mark contrastive focus compared to the Narrow focus condition, further pairwise comparisons showed that this difference is not significant (β=-0.2873, SE=0.3515, z=-0.817, p>.05).

Figure 3.11: Antecedent choices (subject or object) for Experiment 4



A second log-linear mixed-effects model analysis with Focus type and Syntactic function as fixed effects (excluding the baseline condition), and random intercepts for Participants and Items, corroborated these results yielding a significant main effect of Syntactic factor ($\chi^2(1)=9.5427$, $p<.01$). The analyses yielded no main effect of Focus type ($\chi^2(1)= 0.1741$, $p>.05$) and no significant interaction between both factors ($\chi^2(1)= 0.5637$, $p>.05$). Pairwise comparisons of the factor Syntactic function for the two types of focus showed that the lack of interaction was due to the fact that the difference between the conditions Narrow Subject and Narrow Object was not significant (β=-0.5120, SE=0.3248, z=-1.576, $p>.05$). The difference between Contrastive Subject and Contrastive Object came out significant (β=-0.8675, SE=0.3431, z=-2.529, $p<.05$).

3.3. Discussion

Summarizing the results of Experiment 4, there was no clear baseline preference for either the subject or the object antecedent. This result is in line with those in Experiments 1 and 2 in the same condition. In line with Experiments 1 and 2 is also the observation that clefting an antecedent did not lead to an increase in the number of clefted antecedent choices with respect to the baseline condition, but rather to the opposite effect: clefted antecedent choices decreased significantly with respect to the baseline condition. Incidentally, in this experiment, these two patterns seem to come about as a function of the grammatical role of the antecedent: subject antecedent choices remained the same when the subject is clefted; however, object antecedent choices decreased significantly with respect to the baseline condition when the

object antecedent was clefted. This was also the pattern observed in Experiment 2 but not in Experiment 1 where the dispreference for the clefted antecedent arose irrespective of the grammatical role of the antecedent. Colonna et al. (2015) report the same results for German where the decrease in clefted antecedent choices was much stronger for objects than for subjects, which, Colonna and colleagues argue, points to a strong role of grammatical function in within-sentence pronoun resolution.

More importantly, like in previous experiments, these results suggest that focusing a potential antecedent by means of an *it-cleft* construction does not enhance its accessibility; rather, in certain cases, it seems to have the opposite effect. Moreover, this seems to be true for the two types of focus manipulated in the present study, namely narrow focus and contrastive focus, which behave in exactly the same manner. We hypothesized that the lack of significant differences between narrow and contrastive focus would be indicative an effect of the informational status of the clefted antecedent: a dispreference for focused antecedents in general, irrespective of the type of focus, which can be accounted for in terms of a tendency to avoid a potential topic-shift within the sentence. However, we argued that these results would also indicate that the observed pattern is also due to effects of the syntactic, semantic, and pragmatic characteristics of the *it-cleft* construction itself: it is not just a dispreference for the focused antecedent but also a preference for the antecedent within the clefted clause, which constitutes presupposed, given, retrievable information that is part of the common ground knowledge. These two possibilities are not by any means mutually exclusive, which means that a combination of both of these scenarios could also be behind the observed patterns. Experiment 5 explores this hypothesis further.

4. Experiment 5

The results of Experiment 4 go in line with the results of Experiments 1 and 2 and previous studies in French and German showing that clefting an antecedent does not render antecedents more accessible intra-sententially, but rather it seems to have to opposite effect. Indeed, when an antecedent is clefted participants tend to systematically prefer the non-clefted antecedent. The results of Experiment 4 indicate that this pattern of results holds regardless of the type of focus, narrow or contrastive.

The results of Experiment 4 constitute preliminary evidence in favor of our hypothesis that the dispreference for clefted antecedents is not just an anti-focus effect (i.e. an effect of the informational status of the antecedent), but also an effect of the inherent syntactic,

semantic, and pragmatic characteristics of the *it-cleft* construction itself. In Experiments 5 and 6 we try to provide further evidence that would support this hypothesis by investigating the role of the focus-sensitive particles *also, even,* and *only* in intra-sentential pronoun resolution. Recall that focus-sensitive particles are adverbs that associate with a focused entity both syntactically (c-command) and prosodically (pitch accent). The interpretation of focus particles stems from the relation between the focused element and a set of alternatives, and, depending on this relation, there are significant semantic and pragmatic differences between the particles. The use of focus-sensitive particles allows us to further test the hypothesis that the *anti-focus effect* is not the result of a single factor but rather of a combination of factors. The prediction is that if, on the one hand, the dispreference for clefted antecedents is exclusively an effect of focus, we should observe a similar pattern of results with all the particles, with participants preferentially choosing the antecedent outside the scope of the particle; if, on the other hand, this dispreference in previous experiments is due to the syntactic, semantic, and pragmatic characteristics of the *it-cleft* construction itself, the dispreference for the focused antecedent, that is, the entity within the scope of the particle, might not arise altogether. Alternatively, if, as we hypothesize, the syntactic, semantic, and pragmatic characteristics of the constructions under study do also play a role, we might also observe certain differences between the focus particles manipulated.

4.1. Method

We tested the predictions above in Experiment 5. Thirty-three Spanish native speakers (of varieties other than Caribbean) completed a sentence interpretation task online via Amazon's Mechanical Turk and were paid $1.86 in exchange for their participation. Twenty-eight experimental items were created for this experiment. The Spanish sentences were complex sentences that featured two human referents of the same sex, 13 masculine and 12 feminine, in the matrix clause and a null pronoun that can refer to either of them in a temporal subordinate clause introduced by the connective *cuando* 'when'. The subject of the sentence is always the agent or the experiencer of the action and the object referent is always the patient or the theme. The focus-sensitive particles manipulated, *también* 'also', *incluso* 'even', and *sólo*[15] 'only', could appear before the subject or the object antecedent, both valid positions for these adverbs due to the flexibility in the position of adverbs in Spanish. Just like

[15] The Spanish Royal Academy allows the spelling of *sólo* without the orthographic accent (*solo*). We decided to use the accented version in order to avoid ambiguity with the adjective *solo/a* 'alone'.

for the previous experiments, verbs were carefully selected to avoid any biases for either antecedent.

The experimental items could appear in 7 different experimental conditions following a 3x2 (+ Baseline) design with Focus-sensitive particle (También 'also' * Incluso 'even' * Sólo 'only') and Syntactic position (subject*object) as independent variables. In addition to these, a baseline condition was also included. Sample sentences are shown in (3.31). The critical sentence was followed by a prompt that replicated the content of the subordinate clause introduced by a gap that replaced the potential referent. Participants were asked to read the sentences carefully and to fill in the gap by choosing one of the two antecedents.

(3.31) a. Juan llamó a Pedro cuando estaba en la oficina.
'Juan called Pedro when he was in the office.'
b. También/Incluso/Sólo Juan llamó a Pedro cuando estaba en la oficina.
'Also/Even/Only Juan called Pedro when he was in the office.'
c. Juan llamó también/incluso/sólo a Pedro cuando estaba en la oficina.
'Juan called also/even/only Pedro when he was in the office.'
PROMPT: _____ estaba en la oficina.

Twice as many distracters (n=56) than experimental items were included in order to draw participants' attention away from the phenomenon under investigation. The distracters were sentences that contained Implicit Causality verbs with a strong bias for one of the two referents in the matrix clause. This bias could be confirmed or contradicted by the information of the subordinate clause, which also contained a null pronoun, as shown in (3.32).

(3.32) a. Susana elogió a Diana porque era la responsable de la exitosa campaña.
'Susana praised Diana because she was responsible for the successful campaign.'
PROMPT: _____era la responsable de la campaña
b. Mireia elogió a Lucía porque estaba satisfecha de la exitosa campaña.
'Mireie praised Lucía because she was satisfied with the successful campaign.'
PROMPT: _____estaba satisfecha de la campaña

Half of the distracters were biased towards to the subject antecedent and half towards the object antecedent. All items appeared on the screen one by one and participants did not

have the option of going back to change previous choices. Presentation lists were automatically generated by the software so that participants would not see the same item in more than one experimental condition.

4.2. Results

Subject antecedent choices were assigned a 1 and object antecedent choices were assigned a 0 for a log-linear mixed-effects model analysis containing a fixed effect of Condition (with 5 levels), and random intercepts for Participants and Items. The statistical comparison between the full and the reduced models yielded a highly significant effect ($\chi^2(6)=37.817$, $p<.001$), which indicates that the experimental manipulations had a systematic effect on our participants' antecedent choices. Table 3.6 gives the fixed effects yielded by this analysis.

As Figure 3.12 shows, the results show no clear preference for either antecedent in the Baseline condition. When the subject antecedent is within the scope of a focus-sensitive particle, there is a preference for the object antecedent, and likewise, when the object antecedent is preceded by a focus particle, there is a general preference for the subject antecedent. Although this pattern seems to hold for all three focus particles, crucially, it seems to gradually increase from one focus particle to the next, being significantly more robust with *sólo* 'only', less so with *incluso* 'even', and very subtle with *también* 'also'. However, as Table 3.6 shows, subject and object antecedent choices were only significantly different in the two *only* conditions.

A second log-linear mixed-effects model analysis with Focus particle and Syntactic function as fixed effects (excluding the baseline condition), and random intercepts for Participants and Items, revealed a highly significant main effect of Syntactic function ($\chi^2(1)=27.436$, $p<.001$), but no main effect of Focus particle ($\chi^2(2)=0.8452$, $p>.05$). The interaction between both factors was significant too ($\chi^2(2)=10.351$, $p<.01$). Pairwise comparisons of the factor Focus particle for the subject and object the interaction was mainly driven by the *sólo* 'only' conditions that were significantly different from one another (β=1.5130, SD=0.2954, z=-5.122, $p<.001$), and less so by the *incluso* 'even' conditions (β=-0.6466, SD=0.2869, z=-2.254, $p<.05$). The difference between the two *también* 'also' conditions did not come out significant (β=-0.3100, SD=0.2915, z=-1.063, $p>.05$).

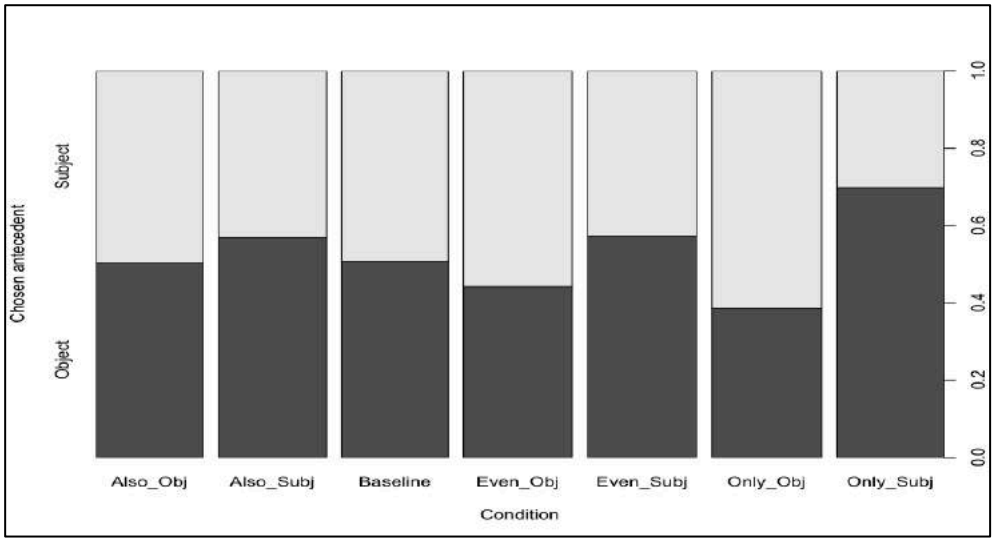
Table 3.6: Fixed effects for Experiment 5

m1 = glmer(Response~ Condition+(1|Participant)+(1|Item), family=binomial(link="logit"), data=data)

m0 = glmer(Response~ 1+(1|Participant)+(1|Item), family=binomial(link="logit"), data=data)

Condition	Estimate	Std. Error	z value	Pr(>|z|)
(Intercept)	-0.06800	0.27418	-0.248	0.804130
Also_Object	0.02016	0.26109	0.077	0.938451
Also_Subject	-0.36986	0.27348	-1.352	0.176234
Even_Object	0.25332	0.27248	0.930	0.352546
Even_Subject	-0.34091	0.27388	-1.245	0.213228
Only_Object	0.56507	0.27452	2.058	0.039554 *
Only_Subject	-0.98166	0.28632	-3.429	0.000607 ***

Figure 3.12: Antecedent choices (subject or object) for Experiment 5



4.3. Discussion

To summarize the results of Experiment 5, in line with previous experiments, there was no clear baseline preference for either antecedent. However, antecedent choices were affected by the presence of a focus-sensitive particle. For all three particles, participants systematically preferred the antecedent that was outside the scope of the particle as the antecedent of the ambiguous pronoun in the subordinate clause. Crucially, however, the robustness of this pattern seems to vary as a function of the particle, reaching significance with the particle *sólo* 'only', less so with *incluso* 'even', but not with *también* 'also'.

The general dispreference for antecedents within the scope of a focus-particle, which echoes the pattern that was previously attested for *it-clefts,* constitutes further evidence of an effect of focus. In other words, participants prefer an antecedent that is not the focus of the utterance (hence the *anti-focus effect*) when the pronominal dependency is established within sentence boundaries. Just like we argued for clefts, this is reasonable if we assume that a focused entity usually provides new, unknown, and unexpected information and, as a consequence, it is not a good antecedent for a pronoun.

Crucially, however, the gradient effect of the focus particles and the fact that this pattern was notably more robust with the particle *sólo* cannot be overlooked. First, as we argued, the differences in the patterns of results of the three focus particles suggest that there is something beyond the focusing effect of these particles that also plays a role in this general dispreference for focused antecedents. Interestingly, this pattern was more robust with the exclusive particle *sólo* 'only'*,* which is the particle that shares more semantic features with *it-clefts* (i.e. exhaustiveness). In addition to this, recall that the associate of *sólo* is part of the presupposition triggered by the particle, whereas the associate of *incluso* and *también* are part of the assertion. It could be conjectured, therefore, that the observed difference between *sólo* and *even* and *también* has to do, at least to a certain extent, with the general tendency to privilege presupposed, topic-like content/entities. These findings provide more evidence in favor of the claim that the *anti-focus effect* is not exclusively an effect of the informational status of the entity in question and that the syntactic, semantic, and pragmatic content of the constructions under investigation also contribute to the attested dispreference for focused elements.

5. Experiment 6

The dispreference for antecedents in a focus construction has now been attested cross-linguistically in French, German (with the *it-cleft* construction) and in Spanish (both with the *it-cleft* construction and with the focus-sensitives). Since one of the main goals of our research being to perform a cross-linguistic comparison of the phenomenon under study, we wanted to see whether it would arise in yet another language: English[16]. For that, Experiment 6 below tries to replicate the results obtained in Experiment 5.

[16] We did not run the same experiment in French because the French focus particle equivalent two *only* has two different forms depending on whether it appears before the subject or the object antecedent. Thus, we say ***Seul*** *Paul est venu à la soirée* 'Only Paul came to the party' but *Paul a* ***seulement*** *mangé deux pommes* 'Paul only ate two apples'.

5.1. Method

Thirty-seven English native speakers completed the same sentence interpretation task (SIT) used in the previous experiments via Amazon's Mechanical Turk for which they received $1.86.

Twenty-five experimental items were created for this experiment based on the Spanish questionnaire. The English sentences were complex sentences that featured two human referents of the same sex, 13 masculine and 12 feminine, in the matrix clause and a pronoun that could refer to either of them in a temporal subordinate clause introduced by the connective *when*. The two focus particles manipulate, *even* and *only,* could appear immediately before the subject or object antecedents. Given that in English, *also* cannot occur right before a subject, we decided not to include it in the experimental manipulations. Verbs were carefully selected to avoid any biases for either antecedent. Each sentence was followed by a prompt repeating the content of the subordinate clause starting with a gap.

The experimental items could appear in 5 different experimental conditions following a 2x2 design with Focus-sensitive particle (even*only) and Syntactic position (subject*object[17]) as independent variables, plus a Baseline condition, as the examples in (3.33) illustrate. Participants were asked to read the sentences carefully and to fill in the gap in the prompt by choosing one of the two antecedents.

(3.33) a. *Baseline*: John called Peter when he was in the office.
b. *Even_Subject*: Even John called Peter when he was in the office.
c. *Even_Object*: John called even Peter when he was in the office.
d. *Only_Subject*: Only John called Peter when he was in the office.
e. *Only_Object*: John called only Peter when he was in the office.
PROMPT: _____ was in the office.

Fifty distracters were included in order to draw participants' attention away from the phenomenon under investigation. The distracters were sentences that also featured two referents in the matrix clause and a temporarily ambiguous pronoun in the subordinate clause. The difference with the experimental items is that the ambiguity was always resolved towards

[17] In order to avoid scope ambiguity, the focus-sensitive particles were placed between the verb and the object antecedent in the object condition. We are aware of the fact that, in English, the preferred way to mark focus in this case would be by placing the focus-sensitive particle before the verb and by placing the pitch accent on the focused constituent. In Chapter 4 we present an experiment that investigated whether this choice had any bearings on our results.

one of the two potential antecedents with the content of the subordinate clause, as shown in (3.34). Items appeared on the screen one by one and participants did not have the option of going back to change previous choices. Presentation lists were automatically generated and individually randomized by the software so that participants would not see the same item in more than one experimental condition.

(3.34) a. Rhoda followed Doris because she felt suspicious.
PROMPT: _____ felt suspicious.
b. Diane followed Lois because she looked suspicious.
PROMPT: _____ looked suspicious.

5.2. Results

Subject antecedent choices were assigned a 1 and object antecedent choices were assigned a 0 for a general log-linear mixed-effects model analysis containing a fixed effect of Condition (with 5 levels), and random intercepts for Participants and Items (Baayen et al., 2008). The statistical comparison between the full and the reduced models yielded a highly significant effect ($\chi^2(4)=52.414$, $p<.001$), which indicates that the experimental manipulations had a systematic effect on our participants' antecedent choices in their continuations. Table 3.7 gives the fixed effects yielded by this analysis.

In particular, as Figure 3.13 shows, the results show no preference for either antecedent in the baseline condition and a general preference for the antecedent outside the scope of the focus particle for both *even* and *only* and regardless of its syntactic function: a general subject antecedent preference when the focus particles associate with the object, and a general object antecedent preference when the focus particles associate with the subject.

A second log-linear mixed-effects model analysis with Focus-sensitive particle and Syntactic function as fixed effects (excluding the Baseline condition), and random intercepts for Participants and Items yielded no main effect of Focus-sensitive particle ($\chi^2(1)=0.3496$, $p>.05$) but a highly significant main effect of Syntactic function ($\chi^2(1)=53.635$, $p<.001$). The interaction between both factors did not come out significant ($\chi^2(1)=0.6913$, $p>.05$).

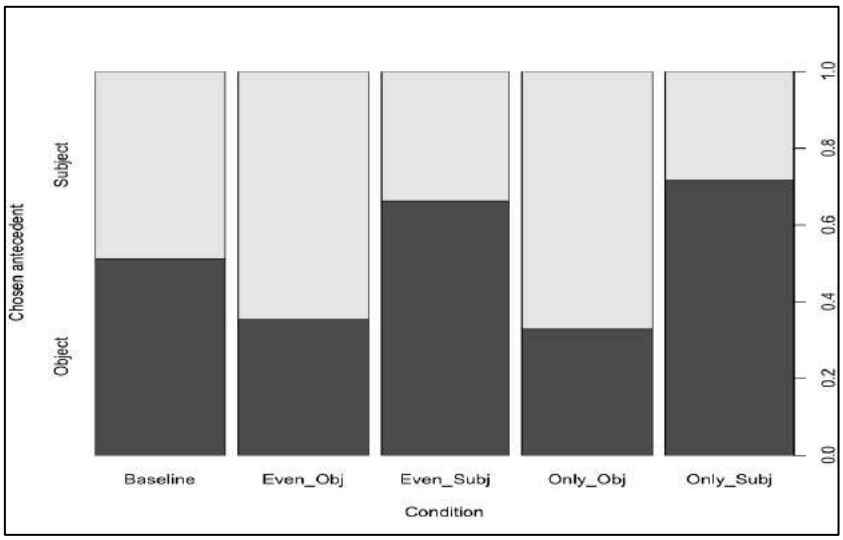
Table 3.7: Fixed effects for Experiment 6

m1 = glmer(Response~ Condition+(1|Participant)+(1|Item), family=binomial(link="logit"), data=data)

m0 = glmer(Response~ 1+(1|Participant)+(1|Item), family=binomial(link="logit"), data=data)

Condition	Estimate	Std. Error	z value	Pr(>|z|)
(Intercept)	-0.059595	0.001727	-34.5	<2e-16 ***
Even_Object	0.889493	0.001727	515.0	<2e-16 ***
Even_Subject	-0.835091	0.001727	-483.5	<2e-16 ***
Only_Object	0.986409	0.001727	571.1	<2e-16 ***
Only_Subject	-1.239871	0.001727	-717.9	<2e-16 ***

Figure 3.13: Antecedent choices (subject or object) for Experiment 6



Additional pairwise comparisons of the factor Syntactic function for the two focus particles corroborated these results showing highly significant differences between the Even Subject and Even Object conditions (**β**=-1.6431, SD=0.4235, z=-3.880, p<.001) and between the Only Subject and Only Object conditions (**β**=-2.2014, SD=0.4890, z=-4.502, p<.001). The comparisons of the factor Focus particle for the two syntactic functions did not reveal any significant differences: Even Subject vs. Only Subject (**β**=-0.4109, SD=0.4395, z=-0.935, p>.05), and Even Object vs. Only Object (**β**=0.0362, SD=0.4017, z=0.090, p>.05).

5.3. Discussion

The results of Experiment 6 replicate for the most part those of Experiment 5. There was no baseline preference for either antecedent in the baseline condition. The presence of a focus particle, however, altered significantly participants' antecedent choices with respect to the baseline, as they systematically preferred the antecedent that was outside the scope of the two particles. In other words, for both *even* and *only,* participants preferred the object antecedent when the subject was within the scope of the particle, and likewise, they preferred the subject antecedent when the object was within the scope of the particle. Although the difference between the *only* conditions seemed numerically more robust than between the *even* conditions, this pattern reached significance across all four conditions.

These results are yet more evidence for an effect of the informational status of the antecedents as being responsible for the attested *anti-focus effect.* Furthermore, these results are evidence for the *anti-focus effect* in yet another language where this effect had not been attested until now, English, and constitute yet further evidence in favor of the prediction that the *anti-focus effect* is due to both an effect of the informational status of the antecedent and to the syntactic, semantic, and pragmatic characteristics of the construction itself. The fact that in English we do not observe the strong numeric difference in antecedent choices between *even* and *only* that we elicited in Spanish may be indicative of subtle cross-linguistic difference in how these syntactic and semantic factors affect discourse interpretation in the two languages. We leave this hypothesis for future research.

6. General discussion

The following research questions guided this part of the study:

1. Is the *anti-focus effect* attested in intra-sentential pronoun resolution in French, German, and Spanish related to a specific type of focus (e.g. narrow, contrastive)?

The results of Experiment 4 suggest that the answer to this question is negative. Participants' antecedent choices in this experiment did not increase when the subject antecedent was focused by means of an *it-cleft* construction, but they decreased significantly when the object antecedent was clefted. Crucially, this pattern was identical for both types of focus, narrow and contrastive.

We hypothesized that a lack of differences between the Narrow focus and the Contrastive focus conditions would constitute evidence for the hypothesis that the

dispreference for clefted/focused antecedents cannot only be explained in terms of an effect of the informational status of the antecedent. We hypothesized that the syntactic, semantic, and pragmatic features of the *it-cleft* construction might also be partly responsible for the observed patterns of results. An effect of the informational status of the antecedent, what has been referred to as an *anti-focus effect,* would be justified by the fact that a focused entity usually provides brand-new, unknown, and unexpected information. Since a topic-shift within a sentence does not contribute to coherence, a focused entity is not a good antecedent for a pronoun and is, thus, systematically dispreferred. An effect of the syntactic, semantic, and pragmatic characteristics of *it-clefts* would be justified by the fact that *it-cleft* sentences are decomposed into an asserted part (the cleft phrase), which constitute brand-new, unknown, and unpredictable information, and a presupposed part (the cleft clause), which constitutes given, retrievable information that is part of the common ground knowledge. What has been referred to as an *anti-focus effect* may, thus, also be a preference for antecedents that are within the presupposed, known, given, part of the construction. Coincidentally, these characteristics are also associated with topic. Topic referents have been shown to be generally preferred as antecedents for pronominal expressions.

While the results of Experiment 4 are preliminary data and further evidence is needed to get a more clearer picture of what is really behind the *anti-focus effect,* these results constitute solid evidence for the different effects of focus by clefting in intra-sentential and in inter-sentential pronoun resolution. In addition to this, from a methodological point of view, the use of short dialogues where the focused entity was clearly marked suggests that this effect were not due to the use of out-of-the-blue sentences in previous experiments. Finally, these results suggest that the information status of the antecedent, its grammatical role, as well as other syntactic, semantic, and pragmatic pertaining to the constructions where the pronouns appear, all seem to interact and play a role in the interpretation of the ambiguous pronoun.

2. Does this effect arise exclusively with cleft constructions or is it also present with other focusing devices (e.g. focus-sensitive particles)?

The results of Experiments 5 and 6 show that the dispreference for focused antecedents is not exclusive to the *it-cleft* construction, as it also arises when a potential antecedent is within the scope of the focus sensitive particles *even, only* and *also:* participants systematically preferred the object antecedent when the subject was within the scope of the particles, and likewise,

they preferred the subject antecedent when the object was within the scope of the particles. This effect held cross-linguistically in English and in Spanish. Crucially, however, in Spanish the effect was more robust for the exclusive particle *sólo* 'only' than with *incluso* 'even' and *también* 'also', which we conjectured might be due to the fact that the associate of *sólo* is part of the presupposition triggered by the particle, while the associate of *incluso* and *también* are part of the assertion. We hypothesized that the fact that this numeric difference was not observed in English might be due to subtle cross-linguistic differences in how these syntactic and semantic factors affect discourse interpretation in the two languages investigated here.

The results of Experiments 5 and 6 constitute further evidence for the *anti-focus effect:* as it was discussed at the beginning of Part 2, a focus particle associates with a focused element that it c-commands and that receives prosodic prominence. Their interpretation stems from the relation between this element and a set of alternatives. The differences in the patterns of results of the three focus particles in Spanish, where only the results for *only,* which is the particle that shares more semantic features with *it-clefts* (i.e. exhaustiveness), reached significance, suggest that there is something beyond the focusing effect of these particles that also plays a role in this general dispreference for focused antecedents. In particular, these results provide more evidence in favor of the proposal that the *anti-focus effect* is not exclusively an effect of the informational status of the entity in question and that the syntactic, semantic, and pragmatic content of the constructions under investigation –*it-clefts* and focus-sensitive particles –also contribute to the attested dispreference for focused elements.

Conclusions

Previous work on pronoun resolution has been concerned with the role of antecedent salience/prominence in this process. An important limitation is, however, that most of these studies did not define salience adequately and did not tease apart certain factors that were claimed to contribute to salience, such as the syntactic function, the order of mention, and the information status of a potential antecedent. The experiments presented in Chapter 3, like other studies did before for other languages, investigated the role of information status in ambiguous null subject and object clitic pronouns in Spanish with the goal of teasing apart these factors. In particular, the present study investigated how two syntactic constructions

affecting the information status of potential antecedents (HTLD to mark topic and *it-clefting* to mark focus) affect antecedent choices for ambiguous pronouns. In combination, Experiments 1 and 2 showed that both the syntactic role of the antecedent as well as whether it appears embedded in a HTLD or an *it-clefting* construction influence participants' choices of antecedents. However, they do so differently. Our results showed a general preference for left-dislocated antecedents as well as a dispreference for clefted antecedents, or an *anti-focus effect*, a pattern that had been established for subject pronouns in French and in German (Colonna et al., 2012) in intra-sentential pronoun resolution and that also generalizes to null pronouns and object clitic pronouns in Spanish. The results of Experiments 4, 5 and 6 showed that this dispreference for clefted antecedents is neither exclusive to one type of focus nor to the *it-cleft* construction, as evidenced by the similar results obtained with the focus-sensitive particles *even, only,* and *also* in English and in Spanish. The results of these experiments suggest that the dispreference for clefted/focused antecedents, which has been explained in terms of an effect of the information status of the antecedent, might also be motivated by an effect of the syntactic, semantic, and pragmatic characteristics of the construction where the pronominal dependency is embedded.

Discourse Units and pronoun resolution

How do these results fit into the proposal of a framework of analysis in Chapter 2? Following previous models of pronoun resolution such as Miltsakaki's (2002), we claimed that the notion of Discourse Unit (DU) can provide a better explanation for the differences observed in inter- and intra-sentential pronoun resolution. However, we argued that previous syntactic-based definitions of DU that equate this notion to either the clause or the sentence cannot account for all results, especially those of intra-sentential focus. Based on Johnston's (1994) analysis of adverbial adjuncts, we proposed a "relational" definition of DU according to which the specific syntactic, semantic, and pragmatic characteristics of certain types of subordinate clauses play a role in the establishment of DUs. Johnston divides adverbial adjuncts into relational and non-relational. According to his classification, temporal clauses, which situate events or states temporally by locating the eventuality in time with respect to some other eventuality, are examples of non-relational adjuncts. Non-relational adjuncts restrict an overt/covert adverb of quantification and, therefore, their content is always presupposed. Causal clauses, on the other hand, are a type of relational adjuncts because they introduce higher-order relations that take the eventualities or propositions described by the

matrix and subordinate clauses as their arguments. Relational adjuncts do not restrict an adverb of quantification, which means that their content is not necessarily presupposed.

Based on these facts, we proposed that a complex sentence consisting of a matrix clause and a clause-modifying (causal and temporal) adverbial adjunct could consist of one or multiple DUs. In particular, we proposed that temporal subordinate clauses (introduced by connectives *when, before, after*) are processed as part of the same DU as the matrix clause, whereas causal subordinate clauses (introduced by connective *because*) are processed as independent DU from the matrix clause. The examples in (2.25) and (2.27), repeated in (3.35) and (3.36), illustrate these predictions.

(3.35) [Mary wrote a letter **when** she needed help from her brother.] [1 DU]

(3.36) [Mary wrote a letter] [**because** she needed help from her brother.] [2 DU]

We subsequently argued that our conception of DU has consequences for pronoun resolution. We proposed an account of pronoun resolution that is firmly rooted in the search of a maximum of discourse coherence: pronoun interpretation preferences will come about in the process of *establishing* or *maintaining* coherence. When the matrix and the subordinate clause are processed as a single DU, as it is the case of non-relational temporal adjuncts, coherence has already been established between both clauses, and the tendency will be to *maintain* it. This tendency can manifest itself, for example, with a preference for topic or topic-like entities in the preceding (matrix) clause. In those contexts where the matrix clause and the subordinate clause constitute two separate DUs, as it is the case of relational causal adverbial clause, we predict that resolution preferences will come about in the process of *establishing* coherence between units, which will be achieved through the focusing effects of the semantics of certain elements in the proposition, such as verbs and connectives.

All the stimuli employed in Experiments 1 to 6 were complex sentences consisting of a matrix clause, which featured two human referents, followed by a temporal subordinate adjunct that contained an ambiguous pronoun. According to our definition of DU, all these stimuli constitute a single DU where the non-relational temporal adjunct, whose function is to anchor temporally the events described in both clauses, is processed as part of the same DU as the matrix clause. The results of the sentence interpretation tasks where participants were asked to choose one of the two referents as the antecedent of the ambiguous pronoun can be summarized as follows: in Experiments 1 and 2 there was a general preference for the topic antecedent in a HTLD construction, and a general dispreference for the focus antecedent in an

it-cleft construction, as shown in (3.37). The results of experiment 4 showed that this dispreference for focus antecedents is not specific to a type of focus, but rather it seems to be an effect of both the information status of the antecedent and the syntactic, semantic, and pragmatic characteristics of *it-clefts.* The results of Experiment 5 showed that this dispreference for focus antecedents is not specific to *it-clefts,* as it also occurs with other focusing devices like with the focus-sensitive particles *sólo* 'only'*, incluso* 'even'*, y también* 'also' in Spanish (3.38). The fact that this pattern was stronger with *sólo* 'only'*,* which is the particle that shares more features with clefts, and whose associate is part of the presupposition triggered by the particle, were taken as further evidence for the effects of semantic and pragmatic factors being partially responsible for the observed results. The results of Experiment 6 provided cross-linguistic evidence for these findings in a language other than Spanish: English (3.39).

(3.37) a. Hablando de Eduardo, él llamó a Samuel cuando *pro* estaba en la oficina. [*pro*=Eduardo]

b. Fue Eduardo quien llamó a Samuel cuando *pro* estaba en la oficina. [*pro*=Samuel]

(3.38) a. Sólo Juan llamó a Pedro cuando *pro* estaba en la oficina. [*pro*=Pedro]

b. Incluso Juan llamó a Pedro cuando *pro* estaba en la oficina. [*pro*=Pedro]

c. También Juan llamó a Pedro cuando *pro* estaba en la oficina. [*pro*=Pedro]

(3.39) a. Only John called Peter when *he* was in the office. [*he*=Peter]

b. Even John called Peter when *he* was in the office. [*he*=Peter]

We argued (i) that the results in (3.37a) are not surprising, as topic antecedents have been shown to be generally preferred across the board, and, in this case, the topic of the sentence is clearly established through a HTLD construction, and (ii) that the results in (3.37b), (3.38), and (3.39), which have been explained as an effect of the information status of the antecedent (or *anti-focus* effect) and of the semantic/pragmatic characteristics of the constructions employed, can also be accounted for in terms of continuity and coherence in discourse: a focused entity, which is introduced in the discourse universe (inactive), usually provides brand-new, unknown, and potentially unexpected information, and, therefore, it is not as good an antecedent as an entity that is already part of the discourse (of the Ground) for a certain time. However, the focus of an utterance may be related to the topic of the following one, and, thus, these focusing constructions might signal a potential topic-shift. As a result of

this, a clefted antecedent or an antecedent within the scope of a FSP is expected to co-refer preferentially with a pronoun in a new sentence but not in the same sentence. A topic-shift within a sentence reduces coherence, whereas a topic-shift may occur in a new sentence and this would not affect negatively discourse coherence (Colonna et al., 2012, 2015; Givón, 1983; Zubizarreta, 1998, 2012). What we see instead is that, in the case of *it-clefts,* there is a general preference for the antecedent within the presupposed, known, given part of the utterance. Coincidentally, these characteristics are also associated to topic.

This general preference for clearly established topics and topic-like antecedents that constitute presupposed, given, known information, and the general dispreference for antecedents that potentially constitute new, unknown, unexpected information, fit well with the predictions of our account: a potential topic-shift within the unit brings about discontinuity and breaks coherence and is, thus, dispreferred; referring to topic(-like) antecedents helps *maintain* coherence within the unit –a tendency that is favored.

Interestingly, the results of Experiments 5 and 6 show that, although stronger in the case of *only,* the focus particles employed all had the same effect on participants' antecedent choices. This was true regardless of their specific semantic and pragmatic characteristics. If, as our account predicts, the semantic/pragmatic characteristics of certain elements should play a bigger role in pronoun interpretation in the context of two DUs, we expect these particles to behave differently when the temporal clause is replaced by a causal clause. We test this prediction in Chapter 4.

Chapter 4

Implicit Causality beyond the verb:

The role of coherence relations in pronoun resolution

1. Introduction

In Chapter 4, we investigate the role of coherence relations in pronoun resolution. Recall from the studies reviewed in Chapter 1 that coherence relations have been able to account for a great deal of previously observed pronoun interpretation preferences – a fact that has lead some authors to claim that most of the resolution strategies proposed in the literature are epiphenomena of a more general tendency to establish coherence in discourse (Kehler, 2002). While we believe that this tendency to maintain/establish coherence is a key aspect of language comprehension and production, the goal of the present dissertation is to investigate the factors that contribute to discourse coherence and, crucially, the contexts in which each one of them contributes the most.

In Chapter 3, we investigated the role of information status in pronoun resolution and found that antecedent interpretation preferences in our experiments can be better accounted for by taking into account a combination of factors, such as the syntactic function and the information status of the antecedent, but also other syntactic, semantic, and pragmatic characteristics of the constructions where the pronominal dependency is embedded. In line with previous results, topic antecedents were generally preferred intra-sententially. However, the results of clefting, a construction that has been shown to enhance antecedent accessibility across sentence boundaries, show that focusing by means of an *it-cleft* construction does not have the same effect within the sentence, where clefted antecedents are generally dispreferred. A closer examination of this so-called *anti-focus effect* has shown that this effect is not specific to one type of focus (narrow, contrastive) nor is it exclusive to *it-clefts*. Indeed, the same dispreference for focused antecedents arises with other focusing devices, such as the focus-sensitive particles *even* and *only*. We argued that this *anti-focus effect* might be more than just an effect of the information status of the potential antecedent, and that it might actually be due to a combination of factors: an effect of focus (to avoid a potential topic-shift within the sentence) and an effect of the syntactic and semantic/pragmatic characteristics of the constructions under study (a preference for antecedents that constitute given, old, presupposed information, that are already part of the discourse universe). We argued that these results fit well into the framework of analysis proposed in Chapter 2: all experimental items employed were examples of complex sentences containing a matrix clause and a temporal adjunct, which, according to our proposal, are processed as part of the same DU. We proposed that, in the context of a single DU, pronoun interpretations respond to a tendency to *maintain* coherence within the unit. The general preference for topic and topic-like antecedents attested in our experiments evidences this tendency.

In the present chapter, we put the emphasis on a coherence relation that has been shown to enjoy a special status in discourse processing: causal relations. Previous research has shown that speakers tend to relate two events as one being the cause of the other (cf. Asher & Lascarides, 1998; Ginzburg, 2012; Sanders, 2005). In Chapter 1, we discussed in particular the case of certain verbs that, when used with nouns referencing human or animate beings, import an implicit attribution of the cause of the action or attitude indicated by the verb. This phenomenon, referred to as *Implicit Causality* (IC), is perhaps the best-studied phenomenon concerning the interaction between coherence relations and pronoun interpretation. Our discussion revolved around the role of the connective *because* in IC. On the one hand, some of the studies discussed (cf. Ehlrich, 1980; Koornneef & Sanders, 2013; McKoon et al., 1993) show that IC effects are conditioned by the presence of the connective *because* and that the use of other connectives attenuates the effect or even makes it disappear. On the other hand, other studies attested IC effects even in the absence of the connective *because* and, crucially, that IC verbs generate stronger-than-usual expectations for upcoming explanations (Kehler et al., 2008). Bott and Solstad (2014) provide an explanation for this finding, claiming that, if there is missing causal content that can be specified by an explanation in the form of a *because*-clause or an independent sentence, then providing this explanation should be the default strategy in language processing (i.e. specification of yet unspecified content). Otherwise, interpreters would be forced to accommodate the missing information, a cognitively taxing operation that should be dispreferred.

1.1. Our proposal: a new framework of analysis

Causal clauses introduced by the connective *because* are of special interest for the purposes of the present dissertation. Recall from Chapter 2 that the predictions of our framework of analysis change in those contexts where the subordinate adjunct and the matrix clause are processed as two separate DUs, as it is the case with causal clauses.

Based on Johnston's (1994) analysis of complex sentences consisting of a matrix clause and a clause-modifying adverbial adjunct, we proposed that (relational) causal subordinate clauses (introduced by connective *because*) are processed as independent DU from the matrix clause and that this distinction is crucial to account for pronoun resolution preferences. In particular, we predicted that, in those contexts where the matrix clause and the subordinate clause constitute two separate DUs, resolution preferences occur within the process of *establishing* coherence between units, which will be done through the semantics

and pragmatics of certain elements in the proposition, such as verbs and connectives. In what follows, we present a series of experiments that test this prediction.

1.2. Specific predictions

The experiments that we present in Chapter 4 investigate how the semantics of the causal connective *because* interacts with the semantic and pragmatic content of the Focus-sensitive particles *even* and *only* that we also manipulated in Chapter 3.

In Chapter 3 we discussed the main characteristics of Focus-sensitive particles (FSP), which include (i) that they associate with an element that constitutes the focus of the utterance (syntactically via c-command and prosodically via the highest pitch accent); (ii) that a sentence containing a FSP constructs a discourse representation in which a set of explicit entities (the focus set) is contrasted with an inferred set of alternatives (the alternative set). Furthermore, a sentence containing *only,* like (4.1), gives rise to two propositions: the presupposition that Peter went to the party, and the negative assertion that quantifies the value of the focus set over the alternatives (exhaustivity*: nobody else*). Like *only, even* asserts a proposition equivalent to the sentence without the particle, but, unlike *only,* it presupposes that someone other than Peter went to the party. Besides, *even* gives rise to a third proposition as it selects a set of alternatives that are ranked higher on a likelihood scale with respect to the event denoted in the sentence. A sentence with *even,* like (4.2), gives rise to a scalar implicature whereby the focus set is ranked lowest on this contextual likelihood. The examples in (4.1) and (4.2) summarize the characteristics of *even* and *only*.

(4.1) Only **Peter** went to the party
  a. Alternatives: {Peter, Mary, John}
  b. Effect of *only*: Peter and not Mary and not John went to the party.

(4.2) Even **Peter** went to the party
  a. Alternatives: {Peter, Mary, John}
  b. Effect of *even*: Peter and Mary and John went to the party. Peter was the least expected person to go to the party.

In line with what we discussed above, we predict that, in the context of two DUs (e.g. matrix clause and subordinate causal adjunct), pronoun interpretation will be guided by the interaction of the semantic/pragmatic content of the focus particle and by that of the connective in the process of establishing discourse coherence. More specifically, we propose

that FSPs behave like Implicit Causality verbs in that they create expectations for an explanation that need to be filled to avoid the accommodation of missing information (Bott & Solstad, 2014). In particular, we argue that FSPs create expectations for an explanation about the relationship between the focus entity in the scope of the particle and the set of alternatives related to it:

- *Only* X VP: X but not Y, Z → expectation for an explanation for the *exhaustiveness* of its associate in relation with its alternatives within the described event
- *Even* X VP: X less likely than Y, Z → expectation for an explanation for the *unlikeliness* of its associate in relation with its alternatives within the described event, which, in turn, should result in an expectation for a negative explanation (i.e. a concessive e.g. *Even Peter went to the party although he was sick*).

According to these predictions, in a sentence like (4.3), *even* should trigger an expectation for a missing reason for the unlikeliness of Peter, who is the least likely person to interrupt Mary, doing so, which is in essence an expectation for a concessive. Adopting the analysis advocated by e.g. König (1991) and König and Siemud (2000) that argues that the concessive "q although p" implies the same counterfactual as the one entailed by the causal "~q because p"[1], in a sentence like (4.3) where the causal connective *because* is given, there should be a general preference for an explanation related to the antecedent *outside* the scope of *even,* i.e. Mary. In a sentence like (4.4), *only* should trigger an expectation for an explanation for the exhaustivity of the entity in its scope, that is, why Peter and nobody else interrupted Mary. This should result in a preference for the antecedent *within* the scope of *only,* i.e. Peter. In Experiment 7, we put these predictions to the test.

(4.3) Even Peter interrupted Mary last night *because*…

(4.4) Only Peter interrupted Mary last night *because*...

[1] König (1991) and König and Siemud (2000) argue that concessive clauses seem to imply that the main clause proposition would a fortiori be true if the concessive clause proposition were not true, that is to say, "q although p" seems to entail p and q and, moreover, to imply that q would surely hold were p not to hold. This analysis means that the concessive "q although p" implies the same counterfactual as the entailed by the causal "~q because p". Thus, a sentence like (ia) can be paraphrased by a sentence like (ib).

(i) a. The burglars were caught although they were not monitored.
b. The burglars did not escape because they were not monitored.

Our predictions will be tested for English in Experiments 7, 8, 9, and 12. Their cross-linguistic validity will be assessed in Experiments 10, 11, and 13 for French.

2. Experiment 7

Experiment 7 investigated the interaction of the Focus-sensitive particles *even* and *only* and the connective *because* to test the predictions laid out above, namely:

(i) Causal adjuncts are processed as a separate DU from the matrix clause and, in the context of two DUs, pronoun interpretation occurs within the process of *establishing* coherence through the semantic/pragmatic content of certain elements in the utterance.

(ii) The FSPs *even* and *only* in combination with the connective *because* behave like IC verbs in that they create expectations for specific explanations to avoid leaving missing causal content unspecified. These expectations will vary as a function of the semantic/pragmatic characteristics of *even* and *only*.

2.1. Method

Forty English native speakers completed a Sentence Continuation Task (SCT) online via Amazon's Mechanical Turk. The choice for a SCT instead of a SIT like in Experiment 1 is justified by the difficulty in creating completely ambiguous causal subordinate sentences. In addition to this, most studies that investigate implicit causality verbs employed SCTs to do so. Since our hypothesis is the interaction of focus-sensitive particles and connectives will create biases similar to those elicited with IC verbs, we considered it appropriate to use parallel tasks here. Despite the fact that SITs tap more into comprehension and SCTs into production, following e.g. Arnold (2001), we argue that in SCTs participants create a mental model of the event described by the context sentence before writing a continuation, therefore, the task involves not only production but also interpretation.

Twenty-five experimental items were constructed for Experiment 7. These sentence onsets were complex sentences that featured two human referents in the matrix clause and the connective *because* to mark the beginning of the causal subordinate clause. In order to avoid any ambiguity in the participants' continuations, the referents were here of the opposite sex. Thirteen items contained masculine subjects and feminine objects, and 12 contained feminine subjects and masculine objects. The subject of the sentence is always the agent or the

experiencer of the action and the object referent is always the patient or the theme. The focus-sensitive particles *even* and *only* were placed before the subject or before the object antecedents. Like for previous experiments, the verbs in the matrix clause were carefully selected to avoid verb-based IC biases.

The experimental items could appear in 5 different experimental conditions with Focus-sensitive particle (even vs. only vs. none) and Syntactic position of the FSP (subject vs. object) as independent variables, as the examples in (4.5) illustrate. Participants were asked to read the sentence onsets carefully and to provide an appropriate continuation to create a natural-sounding full sentence.

(4.5) a. **Baseline**: John interrupted Mary last night because...
b. **Even_Subject**: Even John interrupted Mary last night because...
c. **Even_Object**: John interrupted even Mary last night because...
d. **Only_Subject**: Only John interrupted Mary last night because...
e. **Only_Object**: John interrupted only Mary last night because...

Twenty-five distracters were included in order to draw participants' attention away from the phenomenon under investigation. The distracters were also sentence onsets containing two referents of opposite sex and the connective *because.* The verbs in the distracters, however, were highly biased IC verbs, half of which were biased towards of the subject antecedent and the other half towards the object antecedent, as in (4.6). Items appeared on the screen one by one and participants did not have the option of going back to change previous responses.

(4.6) a. John admired Mary because…
b. John amazed Mary because…

2.2. Results

A total of 79.2% of all the continuations (n=1000) contained 3rd person-singular (*he* or *she)* pronouns that unambiguously referred to either antecedent. Only these continuations were taken into account for subsequent analyses. These continuations were fairly evenly distributed across conditions: 21% Baseline, 19% Even_Subject, 22% Even_Object, 17% Only_Subject, and 21% Only_Object. Like for previous experiments, for the statistical analyses, subject antecedent choices were assigned a 1 and object antecedent choices were assigned a 0 for a

log-linear mixed-effects model analysis containing a fixed effect of Condition (with 5 levels), and random intercepts for Participants and Items. The statistical comparison between the full and the reduced models yielded a highly significant effect ($\chi^2(4)=52.563$, $p<.001$), which indicates that the experimental manipulations had a systematic effect on our participants' antecedent choices in their continuations. Table 4.1 gives the fixed effects yielded by this analysis[2].

Table 4.1: Fixed effects for Experiment 7

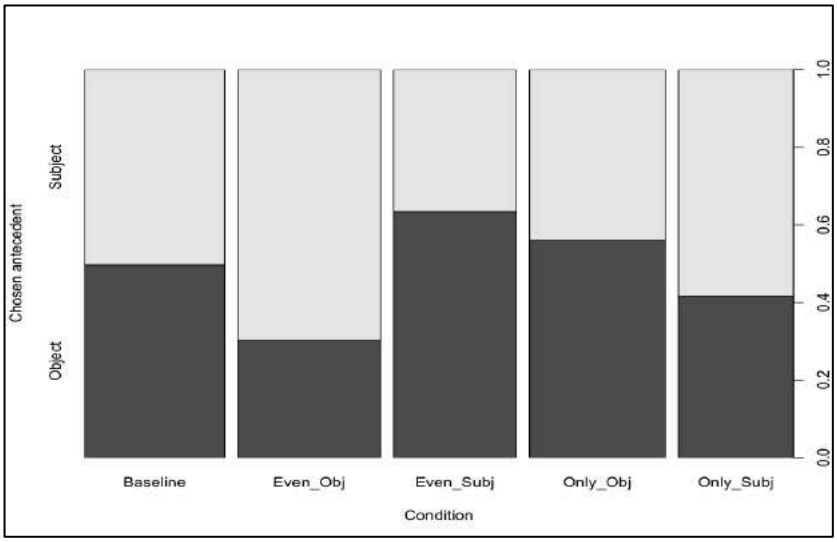
	Estimate	Std. Error	z value	Pr(>|z|)
(Intercept)	0.01211	0.23187	0.052	0.95836
Even_Object	0.97088	0.24600	3.947	7.93e-05 ***
Even_Subject	-0.68294	0.24916	-2.741	0.00613 **
Only_Object	-0.29943	0.23891	-1.253	0.21010
Only_Subject	0.42501	0.25078	1.695	0.09012 .

As Table 4.1 shows and Figure 4.1 illustrates, there is no preference for either antecedent in the baseline condition, just like in previous experiments. However, for sentences with *even*, participants had a robust preference for the antecedent that was *outside* the scope of the focus particle. The conditions with *only* did not differ significantly from the baseline conditions, but see further analyses below.

A second log-linear mixed-effects model analysis with Focus-sensitive particle and Syntactic function as fixed effects (excluding the Baseline condition), and random intercepts for Participants and Items yielded no main effect of Focus-sensitive particle ($\chi^2(1)=0.7517$, $p>.05$) but a significant main effect of Syntactic function ($\chi^2(1)=6.73$, $p<.01$) due to more choices of subject antecedents (average across conditions 52.1% subject antecedents, 47.9% object antecedents). The interaction between both factors was highly significant ($\chi^2(1)=42.2$, $p<.001$).

[2] The same models used and shown in Chapter 3 were used to analyze the data of the experiments presented in the present chapter. To avoid redundancy, we do not include them here.

Figure 4.1: Antecedent choices (subject or object) for Experiment 7



These results were corroborated by additional pairwise comparison analyses for the factor Syntactic function for each focus particle that revealed that continuations relating to the subject were chosen significantly less for Even_Subject compared to Only_Subject conditions (**β**=1.0085, SD=0.2659, z=3.793, p<.001) and continuations relating to the object antecedents were produced significantly less for the Even_Object than for the Only_Object condition (**β**=-1.3125, SD=0.2621, z=-5.008, p<.001). The analysis for the factor Focus particle also revealed significant differences between the Even_Subject vs. Even_Object conditions with less subject related continuations in the Even_Subject condition than in the Even_Object condition (**β**=-1.7491, SD=0.2925, z=-5.980, p<.001) and between the Only_Subject vs. Only_Object conditions, with more subject related continuations in the Only_Subject condition than in the Only_Object condition (**β**=0.7281, SD=0.2594, z=2.806, p<.001). Fixed effect values for the complete model with the two experimental factors for this experiments and all experiments presented in Chapter 4 are given in Appendix E.

2.3. Discussion

To summarize the results of Experiment 7, there was no clear preference for either antecedent on the baseline condition. In the focus particle conditions, however, there was a general preference for the antecedent *outside* the scope of *even* regardless of its grammatical function, and a general preference for the antecedent *within* the scope of *only* regardless of its grammatical function.

The first crucial observation from the results of Experiment 7 is that the focus particles *even* and *only* do not affect pronoun interpretation in the same manner when they are followed by a temporal adjunct (cf. Experiments 5 and 6, Chapter 3) as with a causal adjunct. This was, indeed, predicted by our proposal on DUs. Our prediction was that, in the context of two DUs, pronoun interpretation would be guided by the interaction of the semantic/pragmatic content of the focus particle and by that of the connective in the process of establishing discourse coherence. Our results confirm these predictions.

More specifically, we proposed that FSPs behave like Implicit Causality verbs in that they create expectations for an explanation that need to be filled to avoid the accommodation of missing information (Bott & Solstad, 2014). In particular, we argued that FSPs create expectations for an explanation about the relationship between the focus entity in the scope of the particle and the set of alternatives related to it. The results of Experiment 7 confirm these predictions too: *even* triggers an expectation for a missing reason for the unlikeliness of its associate in relation to the predicate, which is in essence an expectation for a concessive. Given that our experimental materials contained the causal connective *because* and adopting an analysis whereby the concessive "q although p" implies the same counterfactual as the entailed by the causal "~q because p", this was evidenced by the general preference for the antecedent *outside* the scope of *even* in our experimental sentences. *Only,* on the other hand, triggers an expectation for an explanation for the exhaustivity of the entity in its scope, which was evidenced by the general preference for the antecedent *within* the scope of *only.*

The results of Experiment 7 constitute preliminary evidence in favor of our proposal on DUs and how it affects pronoun interpretation. Before drawing any further conclusions, however, we present a series of experiments that were conducted with the goal of addressing potential shortcomings that might have influenced the results of Experiment 7 or to further corroborate these findings and, by extension, our claims. At the end of the chapter, we will draw general conclusions in light of the combined results of the experiments presented in this chapter.

3. The position of Focus-sensitive particles

In Chapter 3 we discussed the main characteristics of FSPs, which were defined as a subgroup of adverbs that associate with a focused constituent that they c-command and that is prosodically marked. It was shown that, in fact, their interpretation depends on the placement of focus elsewhere in the utterance. Thus, in a sentence like (4.7), it is only by identifying the focus constituent, which carries the highest pitch accent, that the utterance can be understood.

(4.7) John **only** read his new novel to Mary.

In languages like English, however, the position of the particle is rather flexible and, thus, the focus constituent can appear in an adjoining position to the particle or further to its right. This is shown in (4.8) and (4.9) where *only* appears in two different positions –pre-verbal and post-verbal –but, nevertheless, associates with the same constituent. Both sentences are grammatical and equivalent in terms of truth-conditions.

(4.8) John **only** read [his new NOVEL]$_{Foc}$ to Mary.
(4.9) John read **only** [his new NOVEL]$_{Foc}$ to Mary.

Given its written nature, in Experiment 7 we placed the focus particles in a post-verbal position adjoining the object antecedent. By doing this, the object antecedent is clearly marked for focus, avoiding any scope ambiguities that could have arisen had we placed the focus particle in pre-verbal position. Since both positions are grammatical and equivalent in terms of the information conveyed (when the focus entity is clearly marked), in Experiment 8, an Acceptability Judgment Task (henceforth AJT), we wanted to test whether, in the absence of explicit prosodic marking, one of the two positions is generally preferred. Put it differently, this experiment wanted to test specifically whether placing FSPs in the post-verbal object-adjoining position was judged as (completely) unacceptable, a finding that could potentially have had some bearings on the results of Experiment 7.

3.1. Experiment 8

3.1.1. Method

A total of one hundred and sixty English native speakers completed the AJT online via Amazon's Mechanical Turk. They were asked to read the sentences carefully and to rate them on an acceptability scale from 0, not acceptable, to 7, completely acceptable.

Twenty-four experimental items from Experiment 7 were used in this experiment. The only difference was that the two focus particles manipulated, *even* and *only,* could appear in three different positions: before the subject antecedent, before the verb, or before the object antecedent. The experimental items could appear in 6 different experimental conditions

following a 3x2 design with Focus-sensitive particle (even vs. only) and Position (subject vs. verb vs. object) as independent variables, as the examples in (4.10) illustrate.

(4.10) a. **Even_Subject**: Even John called Peter when he was in the office.
b. **Even_Verb**: John even called Peter when he was in the office.
c. **Even_Object**: John called even Peter when he was in the office.
d. **Only_Subject**: Only John called Peter when he was in the office.
e. **Only_Verb**: John only called Peter when he was in the office.
f. **Only_Object**: John called only Peter when he was in the office.

Forty-eight as many distracters were included in order to draw participants' attention away from the phenomenon under investigation. Items appeared on the screen one by one and participants did not have the option of going back to change previous choices.

3.1.2. Results

For the statistical analyses, mean acceptability judgments were entered into a log-linear mixed-effects model analysis containing a fixed effect of Condition (with 6 levels), and random intercepts for Participants and Items. The statistical comparison between the full and the reduced models yielded a highly significant effect ($\chi^2(5)=470.17$, $p<.001$), which indicates that the experimental manipulations had a systematic effect on our participants' judgments. Table 4.2 gives the fixed effects yielded by this analysis.

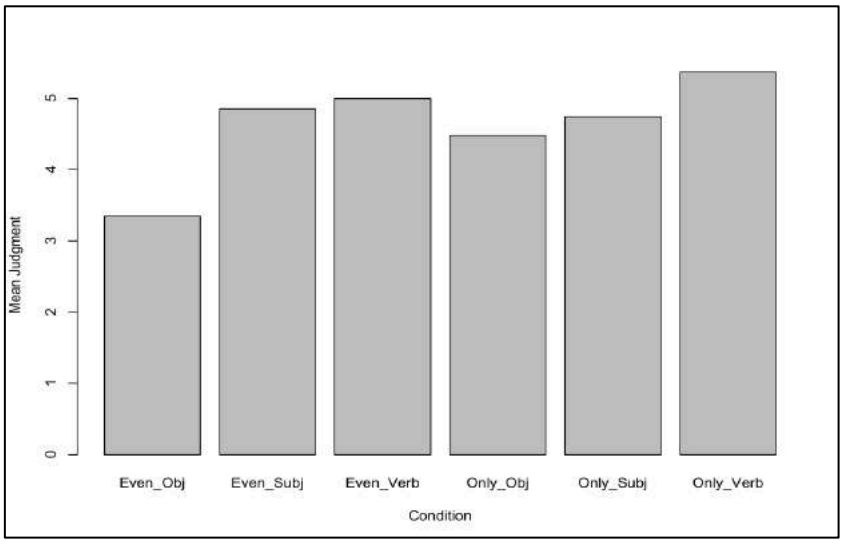
Table 4.2: Fixed effects for Experiment 8

	Estimate	Std. Error	t value
(Intercept)	3.3500	0.1464	22.88
Even_Subj	1.5042	0.0970	15.51
Even_Verb	1.6500	0.0970	17.01
Only_Obj	1.1313	0.0970	11.66
Only_Subj	1.3917	0.0970	14.35
Only_Verb	2.0229	0.0970	20.86

As Figure 4.2 illustrates, the results of Experiment 8 show that, *even* is significantly more acceptable in the pre-subject and pre-verbal positions. The condition where *even* appears in a post-verbal position preceding the object referent is judged the least acceptable of

the six conditions. *Only* is judged most acceptable in the pre-verbal position, followed closely by the pre-subject and post-verbal (pre-object) positions. Interestingly, the biggest difference in the ratings between the two particles comes in the post-verbal object-adjoining position, where *even* is judged less acceptable than *only* by over 1 point (~3.3 vs. 4.5). A second log-linear mixed-effects model analysis with Focus-sensitive particle and Position as fixed effects, and random intercepts for Participants and Items yielded highly significant effects of Focus-sensitive particle ($\chi^2(1)=65.86$, $p>.001$) and Position ($\chi^2(2)=329.4$, $p<.001$). The interaction between both factors was highly significant ($\chi^2(2)=82.405$, $p<.001$). Additional subset analyses for each focus particle revealed significant differences between the Subject and Object conditions for both particles (*even* t=16.76, *only* t=2.73), between the Object and Verb conditions (*even* t=17.8, *only* t=9.43), and between the Subject and Verb conditions only in the case of *only* (t=6.68, *even* t=1.59).

Figure 4.2: Mean acceptability judgments for Experiment 8



3.1.3. Discussion

There are two main findings from Experiment 8. The first one is that the conditions where the focus particles *even* and *only* appear post-verbally adjoining the object antecedent are judged as less acceptable than those conditions where the particles appear before the subject or before the verb. The second finding is that, crucially, the two particles are not rated similarly in this condition, as *even* is rated significantly lower when it appears before the object antecedent than *only*.

The reduced acceptability of sentences where *even* and *only* appear before the object antecedent compared to conditions where the particles appear before the verb –a position that, in the absence of overt prosodic marking to signal the focus entity, allows for two readings, one where the verb is the focus and another where the object is the focus –seems to be in line with accounts that propose that, if syntactically allowed, FSPs are preferred in positions that allow the most focus possibilities (e.g. the *Broad Focus Hypothesis*, Harris & Carlson, 2014). They are less compatible, however, with accounts that defend that FSPs are preferred in a position that adjoins the focus entity (e.g. the *Closesness Principle*, Büring & Hartmann, 2001). Although we will not be discussing these accounts in detail, the results of Experiment 8 suggest that the pre-verbal position imposes the fewest restrictions on the discourse, facilitating the accommodation of a sentence in isolation when it is underspecified for focus marking.

The second interesting finding is the difference in ratings between *even* and *only* in the post-verbal object-adjoining position, where *only* is rated significantly more acceptable than *even*. In other words, *even* seems to be syntactically less flexible, strongly preferring the pre-verbal position, while *only* is accepted in multiple positions. These results are similar to those obtained by Harris and Carlson (2014) in their Experiment 1 –a written rating study –where *even* was strongly preferred in pre-verbal position, *only* was accepted both pre- and post-verbally, and, also in line with our results, they found that both particles were rated highest in pre-verbal position. Providing an explanation for the differences in ratings between both particles is not relevant at this point. What is crucial for us here, however, is the fact that the post-verbal position is not systematically rejected by our participants: in the case of *only* ratings for this position are virtually the same as for the pre-subject position; in the case of *even,* the difference between the pre-subject and pre-object position is significantly bigger, yet, ratings for the post-verbal pre-object position reached the 3.5 points out of 7, meaning that on average this position was considered not optimal but not completely unacceptable either.

Summarizing, in the absence of explicit prosodic marking to mark focus, the FSPs *even* and *only* are preferred in pre-verbal position over post-verbal object-adjoining position. These results suggest that focus particles are preferred in positions that allow for more focus possibilities, as this facilitates the accommodation of a sentence in isolation when it is underspecified for focus marking. While this is especially true for *even,* which is strongly preferred in the pre-verbal position, *only* is accepted in multiple positions. Given that the post-verbal object-adjoining position is not systematically rejected by our participants

(regardless of the difference between *even* and *only*), and that we wanted to precisely avoid the possibility of multiple interpretations, we still consider our evidence as highly valid. Moreover, the effects of FSPs on pronoun resolution turned out to be highly similar for subject and object antecedents despite the reduced acceptability of preverbal FSPs. However, given this similarity, we do not expect the variation of syntactic function to be of central importance for our following experiments. We will, therefore, focus on constructions where only the subject is in the scope of a FSP[3].

4. The role of the different methodologies employed and the cross-linguistic validity of our claims

The results of Experiments 5, 6, and 7 combined show that FSPs do not affect resolution the same way: while there is a general dispreference for the antecedent within the scope of *even* and *only* in the context of a matrix clause and a temporal adjunct (Experiments 5 and 6), in the context of a matrix clause and a causal adjunct (Experiment 7), the resolution pattern changes as a function of the semantic and pragmatic content of the FSPs and the connective. We have claimed that these results constitute preliminary evidence in favor of our proposal on DUs and pronoun resolution.

However, as was already pointed out in the description of Experiment 7, the methodology used in Experiments 5 and 6 was not the same as the one used in Experiment 7. In Experiments 5 and 6, we employed a Sentence Interpretation task (SIT) where participants were given full sentences followed by a prompt with a gap that they had to fill in by choosing an antecedent. In Experiment 7, we employed a Sentence Continuation (or Completion) task (SCT) where participants were given sentence onsets and were instructed to provide a continuation to create a natural-sounding full sentence. These two methodologies are different in nature, as SITs tap more into comprehension, while SCTs tap more into production. Regardless of this difference, we argue that, in a SCT, participants need to create a mental model of the event described by the sentence onset before writing a continuation, which means that the task involves not only production but also interpretation (Arnold, 2001). Nevertheless, we cannot neglect the possibility that the differences in the observed patterns of results might be, at least to a certain extent, due to the different methodologies employed. The experiments we present below address this potential shortcoming.

[3] FSPs adjoined to the object are fully acceptable in Spanish. These considerations only concern our experiments on English.

In addition to that, Experiments 9 and 10 below address an important aspect of the present dissertation: testing the cross-linguistic validity of our claims. As we have already pointed out, one of the main goals of the present study is to perform a cross-linguistic comparison of the phenomenon under study. The first part of Chapter 3 focused on Spanish. In the second part of the chapter, we saw that some of the findings in Spanish were also applicable to English. It is important to note, however, that Spanish is a null-subject language and, therefore, the methodology employed in Experiment 7 (a Sentence continuation task) is not suitable to perform a direct comparison between these two languages, as participants can provide pronounless continuations that remain globally ambiguous. For this reason, in Chapter 4 we will perform a comparison of English with another non-null subject language: French. Recall from the studies reviewed in Chapter 1 that a strong object-antecedent preference has been attested in French for canonical structures (i.e. the baseline condition in Colonna et al., 2012). This general object preference for French, which has been analyzed as being the result of the existence of alternative non-ambiguous constructions, can potentially have important consequence for the cross-linguistic comparison of the phenomenon under study.

4.1. Experiment 9

4.1.1. Method

In Experiment 9 we combined the kind of experimental sentences used in the SITs, namely temporal adjuncts introduced by the connective *when,* and those used in the SCTs, namely causal adjuncts introduced by the connective *because* in the same experiment using the same methodology. Eighty-seven English native speakers completed a Sentence Continuation Task (SCT) online via Amazon's Mechanical Turk.

Twenty-four of the 25 experimental items used in Experiment 7 were used in Experiment 9. These sentence onsets were also complex sentences that featured two human referents in the matrix clause and the connective *because* or *when* to mark the beginning of the subordinate clause. In order to avoid any ambiguity in the participants' continuations, the referents were of the opposite sex. Half of the items contained masculine subjects and feminine objects, and the other half contained feminine subjects and masculine objects. Given the lack of an antecedent preference in the Baseline condition in Experiment 7, we decided not include it in this experiment. The experimental items could, thus, appear in 4 different experimental conditions following a 2x2 design with Focus-sensitive particle (even*only) and

Connective (when*because) as independent variables. The focus-sensitive particles associated only with the subject antecedent in this experiment, as shown in (4.11). Participants were asked to read the sentence onsets carefully and to provide an appropriate continuation to create a natural-sounding full sentence. The same number of distracters (n=24) was included in order to draw participants' attention away from the phenomenon under investigation. The distracters were the same sentences containing Implicit Causality verbs used in Experiment 7. Items appeared on the screen one by one and participants did not have the option of going back to change previous choices.

(4.11) a. **Even_Temporal**: Even John interrupted Mary last night when...
b. **Even_Causal**: Even John interrupted Mary last night because...
c. **Only_Temporal**: Only John interrupted Mary last night when...
d. **Only_Causal**: Only John interrupted Mary last night because...

4.1.2. Results

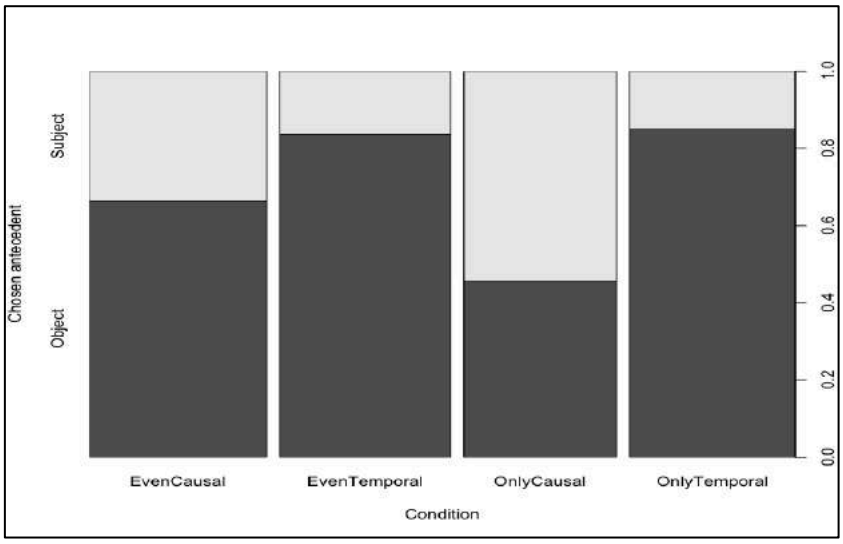
A total of 78% of all the continuations (n=2152) contained 3rd person-singular (*he* or *she)* pronouns that unambiguously referred to either antecedent. Only these continuations were taken into account for subsequent analyses. These continuations were fairly evenly distributed across conditions: 27% Even_Causal, 25% Even_Temporal, 23% Only_Causal, and 25% Only_Temporal. Like for previous experiments, for the statistical analyses, subject antecedent choices were assigned a 1 and object antecedent choices were assigned a 0 for a log-linear mixed-effects model analysis containing a fixed effect of Condition (with 4 levels), and random intercepts for Participants and Items. The statistical comparison between the full and the reduced models yielded a highly significant effect ($\chi^2(3)=138.75$, $p<.001$), which indicates that the experimental manipulations had a systematic effect on our participants' antecedent choices in their continuations. Table 4.3 gives the fixed effects yielded by this analysis.

Table 4.3: Fixed effects for Experiment 9

	Estimate	Std. Error	z value	Pr(>|z|)
(Intercept)	-1.0509	0.2164	-4.857	1.19e-06 ***
Even_Temporal	-0.5821	0.2023	-2.878	0.004 **
Only_Causal	1.2739	0.1897	6.714	1.89e-11 ***
Only_Temporal	-0.9254	0.2118	-4.368	1.25e-05 ***

Descriptively, in the Temporal conditions, there was a general preference for the antecedent outside the scope of both *even* and *only*, whereas in the Causal conditions, preferences varied as a factor of the focus particle: on the one hand, there was a robust preference for the antecedent that was *outside* the scope (the object) of the focus particle *even*, and, on the other hand, there was a clear preference for the antecedent that was *within* the scope (the subject) of the focus particle *only* with respect to the other conditions. This pattern is shown in Figure 4.3.

Figure 4.3: Antecedent choices (subject or object) for Experiment 9



These descriptive effects were confirmed by a second log-linear mixed-effects model analysis with Focus-sensitive particle and Connective as fixed effects and random intercepts for Participants and Items. This analysis yielded a highly significant main effect of Focus-sensitive particle ($\chi^2(1)=19.024$, $p<.001$) with less subject related continuations for *even* (23%) than for *only* (32%) and a highly significant main effect of Connective ($\chi^2(1)=91.169$, $p<.001$) with more subject related continuations for causal (43.5%) than for temporal (11.5%) adjuncts. The interaction between both factors was also highly significant ($\chi^2(1)=30.954$, $p<.001$). Additional pairwise comparisons on the Focus-sensitive particle factor for each of the two connectives revealed that the interaction was mainly driven by the *only* conditions with a significantly less subject related continuations the Temporal compared to the Causal conditions for *only* (β=-2.2826, SD=0.3304, z=-6.908, $p<.001$) but a marginally significant difference for the *even* conditions (β=-0.6157, SD=0.3560, z=-1.729, $p<.1$). Additionally, the same type of analysis for the Connective factor for each focus particle revealed no significant

differences between the Temporal conditions (β=-0.3528, SD=0.2393, z=-1.474, p>.05) but a highly significant difference between the two Causal conditions (β=1.4410, SD=0.2107, z=6.839, p<.001) with more subject related continuations for Only than for Even, which confirms that it is the interaction of the semantics of the focus particles and that of the connective *because* what drives the pattern of antecedent choices.

We discuss these results in light of the findings of Experiment 10, which tests the cross-linguistics validity of the results of Experiment 9 in French.

4.2. Experiment 10

4.2.1. Method

Ninety-three French native speakers completed a Sentence Continuation Task (SCT) online via Ibex Farm.

The 24 experimental items used in Experiment 9 were translated into French and used in Experiment 10. These sentence onsets were also complex sentences that featured two human referents in the matrix clause and the connective *parce que* 'because' or *quand* 'when' to mark the beginning of the subordinate clause. In order to avoid any ambiguity in the participants' continuations, the referents were of the opposite sex. Twelve items contained masculine subjects and feminine objects, and 12 contained feminine subjects and masculine objects. The experimental items could appear in the same 4 different experimental conditions following a 2x2 design with Focus-sensitive particle (*même* 'even' * *seul* 'only') and Connective (*quand* 'when' * *parce que* 'because') as independent variables (see 4.12). Participants were asked to read the sentence onsets carefully and to provide an appropriate continuation to create a natural-sounding full sentence. Forty-eight distracters were included in order to draw participants' attention away from the phenomenon under investigation. Items appeared on the screen one by one and participants did not have the option of going back to change previous choices.

(4.12) a. **Même_Temporal**: Même Pierre a interrompu Marie quand…
b. **Même_Causal**: Même Pierre a interrompu Marie parce que…
c. **Seul_Temporal**: Seul Pierre a interrompu Marie quand…
d. **Seul_Causal**: Seul Pierre a interrompu Marie parce que…

4.2.2. Results

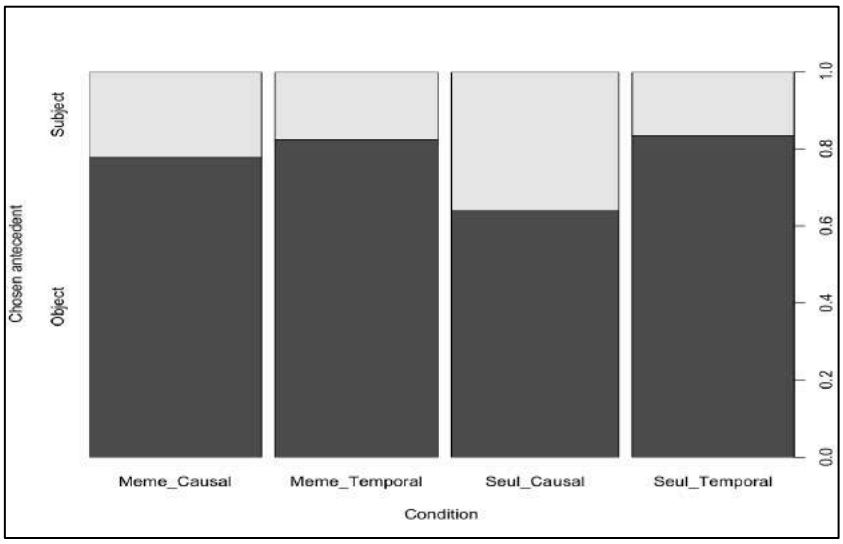
A total of 89.7% of all the continuations (n=2248) contained 3rd person-singular (*il* 'he' or *elle* 'she'*)* pronouns that unambiguously referred to either antecedent. Only these continuations were taken into account for subsequent analyses. These continuations were fairly evenly distributed across conditions: 26% Même_Causal, 25% Même_Temporal, 25% Seul_Causal, and 24% Seul_Temporal. Like for previous experiments, for the statistical analyses, subject antecedent choices were assigned a 1 and object antecedent choices were assigned a 0 for a log-linear mixed-effects model analysis containing a fixed effect of Condition (with 4 levels), and random intercepts for Participants and Items. The statistical comparison between the full and the reduced models yielded a highly significant effect ($\chi^2(3)=80.197$, $p<.001$), which indicates that the experimental manipulations had a systematic effect on our participants' antecedent choices in their continuations. Table 4.4 gives the fixed effects yielded by this analysis.

Descriptively, the results of Experiment 10 show a general preference for the object antecedent across conditions. This finding goes in line with previous results in French by Colonna and colleagues who observe a similar preference for the object antecedent in baseline conditions. However, if we take a closer look at the differences between conditions we observe that these results replicate those of Experiment 9 and previous experiments: in the Temporal conditions, relative to the Causal conditions, there was a stronger preference for the antecedent outside the scope of both *même* and *seul*. This preference was also observed in English but was significantly more robust in French, which might be due to the fact that in French participants prefer object antecedents already. In the Causal conditions, relative to the Temporal conditions, there was a clear preference for the antecedent that was *outside* the scope of the focus particle *même*. For *seul,* however, participants produced more continuations related to the antecedent within its scope (the subject) compared to *même* (although the object antecedent is still the preferred one). This pattern is shown in Figure 4.4.

Table 4.4: Fixed effects for Experiment 10

	Estimate	Std. Error	z value	Pr(>|z|)
(Intercept)	-1.4449	0.1961	-7.367	1.75e-13 ***
Meme_Temporal	-0.5138	0.1741	-2.952	0.00315 **
Seul_Causal	0.7982	0.1547	5.159	2.49e-07 ***
Seul_Temporal	-0.4022	0.1743	-2.308	0.02102 *

Figure 4.4: Antecedent choices (subject or object) for Experiment 10



These descriptive results are confirmed by an additional log-linear mixed-effects model analysis with Focus-sensitive particle and Connective as fixed effects and random intercepts for Participants and Items. This analysis yielded a highly significant main effect of Focus-sensitive particle ($\chi^2(1)=18.964$, $p<.001$) with fewer subject related continuations for *même* (20%) than for *seul* (26%) and a highly significant main effect of Connective ($\chi^2(1)=53.105$, $p<.001$) with fewer subject related continuations for temporal (17%) than for causal (29%) adjuncts. The interaction between both factors was also significant ($\chi^2(1)=8.0415$, $p<.01$). Subsequent pairwise comparisons on the Focus-sensitive particle factor for each of the two connectives revealed a highly significant difference between the Temporal and Causal conditions for *seul* (β=-1.1887, SD=0.1687, z=-7.045, $p<.001$) and a small but significant difference for the *même* conditions (β=-0.5785938, SD=0.0008971, z=-644.9, $p<.001$). In both cases, there were fewer subject related continuations for temporal adjuncts. Additionally, the same type of analysis for the Connective factor for each focus particle revealed a small but significant difference between the Temporal conditions with slightly fewer subject related continuations for *seul* (β=0.1750187, SD=0.0008675, z=201.7, $p>.05$) and a highly significant difference between the two Causal conditions (β=0.8104, SD=0.1574, z=5.149, $p<.001$). This pattern closely resembles the results for English.

4.2.3. Discussion

To sum up the results of Experiments 9 and 10, in the Temporal conditions, there was a general preference for the antecedent outside the scope of both *even* and *only*; in the Causal conditions, however, there was a robust preference for the antecedent that was *outside* the scope of the focus particle *even*, which decreased significantly in favor of the subject antecedent (i.e. the antecedent *within* the scope of the particle) in the case of *only*. The results of Experiment 10 show that, in French, regardless of the differences in responses in each condition, there was a general preference for the object antecedent across the board, which we argue might be due to a general object-antecedent preference previously attested for French within-sentence pronoun resolution.

The results of Experiment 9 and 10 are in line with the results of previous experiments where we observed differences in the patterns of interpretation depending on whether resolution occurs in the context of a main and a temporal subordinate clause or in the context of a main and a causal subordinate clause. While in the former case, there is a general dispreference for the particle's associate, irrespective of the particle; in the latter case preferences vary as a function of the semantic and pragmatic content of the focus particles and the kind of expectations they create. We will further discuss these results and how they relate to our proposal on DUs in the general conclusions section at the end of the chapter.

Crucially, and addressing the points that motivated this set of experiments, the fact that these results replicate the results of previous experiments confirms that the different interpretation patterns observed in previous experiments for the two types of subordinate adjuncts manipulated are not due to the different tasks employed. Interestingly, the results of Experiments 10 show that, while this pattern of results holds cross-linguistically, in English and in French, language-specific factors are also at stake affecting resolution preferences.

5. The role of *it-clefts* and causal connectives in pronoun resolution

One of the central results of the experiments presented in Chapter 3 was that focus antecedents (marked via *it-cleft* constructions) are dispreferred, at least intra-sententially, and that this so-called *anti-focus effect* arises with different focusing devices (*it-clefts* and the Focus-sensitive particles *even* and *only*). Crucially, the results of Experiments 7, 9, and 10 have shown that the effects of the FSPs *even* and *only* depend on the contextual circumstances of the pronominal dependency. The pattern described above was attested when the pronominal dependency is established between a matrix clause and a temporal subordinate. However, when the temporal connective is replaced by a causal connective, like *because*, the

anti-focus effect gives way to a more elaborate pattern in pronoun interpretation that, we claim, occurs in the process of establishing coherence through the semantic/pragmatic content of FSPs, on the one hand, and the connective *because,* on the other.

One question that we can address at this point is whether the same interaction observed between the semantics/pragmatics of FSPs and that of the causal connective arises with *it-clefts*. Recall from Chapter 3 that *it-clefts* and the exclusive focus particle *only* both carry an exhaustiveness implicature on the clefted entity/associate. If, in the context of a causal adjunct, pronoun interpretation occurs in the process of establishing coherence through the semantic/pragmatic content of the construction, the prediction is that we should observe a similar pattern of results with *it-clefts* as with *only.* Experiment 11 addresses this question.

5.1. Experiment 11

5.1.1. Method

A total of 27 native speakers of French completed a Sentence Continuation Task online via Ibex Farm.

The same 24 experimental items used in Experiment 10 were used in Experiment 11 with the sole difference that Focus-sensitive particles were replaced by cleft constructions for this experiment. These sentence onsets were also complex sentences that featured two human referents in the matrix clause and the connective *parce que* 'because' or *quand* 'when' to mark the beginning of the subordinate clause. The experimental items appeared in 4 different experimental conditions following a 2x2 design with Clefted antecedent (subject vs. object) and Connective (when vs. because) as independent variables, as shown in (4.13). Participants were asked to read the sentence onsets carefully and to provide an appropriate continuation to create a natural-sounding full sentence. Since, to our knowledge, there are not any published studies on Implicit Causality in French giving access to a corpus of verb biases, we translated the same verbs from previous experiments in English and Spanish. In those cases where the translation would not be appropriate, for instance, because of the verb's different subcategorization configuration in the language, we employed a synonym.

(4.13) a. **Cleft Subject_Causal***:* C'est Pierre qui a interrompu Julie parce que…
b. **Cleft Subject_Temporal***:* C'est Pierre qui a interrompu Julie quand…
c. **Cleft Object_ Causal***:* C'est Julie que Pierre a interrompue parce que…
d. **Cleft Object_Temporal***:* C'est Julie que Pierre a interrompue quand…

Twenty-four distracters were included in order to draw participants' attention away from the phenomenon under investigation. The distracters, exemplified in (4.14) were the sentences containing a combination of focus-sensitive particles and complex NPs that create a potential ambiguity about the antecedent of the relative pronoun *qui* 'who' and sentences featuring two entities, one of them negated, and the connective *quand* 'when' or *parce que* 'because'. Items appeared on the screen one by one and participants did not have the option of going back to change previous choices.

(4.14) a. Seul/Même Pierre court avec le fils du professeur qui…
'Only/Even Pierre jogs with the son of the professor who…'
b. Marie n'a pas préparé un gateau mais une tarte parce que/quand…
'Marie didn't make a cake but a pie because/when…'

5.1.2. Results

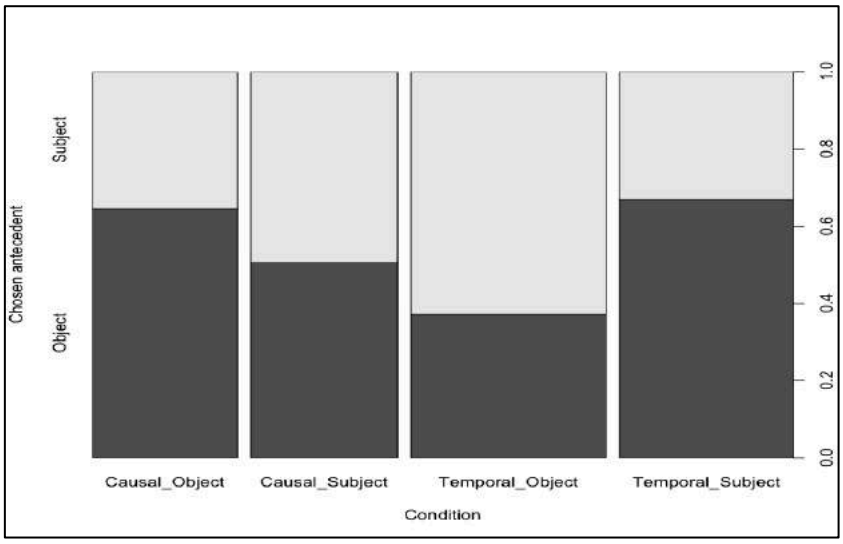
A total of 70% of all the continuations (n=630) contained 3rd person-singular (*il* 'he' or *elle* 'she'*)* pronouns that unambiguously referred to either antecedent. Only these conditions were taken into account for subsequent analyses. These continuations were fairly evenly distributed across conditions: 22% Clefted Subject_Causal, 26% Clefted Subject_Temporal, 22% Clefted Object_Causal, and 30% Clefted Object_Temporal. Like for previous experiments, for the statistical analyses, subject antecedent choices were assigned a 1 and object antecedent choices were assigned a 0 for a log-linear mixed-effects model analysis containing a fixed effect of Condition (with 4 levels), and random intercepts for Participants and Items. The statistical comparison between the full and the reduced models yielded a highly significant effect ($\chi^2(3)=28.596$, $p<.001$), which indicates that the experimental manipulations had a systematic effect on our participants' antecedent choices in their continuations. Table 4.5 gives the fixed effects yielded by this analysis.

Table 4.5: Fixed effects for Experiment 11

	Estimate	Std. Error	z value	Pr(>|z|)
(Intercept)	-0.6334	0.3147	-2.013	0.044128 *
Causal_Subject	0.6518	0.3233	2.016	0.043809 *
Temporal_Object	1.1531	0.3221	3.580	0.000344 ***
Temporal_Subject	-0.2965	0.3343	-0.887	0.375216

Descriptively, as Figure 4.5 illustrates, in the Temporal conditions, there is a general preference for non-clefted antecedents: participants prefer the object antecedent, when the subject antecedent is clefted, and, likewise, they prefer the subject antecedent, when the object antecedent is clefted. In the Causal conditions, however, the preference is for the clefted antecedent: compared to the temporal conditions, participants preferentially picked the subject antecedent more often in the condition where the subject antecedent is clefted, and the object antecedent in the condition where the object antecedent is clefted.

Figure 4.5: Antecedent choices (subject or object) for Experiment 11



These effects were confirmed by subsequent log-linear mixed-effects model analysis with Clefted antecedent (or syntactic function) and Connective as fixed effects and random intercepts for Participants and Items. The analyses yielded a significant main effect of Syntactic function ($\chi^2(1)=5.1073$, $p<.05$), due to an overall higher number of object related than subject related continuations (55% - 45%). There was no main effect of Connective ($\chi^2(1)=0.32$, $p>.05$). The interaction between both factors was, however, highly significant ($\chi^2(1)=23.058$, $p<.001$). Additional pairwise comparisons on the Syntactic function factor for each of the two connectives revealed significant differences between the Temporal and Causal conditions both when the Subject was clefted (β=-1.13008, SD=0.36117, z=-3.129, $p<.01$) as well as when the Object was clefted (β=1.2608, SD=0.3348, z=3.766, $p<.001$). Additionally, the same type of analysis on the Connective factor for each clefted antecedent revealed a highly significant difference between the Temporal conditions (β=-1.4922, SD=0.3178, z=-

4.695, p>.001) and a significant difference between the two Causal conditions (**β**=0.6651, SD=0.3254, z=2.044, p<.05).

5.1.3. Discussion

Summarizing the results of Experiment 11, there is a general dispreference for clefted antecedents in the temporal conditions, and a general preference for clefted antecedents in the causal conditions.

The results of Experiment 11 confirm that cleft constructions and the exclusive FSP *seulement* 'only' behave similarly, as both constructions have a comparable effect on participants' antecedent choices. In line with Experiments 1, 2, and 4 in Chapter 3 that investigated the role of information status in pronoun resolution with temporal adjuncts, the results of Experiment 11 show a general dispreference for clefted antecedents in the temporal conditions that we accounted for in terms of the information status of the antecedent and the semantic and pragmatic characteristics of *it-clefts:* participants dispreferred focus antecedents because they signal a potential topic-shift and prefer topic-like (old, known, presupposed) antecedents that contribute to continuity and coherence. The same pattern of results was observed in previous experiments in those conditions where *only* was followed by a temporal subordinate. These results also replicate those from Colonna et al. (2012). In line with Experiments 7, 9, and 10 that investigated pronoun resolution in the context of causal subordinates, the results of Experiment 11 show a general preference for clefted antecedents in the causal conditions, similar to that observed with the focus particle *only,* which we explained in terms of an interaction of the semantic/pragmatic content of the constructions under study (focus particles and clefts) and that of the connective (*because*) in the process of establishing discourse coherence. In particular, *only* and *it-clefts* create an expectation for an explanation for the exhaustivity of the focus entity in relation with its alternatives within the described event. This expectation results in the observed preference for the clefted antecedents and antecedents within the scope of *only.* We will further discuss the implications of these results in relation with our proposal on DUs in the conclusion section.

6. The role of FSPs and concessive connectives in pronoun resolution

The results of Experiment 11, as well as those of Experiments 7, 9, and 10, show that, in the context of a main clause and a subordinate causal adjunct, *it-clefts* and *only* trigger an expectation for a missing reason behind the exhaustivity of its associate/clefted entity in relation to its alternatives within the event described. This expectation results in the resolution

patterns observed where participants preferred the clefted entity/associate within the scope of *only* as the antecedent of the pronoun in their continuations.

In the case of *even,* however, we predicted that a preference for the antecedent inside its scope would occur as a result of an expectation for a missing reason for the unlikeliness of its associate in relation with its alternatives within the described event. This expectation should in turn bring about an expectation for a concessive continuation. Following König (1991) and König and Siemud (2000) who argued that the concessive "q although p" implies the same counterfactual as the entailed by the causal "~q because p", we predicted the opposite pattern, i.e. a preference for the antecedent *outside* the scope of *even,* motivated by the preference of the connective *because.* The results of Experiments 7, 9, and 10 confirmed this prediction.

Keeping in mind the above predictions and findings for sentences containing a causal subordinate introduced by *because*, we wanted to further corroborate these claims by investigating the interaction of FSPs and the concessive connective *although* in pronoun interpretation. If our predictions for causal contexts were based on the assumption that the concessive "q although p" implies the causal "~q because p", the opposite pattern of results to that obtained in previous experiments should arise if we replace the connective *because* for *although.* Experiments 12 and 13 test this prediction; Experiment 12 does so in English, whereas Experiment 13 tests the cross-linguistic validity of these predictions in French.

6.1. Experiment 12

6.1.1. Method

Fifty English native speakers completed the same Sentence Continuation Task (SCT) as in previous experiments online via Amazon's Mechanical Turk.

The same 24 experimental items used in Experiments 6, 7 and 9 were used in this experiment. These sentence onsets were also complex sentences that featured two human referents of opposite sex in the matrix clause and the connective *because* or *although* to mark the beginning of the subordinate clause. The experimental items appeared in 4 different experimental conditions following a 2x2 design with Focus-sensitive particle (even vs. only) and Connective (because vs. although) as independent variables, as shown in (4.15). Twenty-four distracters were included in order to draw participants' attention away from the phenomenon under investigation. The distracters were the same items used in Experiments 7

and 9. Items appeared on the screen one by one and participants did not have the option of going back to change previous choices.

(4.15) a. **Even_Concessive**: Even John interrupted Mary last night although...
b. **Even_Causal**: Even John interrupted Mary last night because...
c. **Only_Concessive**: Only John interrupted Mary last night although...
d. **Only_Causal**: Only John interrupted Mary last night because...

6.1.2. Results

A total of 65% of all the continuations (n=1198) contained 3rd person-singular (*he* or *she)* pronouns that unambiguously referred to either antecedent. Only these continuations were taken into account for subsequent analyses. These continuations were fairly evenly distributed across conditions (32% Even_Causal, 29% Even_Concessive, 25% Only_Causal) except for the Only_Concessive condition where continuations with a pronoun *he/she* reached only 14% of the total. Like for all previous experiments, for the statistical analyses, subject antecedent choices were assigned a 1 and object antecedent choices were assigned a 0 for a log-linear mixed-effects model analysis containing a fixed effect of Condition (with 4 levels) and random intercepts for Participants and Items. The statistical comparison between the full and the reduced models yielded a highly significant effect ($\chi^2(3)=59.367$, $p<.001$), which indicates that the experimental manipulations had a systematic effect on our participants' antecedent choices in their continuations. Table 4.6 gives the fixed effects yielded by this analysis.

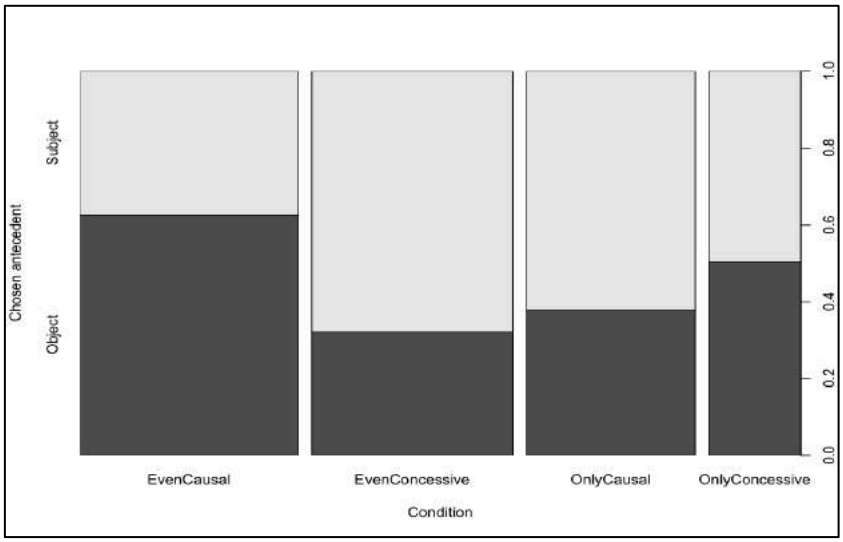
Table 4.6: Fixed effects for Experiment 12

	Estimate	Std. Error	z value	Pr(>|z|)
(Intercept)	-0.7071	0.2857	-2.475	0.0133 *
Even_Concessive	1.7916	0.3219	5.566	2.61e-08 ***
Only_Causal	1.6957	0.2845	5.961	2.50e-09 ***
Only_Concessive	0.5923	0.3512	1.687	0.0917 .

Descriptively, as Figure 4.6 shows, the results of Experiment 12 go in line with the results of previous experiments and with our predictions for this one: in the Causal conditions there was a robust preference for the antecedent that was *outside* the scope of the focus particle *even*, and a clear preference for the antecedent that was *within* the scope of the focus particle *only*. Crucially, however, this pattern is reversed in the Concessive conditions where

we observe that *even* triggered more Subject antecedent choices (that is, the antecedent *within* its scope), and *only* triggered more Object antecedent choices (antecedent *outside* its scope) with respect to the Causal condition. As Table 4.6 shows, however, while this pattern is rather robust with the particle *even* it is less so with *only,* where Subject and Object antecedent choices in the Concessive conditions are only marginally different (see below).

Figure 4.6: Antecedent choices (subject or object) for Experiment 12



A second log-linear mixed-effects model analysis with Focus-sensitive particle and Connective as fixed effects and random intercepts for Participants and Items yielded a significant main effect of Focus-sensitive particle ($\chi^2(1)=7.5291$, $p<.01$), due to the higher number of subject related continuations with *only* (55.85%) than with *even* (52.59%), as well as a significant main effect of Connective ($\chi^2(1)=6.5204$, $p<.05$), driven by the higher number of subject related continuations with *although* (58.67%) than with *because* (49.76%). The interaction between both factors was highly significant ($\chi^2(1)=46.203$, $p<.001$). Additional pairwise comparisons on the Focus-sensitive particle factor for each of the two connectives confirmed the above results with significantly more subject related continuations for the Concessive than for the Causal condition for *even* (β=1.8999, SD=0.3731, z=5.093, $p<.001$) and an inverse effect leading to a marginally significant difference for the *only* conditions (β=-0.6930, SD=0.3760, z=-1.843, $p<.1$). Additionally, the same type of analysis for the Connective factor for each focus particle revealed significantly more subject related continuations for *even* than for *only* in the Concessive condition (β=-1.0626, SD=0.3230, z=-

3.290, p<.01) and significantly more subject related continuations for *only* than for *even* for the Causal conditions (β=1.8487, SD=0.3166, z=5.839, p<.001). We discuss the results of Experiment 12 in light of those of Experiment 13 that investigates whether the findings of Experiment 12 extend to French.

6.2. Experiment 13

6.2.1. Method

Eighteen French native speakers completed the same kind of Sentence Continuation Task (SCT) online via Ibex Farm.

The same 24 experimental items used in Experiments 10 and 11 were used in this experiment. These sentence onsets were also complex sentences that featured two human referents of the opposite sex in the matrix clause and the connective *parce que* 'because' or *bien que* 'although' to mark the beginning of the subordinate clause. The experimental items appeared in 4 different experimental conditions following a 2x2 design with Focus-sensitive particle (*même* 'even' vs. *seul* 'only') and Connective (*parce que* vs. *bien que*) as independent variables, as shown in (4.16).

(4.16) a. **Même_Concessive**: Même Jean a interrompu Marie hier soir bien que...
b. **Même_Causal**: Même Jean a interrompu Marie hier soir parce que...
c. **Seul_Concessive**: Seul Jean a interrompu Marie hier soir bien que...
d. **Seul_Causal**: Seul Jean a interrompu Marie hier soir parce que...

Twenty-four distracters were included in order to draw participants' attention away from the phenomenon under investigation. The distracters, exemplified in (4.17) were the sentences containing a combination of focus-sensitive particles and complex NPs that create a potential ambiguity about the antecedent of the relative pronoun *qui* 'who' and sentences featuring two entities, one of them negated, and the connective *bien que* 'although' or *parce que* 'because'.

(4.17) a. Seul/Meme Pierre court avec le fils du professeur qui…
b. Marie n'a pas préparé un gateau mais une tarte parce que/bien que…

6.2.2. Results

A total of 54% of all the continuations (n=431) contained 3rd person-singular (*il* 'he' or *elle* 'she'*)* pronouns that unambiguously referred to either antecedent and were taken into account for subsequent analyses. These continuations were fairly evenly distributed across conditions (25% Même_Causal, 26% Même_Concessive, 25% Seul_Causal, and 24% Seul_Concessive). Like for all previous experiments, for the statistical analyses, subject antecedent choices were assigned a 1 and object antecedent choices were assigned a 0 for a log-linear mixed-effects model analysis containing a fixed effect of Condition (with 4 levels) and random intercepts for Participants and Items. The statistical comparison between the full and the reduced models yielded a highly significant effect ($\chi^2(3)=18.897$, $p<.001$), which indicates that the experimental manipulations had a systematic effect on our participants' antecedent choices in their continuations. Table 4.7 gives the fixed effects yielded by this analysis.

Table 4.7: Fixed effects for Experiment 13

	Estimate	Std. Error	z value	Pr(>|z|)
(Intercept)	-1.1345	0.4071	-2.787	0.005320 **
Même_Concessive	0.7817	0.4433	1.763	0.077847 .
Seul_Causal	1.7021	0.4456	3.820	0.000133 ***
Seul_Concessive	0.2335	0.4541	0.514	0.607013

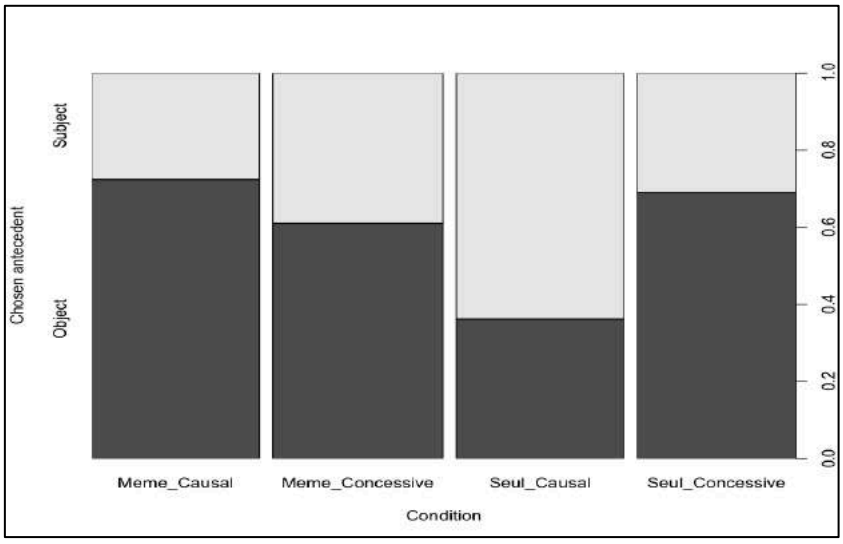
Descriptively, see Figure 4.7, the results of Experiment 13 go in line with the results of the previous experiment in English: in the Causal conditions there was a robust preference for the antecedent that was *outside* the scope of the focus particle *même* (the object), and a clear preference for the antecedent that was *within* the scope of the focus particle *seul* (the subject). Crucially, this pattern is reversed in the Concessive conditions where we observe that *même* triggered more subject antecedent choices (that is, the antecedent *within* its scope) than *only,* which triggered more object antecedent choices (antecedent *outside* its scope) compared to the Causal conditions[4].

A second log-linear mixed-effects model analysis with Focus-sensitive particle and Connective as fixed effects and random intercepts for Participants and Items yielded a

[4] Interestingly, however, contrary to what we observed in Experiment 10 where there was a strong preference for the object antecedent across conditions, this does not seem to be the case in this experiment. This may be a sampling effect. Contrary to earlier studies, the number of participants in this experiment was fairly low. A closer inspection of these between-experiment differences will be left for future work.

significant main effect of Focus-sensitive particle ($\chi^2(1)=4.0721$, $p<.05$), with more subject related continuations with *seul* (47.5%) than with *même* (33.5%), but no main effect of Connective ($\chi^2(1)=1.492$, $p>.05$). The interaction between both factors was highly significant ($\chi^2(1)=13.268$, $p<.001$). Additional pairwise comparisons on the Focus-sensitive particle factor for each of the two connectives yielded a significantly less subject related continuations difference for the Concessive compared to the Causal condition for *seul* (β=-1.5299, SD=0.4502, z=-3.399, $p<.001$) but no significant difference for the *même* conditions (β=0.6663, SD=0.4366, z=1.526, $p>.05$). Additionally, the same type of analysis for the Connective factor for each focus particle revealed significantly more subject related continuations for *seul* than for *même* in the Causal condition (β=1.5650, SD=0.4319, z=3.624, $p<.001$). The difference between the two FSPs in the Concessive condition was not significant (β=-0.5001, SD=0.4634, z=-1.079, $p>.05$). These analyses suggest that the interaction of the semantics of the focus particles, especially *seul,* and that of the connective *because* is what motivated the significant interaction between both factors.

Figure 4.7: Antecedent choices (subject or object) for Experiment 13



6.2.3. Discussion

Summarizing the results of Experiments 12 and 13, in the causal conditions, there was a stronger preference for the antecedent within the scope of *only* (the subject antecedent) and a stronger preference for the antecedent outside the scope of *even* (the object antecedent). This pattern was reversed in the concessive conditions, where there was a stronger preference for

the antecedent within the scope of *even* and for the antecedent outside the scope of *only,* with respect to the causal conditions. These results were similar in English and in French.

The results of Experiments 12 and 13 provide evidence for a strong parallelism between the effects of causal and concessive connectives in pronoun interpretation and constitute evidence in favor of our prediction: in the context of a main clause and a causal adjunct, FSPs create expectations for an explanation about the relationship between the focus entity in the scope of the particle and the set of alternatives related to it that result in the antecedent interpretation patterns observed in these and previous experiments: a preference for an explanation about the antecedent within the scope of *only* with causal connectives, and a preference for an explanation about the antecedent outside the scope of *even,* both motivated by the preference of the connective *because.*

Crucially, the results of Experiments 12 and 13 show that, and in line with the proposal that the concessive "q although p" implies the causal "~q because p" (König, 1991; König & Siemud, 2000), when the causal connective *because* is replaced by the concessive connective *although,* the pattern of antecedent preferences is reversed: we found more continuations for the antecedent outside the scope of *only,* and for the antecedent within the scope of *even* than for causals. These results constitute, in turn, empirical evidence for proposals that defend a close connection between causality and concessivity (e.g. König, 1991).

7. General discussion and conclusions

We begin with a brief summary of the results obtained in the experiments presented in Chapter 4. Experiment 7 investigated how the FSPs *even* and *only* in combination with the causal connective *because* affect participants' antecedent choices (subject or object) in their continuations. The results showed a general preference for the antecedent *outside* the scope of *even* regardless of its syntactic function, and a general preference for the antecedent *within* the scope of *only* regardless of its syntactic function.

Experiment 8 tested the possibility that placing the FSPs in a post-verbal position (instead of the pre-verbal position) to mark the object antecedent as the focus might have affected the results of Experiment 7. The results of the acceptability judgment task showed that *even* and *only* are generally preferred in pre-verbal position over post-verbal object-adjoining position. However, the results also attested differences between the two particles, with *even* being rated significantly less acceptable in this position than *only*. Given that the post-verbal object-adjoining position is not systematically rejected by our participants (3.5 on

a 7-point scale for *even*), we concluded that the choice of this position for our experimental materials probably did not have bearings on our results that would challenge our claims.

Experiments 9 and 10 investigated whether the differences observed between the results of Experiment 7 and those of Experiments 5 and 6 were due to the different types of adjuncts in the experimental items (temporal vs. causal) and or to the fact that we employed two different methodologies (Sentence-interpretation task, SIT vs. Sentence-continuation task, SCT). The results of Experiments 9 and 10 replicated previous results showing a general preference for the antecedent outside the scope of *even* and *only* after the temporal connective *when,* and a preference for the antecedent outside the scope of *even* and within the scope of *only* after the causal connective *because.* These results confirmed that the different interpretation patterns observed in previous experiments for the two types of subordinate adjuncts manipulated are not due to methodological limitations.

Experiment 11 tested whether the resolution pattern elicited for the FSP *only* with causal adjuncts would also arise with *it-clefts,* as both constructions share an exhaustiveness implicature. The results of this experiment evidenced a general dispreference for clefted antecedents in the temporal conditions, and a general preference for clefted antecedents in the causal conditions, regardless of the syntactic function of the antecedent in all cases. These results confirmed the strong parallelism between cleft constructions and the exclusive FSP *only*.

Finally, Experiments 12 and 13 investigated how the observed effects of FSPs in pronoun resolution change when the causal connective *because* is replaced by the concessive connective *although.* In particular, based on the proposal that the concessive "q although p" implies the causal "~q because p" we predicted that the pattern of preferences elicited with causal would be reversed with concessive. In line with this prediction, the results of these experiments showed a general preference for the antecedent within the scope of *only* and for the antecedent outside the scope of *even* in the causal conditions, and a significantly stronger preference for the antecedent within the scope of *even* and for the antecedent outside the scope of *only* in the concessive conditions.

Crucially, the close comparison between English and French has yielded strong evidence for the cross-linguistic validity of these findings in these two languages.

Discourse Units and pronoun resolution

The experiments in Chapter 4 were conducted to further test the validity of our proposal of the new framework of analysis of pronoun resolution that we spelled out in Chapter 2. Recall that we claimed that the notion of Discourse Unit (DU) can provide a better explanation for the patterns observed in inter- and intra-sentential pronoun resolution. Based on Johnston's (1994) analysis of relational and non-relational adverbial adjuncts, we proposed that the specific syntactic and semantic characteristics of certain types of subordinate clauses play a role in the establishment of DUs.

We proposed that complex sentences consisting of a matrix clause and a clause-modifying (causal and temporal) adverbial adjunct could consist of one or multiple DUs. In particular, we claimed that temporal subordinate clauses (introduced by connectives *when, before, after*) are processed as part of the same DU as the matrix clause, whereas causal subordinate clauses (introduced by connective *because*) are processed as an independent DU from the matrix clause, and that this difference has direct consequences for pronoun resolution. We proposed that pronoun resolution searches a maximum of discourse coherence: pronoun interpretation preferences will come about in the process of *establishing* or *maintaining* coherence. When the matrix and the subordinate clause are processed as a single DU, as it is the case of non-relational temporal adjuncts, coherence has already been established between both clauses, and the tendency will be to *maintain* it. This tendency can manifest itself, for example, with a preference for topic or topic-like entities in the preceding (matrix) clause. In those contexts where the matrix clause and the subordinate clause constitute two separate DUs, as it is the case of relational causal adverbial clause, we predict that resolution preferences will come about in the process of *establishing* coherence between units, which will be achieved through the semantics/pragmatics of certain elements in the utterance.

The experiments presented in Chapter 3 tested the role of information status (marked by means of HTLD, *it-clefts,* and focus-sensitive particles) in pronoun resolution in the context of complex structures consisting of a matrix and temporal subordinate clause. The results of this series of experiments constitute solid evidence in favor of the aforementioned prediction for pronoun resolution within a single DU. The experiments in Chapter 4, in turn, were conceived to test the following predictions:

(i) Causal adjuncts are processed as a separate DU from the matrix clause and, in the context of two DUs, pronoun interpretation will occur within the process of *establishing coherence* through the semantic/pragmatic content of certain elements in the utterance (in our experiments the focus-sensitive particles *even* and *only,* and the causal connective *because*).

(ii) The FSPs *even* and *only* in combination with the connective *because* behave like IC verbs in that they create expectations for specific explanations to avoid leaving missing causal content unspecified. These expectations will vary as a function of the semantic/pragmatic characteristics of *even* and *only*.

The results of the series of experiments presented in this chapter are evidence in favor of these two predictions. Using FSPs as a test-case, we observe that these particles do not exert the same effects when pronoun resolution occurs in the context of one DU, as the experiments in Chapter 3 show for temporal clauses, as in the context of two DUs, as the experiments in Chapter 4 show for causal clauses. Specifically, while the general interpretation pattern observed in Chapter 3 was a dispreference for antecedents within the scope of both *even* and *only,* in Chapter 4 we see that these two particles do not behave the same way and that antecedent-interpretation preferences depend on the specific semantic and pragmatic content of each particle.

The results of the experiments in Chapter 4 suggest that, across two DUs, FSPs create expectations for an explanation about the relationship between the focus entity in the scope of the particle and the set of alternatives related to it: the exclusive particle *only* creates an expectation for an explanation for the *exhaustiveness* of its associate in relation with its alternatives within the described event; the scalar particle *even* creates an expectation for an explanation for the *unlikeliness* of its associate in relation with its alternatives within the described event, which, in turn, results in an expectation for a negative explanation (i.e. a concessive: *Even Peter went to the party although he was sick*). Just like it was previously observed with Implicit Causality verbs, these expectations for certain explanations result in the preferences for continuations about one of the two referents available in the immediately preceding context observed in the present study, as shown in the examples in (4.18).

(4.18) a. Even John interrupted Mary last night because… [SHE]
b. Only John interrupted Mary last night because… [HE]

Crucially, the results of the additional experiments further corroborated our claims. First, these results showed that the effects described above are not exclusive to focus particles and that the semantic/pragmatic content of other structures can also have similar effects in pronoun resolution. It was shown, for example, that *it-clefts* exert a very similar effect to that of the exclusive particle *only* as a function of the DU configuration of the sentence. Second, our results showed that concessive clauses introduced by the connective *although* are also processed as a separate DU from the matrix clause, and like with causal clauses, pronoun interpretation preferences happen in the process of establishing coherence between the units through the semantic and pragmatic content of particles and that of the connective. Specifically, we observed that when the connective *because* is replaced by the connective *although* the observed antecedent preference pattern is reversed, as shown in the examples (4.19). This finding is in line with proposals that defend a close connection between causality and concessivity, where the concessive "q although p" implies the same counterfactual as the entailed by the causal "~q because p" (König, 1991; König & Siemud, 2000). Third, the close comparison between English and French that we have performed in Chapter 4 shows that, while this pattern of results holds cross-linguistically, at least in these two languages, the general object-antecedent preference elicited in French suggests that language-specific factors are also at stake affecting resolution preferences.

(4.19) a. Even John interrupted Mary last night although… [HE]
b. Only John interrupted Mary last night although… [SHE]

In conclusion, these experiments have corroborated our proposal of a new framework of analysis based on the notion of DUs and that there are major differences in pronoun resolution inter- and intra-unit. In particular, it has been shown that the factors and strategies that affect pronoun interpretation do not exert the same effects when resolution occurs within a DU as when it occurs across two DUs. In Chapter 4 we have seen that, across two DUs, interpretation seems to be guided by the semantic and pragmatic content of certain elements of the utterance and the kind of expectations they create for the upcoming discourse in the process of establishing coherence. This finding goes in line with previous proposals on the role of Implicit Causality verbs in pronoun resolution (e.g. Bott & Solstad, 2014; Kehler et al., 2008). The information status of the antecedent, which was a key factor in pronoun interpretation within a DU as evidenced by the results in Chapter 3, does not seem to be a relevant factor in the context of two DUs. These results stress the importance of not only

identifying the factors that affect resolution but, crucially, the contextual circumstances where they exert their effects to a bigger extent.

One question remains unanswered. The results of all the experiments presented in Chapters 3 and 4 reflect final interpretation choices. These data, however, do not tell us much about whether the same syntactic, semantic, and pragmatic constraints that guided our participants' conscious final interpretation choices arise during incremental (online) language processing and, if so, what their time-course of integration is. In order to provide an answer to this question, in Chapter 5 we try to replicate Experiments 12 and 13 using a psycholinguistic technique that lends itself extremely useful in the study of moment-to-moment pronoun interpretation preferences: the Visual-World Paradigm in eye-tracking.

Chapter 5

The time-course of pronoun resolution:
Evidence from eye-movements

Introduction

The results of the experiments presented in Chapter 4 constitute solid evidence in favor of the predictions of our account: when a matrix and a subordinate clause are processed as two separate DUs, pronoun antecedent choices are guided by the semantic and pragmatic characteristics of certain elements in the utterance. In the case of our experimental stimuli, we hypothesized that antecedent choices would be guided by the interaction of the semantic/pragmatic content of the focus-sensitive particles *even* and *only* and that of the connective *because.* We argued that these effects are comparable to those of IC verbs and can also be explained following Bott and Solstad (2014): if there is causal content that can be specified by an explanation in the form of a *because*-clause or an independent sentence, then providing this explanation should be the default strategy in language processing. Otherwise, interpreters are forced to accommodate the missing information, a cognitively taxing operation that is dispreferred. We hypothesized that the particle *only* triggers an expectation for an explanation about the exhaustiveness of its associate in relation with its alternatives within the described event. This expectation should result in a general preference for the antecedent *within* the scope of *only.* This finding was also attested with *it-clefts.* The particle *even,* on the other hand, triggers an expectation for an explanation for the unlikeliness of its associate in relation with its alternatives within the described event. In this case, this expectation would be for a negative explanation (i.e. a concessive), which should result in a general preference for the antecedent *outside* the scope of *even* with the connective *because.* The results of our experiments confirmed these predictions. Moreover, our results also confirmed our prediction that the reverse pattern of results should arise when the causal connective *because* was replaced by the concessive connective *although.* Finally, our results showed that these findings were not due to the use of a different methodology to that employed in the experiments presented in Chapter 3, and, crucially, that the observed interpretation patterns hold cross-linguistically in English and in French.

All the results discussed so far in Chapters 3 and 4 constitute final interpretation preferences. The questions that remain unanswered are (i) will the same semantic and pragmatic constraints that guided our participants' final interpretation choices offline arise during online language processing? and (ii) if so, what is their time-course of integration? In order to provide an answer to the questions above, in Chapter 5 we try to replicate Experiments 11 and 12 using a psycholinguistic technique that lends itself extremely useful in the study of moment-to-moment pronoun interpretation preferences: the Visual-World

Paradigm. We begin by providing a brief description of this methodology, followed by Experiment 14.

1. Methodology: The Visual World Paradigm

In our daily lives, we look at target objects when we are asked to perform some kind of action, like touch them or move them, but also when no overt action is required. We do this most likely because we relate a given spoken utterance to the visual input as the information we get from both sources is usually complementary and, therefore, it is useful to process them together (Huettig et al., 2011). The pattern and time-course of eye movements from object to object, what is referred to as *saccades,* and the resulting fixations, are one of the most widely used response measures in cognitive sciences. This is so because eye movements represent a sensitive measure of language processing in which the response is closely time-locked to the input (Tanenhaus & Trueswell, 2006).

A popular technique that makes use of eye movements in the investigation of spoken language processing is the so-called Visual World paradigm (VWP). The VWP is a cross-modal experimental technique in which participants are exposed to spoken utterances while presented with some kind of visual stimulus (Tanenhaus et al., 1995). This technique provides, therefore, information about the way language users integrate linguistic information with information derived from the visual environment. A VWP experiment follows a basic setup: on each trial, participants listen to utterances while they look at a visual stimulus (the experimental display). The visual stimuli generally include objects that are mentioned in the spoken utterance and others that are not mentioned (the distractors). The spoken utterance can be instructions that the participants have to follow or simple descriptions or comments on the experimental display. The participant's eye movements (saccade latencies, fixation probabilities) are recorded for subsequent analyses with infrared cameras typically situated in a head-mounted helmet or in a remote device next to the screen where the visual stimuli are displayed. For the most part, a VWP experiment does not require participants to perform any meta-linguistic judgments. It, thus, relies on the participant's tendency to look at relevant parts of the display as they are mentioned (Duchowski, 2007; Huettig et al., 2011; Sekerina, 2012).

The successful application of the VWP to the study of spoken language processing is based on a linking hypothesis specified as the *Mind-Eye hypothesis*. Trueswell (2008) summarizes this hypothesis in three basic assumptions:

- The eye position indicates the participant's current attentional state, and attention is driven by properties of the world and by the goals of the participant.
- In tasks requiring the linking of speech to a visual referent world, visual attention can be used as an indication of referential decision.
- Referential decisions can in turn be used by researchers to infer the participants' parsing decisions, insofar as these parsing decisions were necessary to determine the referent (adapted from Trueswell, 2008: 81)

The use of eye movements as a tool for studying spoken language comprehension goes back to 1974 when Roger Cooper recorded participant's eye movements as they listened to stories while looking at a display of pictures. Cooper found that participants initiated saccades to pictures that were named in the stories, as well associated to words in the story and that these eye movements were closely time-locked to the point where the object was mentioned in the utterances. However, it was from 1995 and the publication of a study by Tanenhaus, Spivey-Knowlton, Eberhard, and Sedivy that the recent wave of VWP studies, taking advantage of new lightweight head-mounted eye-trackers, started. In their seminal paper, Tanenhaus et al. examined eye movements as participants followed instructions to perform simple tasks with objects in a workspace. Participants were given instructions that contained a temporal ambiguity, like the sentence *Put the apple on the towel into the box*, where the phrase *on the towel* can be interpreted as the final destination of *the apple* or as its modifier (*The apple that is on the towel*). As the sentence is uttered out of context, a destination interpretation is usually preferred leading to a garden-path effect and reanalysis when participants hear the PP *into the box.* Participants were presented with two visual contexts: one that contained an apple on a towel, an empty towel, a box, and a pencil (distractor); the second context contained two apples, one on a towel and one on a napkin, an empty towel, and a box. The first context, which contained just one apple, was consistent with the destination interpretation, whereas the second context, which contained two apples, was consistent with the modifier interpretation. Tanenhaus and colleagues found that upon hearing the ambiguous PP *on the towel* in the first context, participants looked more often at the empty towel (misinterpreting the PP as the destination). In the second context, the PP elicited more looks to the towel with the apple on it (interpreting the phrase as a modifier, and eliminating the need for reanalysis). Tanenhaus and colleagues took these results as evidence

that eye movements can actually reflect online processing of spoken language, and in particular, that visual context mediates syntactic ambiguity resolution; that is, the online syntactic processing of the spoken input is immediately affected by referentially relevant information in the visual input.

The advantages of using the VWP are numerous. First, the VWP allows for the study of spoken language processing with real-time precision by means of a highly ecologically valid task that does not require interrupting the natural speech stream or forcing the participant to make metalinguistic decisions (Tanenhaus & Spivey-Knowlton, 1996). Second, the VWP allows for the study of the role of the real-world visual context, which constitutes a rich source of information for language comprehension, in spoken language processing. Third, the same response measure can be used to study a wide range of different phenomena, ranging from word recognition to higher-level language processing. Research in all these areas has shown, for example, that eye movements to a target object are affected by the presence of competitors with the same initial phonemes (e.g. Allopenna et al., 1998); that reference is established incrementally shortly after sufficient information to disambiguate a referent from an alternative set is available (Cooper, 1974; Eberhard et al., 1995; Tanenhaus et al., 1995); or that language processing is highly predictive and relies to a great extent on top-down expectations about ensuing information (e.g. Altmann & Kamide, 1999).

Moreover, the use of the VWP technique has been of invaluable help in theoretical debates on language processing. A key controversy in the study of language, for example, is how and when language users integrate different types of information. There are two contrasting theoretical views on this topic: structural (or two-stage) accounts and interactive accounts. According to structural accounts, the listener's initial parsing of a sentence is based exclusively on syntactic information and other types of information have an influence only at a later stage (Frazier, 1979, 1987). According to the interactive theories (e.g. Tyler & Marslen-Wilson, 1977), non-syntactic information can influence sentence processing immediately. The currently most influential type of interactive models are constraint-based theories (MacDonald et al., 1994; Trueswell et al., 1994).

Of special interest for the present study is research on pronoun resolution that has employed the VWP to shed some light on the abovementioned theoretical debate. The VWP lends itself particularly useful in this endeavor because looks to potential referents, especially when combined with an offline decision, provide a very complete picture of the potential antecedents that are considered, the referent that is eventually selected, the factors have played a role in this process, and, crucially, the time-course of all these processes. For

example, studies that investigate the interpretation of different types of referring forms, like pronouns, demonstratives, and reflexives (e.g. Arnold, 2001; Arnold et al., 2000; Clackson et al., 2011; Kaiser & Trueswell, 2008; Kaiser et al., 2009; Runner et al., 2003) have shown that, in line with the interactive accounts on language processing, reference resolution is sensitive to multiple constraints (e.g. information structure, syntactic role, word order), whose impact differs across anaphoric forms (e.g. Kaiser et al., 2009) found that resolution of pronouns was influenced more by semantic (and less by syntactic) information than the interpretation of reflexives). These studies are evidence of a complex interaction of syntactic and semantic factors during reference resolution.

2. Experiment 14

2.1. Method

The goal of Experiment 14 was to test whether the factors that we have argued to underlie our participants' interpretations for ambiguous pronouns in previous experiments would also have an effect during online sentence processing, and, if so, investigate their time-course. For that, we made use of a Visual World Paradigm experiment, which enabled us to shed light on our participants' interpretation preferences at different points along the construction of the mental representation of a spoken utterance in relation to a visual display. However, as early preferences for a given referent might not always be the final interpretation of a pronoun, in addition to the eye movements, we also recorded participants' offline antecedent choices at the end of the spoken utterance. It could be argued that asking participants for explicit interpretation choices for an ambiguous pronoun may induce metalinguistic strategies on the participants' part. However, studies that have directly compared the effects of including versus not including explicit interpretation choices have shown an immediate and automatic pronoun resolution process in both experimental settings (e.g., Arnold et al., 2000), confirming that even without explicit questions, the pronoun is fully and automatically interpreted (Colonna et al., 2015).

Although this experimental paradigm combining online and offline data collection has often been used before, especially in the pronoun resolution tradition, we ran into a major technical difficulty in the design of our experiment. As the results of the previous experiments have shown, the combination of certain linguistic elements in an utterance (in our case, focus-sensitive particles and connectives) can create strong expectations about the upcoming discourse. This means that constructing natural-sounding completely ambiguous subordinate

clauses containing a pronoun that could refer to either antecedent in the preceding matrix clause turned out to be an extremely difficult endeavor. One possible solution to this problem would have been to use sentences that were disambiguated by syntactic or semantic information in the subordinate clause, a solution that would still allow us to get eye-movement data of how preferences change over time up to the point of disambiguation but would not allow us to get data about participants' final interpretation choices, as the sentences would no longer be globally ambiguous.

In order to overcome this setback, we decided to combine the VWP eye-tracking experiment with the kind of offline task that we employed in the previous experiments, namely Sentence-continuation and Sentence-interpretation tasks: participants had to listen to sentence onsets about some characters that were presented on the screen, then they had to complete these onsets orally to form a complete sentence, and, finally, they had to click on the character that their continuation was about. Participants' eye movements were recorded all along. The advantage of asking participants to provide a continuation to the sentence onset was that it enabled us to employ items that were comparable up to the ambiguous pronoun without having to worry about the content of the subordinate clause bringing about any kind of bias for either antecedent. A more detailed explanation of the experimental setting and items is given below.

2.2. Participants

A total of 60 native speakers of French (40 female; mean age 23.5, range 19-59) participated in this experiment. One participant was excluded from subsequent analyses due to the fact that her fixations fell for the most part outside the four interest areas.

Eye movement recording was done of the participant's dominant eye only, which was determined by means of a Miles test (Miles, 1930). Participants were recruited at the Université Paris 3 and through the CNRS RISC cognitive science research forum (http://www.risc.cnrs.fr). The completion of the experiment, which included a linguistic background questionnaire and a working memory span test, took from 45 minutes to 1 hour. Participants were paid 10 euros in exchange for their participation. A table summarizing participants' age, sex, recorded eye, and memory test score is given in Appendix B.

2.3. Materials

Thirty-six sentence onsets were used as experimental items, 25 of which were taken from Experiments 9, 10, and 13 on French, the remaining 11 items were created following the same

constraints. The sentence onsets were complex sentences that contained two referents of the same gender (proper names), one in the subject position, the other one in the direct object position. Half of the items featured masculine referents, the other half contained feminine referents. The subject antecedent could be preceded by the focus-sensitive particles *même* 'even' or *seul* 'only'. Verbs in the main clause were always transitive verbs in the active form. These verbs were carefully chosen in order to avoid any previously attested Implicit Causality biases (Bott & Solstad, 2014; Ferstl et al., 2011; Goikoetxea et al., 2008).

The matrix clause was followed by a subordinate clause introduced by the connectives *parce que* 'because' or *bien que* 'although'. Contrary to the SCTs in the previous experiments, in Experiment 14 we included some extra information after the connective, namely a 3rd person singular pronoun (*il* 'he' or *elle* 'she'), which could refer to either antecedent in the matrix clause, and the phrase *a/ait l'habitude de*[1] 'has the habit of'. This extra material was included in order to make sure (i) that there was always a pronoun included in the participants' continuations, and (ii) that there was a sufficiently long time-window following the pronoun with comparable material, in terms of length as well as lexical content, on which to perform subsequent data analyses. The choice of the phrase *avoir l'habitude de* itself was motivated by the fact that it constitutes an individual-level predicate, which we considered unbiased toward any of the antecedents in the matrix clause.

The thirty-six items could appear in six experimental conditions following a 3x2 design with Focus particle (Baseline*Même*Seul) and Connective (parce que*bien que) as independent variables, as the examples in (5.1) illustrate.

(5.1) a. **Baseline_Caus**: Jean a interrompu Pierre hier parce qu'il a l'habitude de
b. **Baseline_Conce**: Jean a interrompu Pierre hier bien qu'il ait l'habitude de
c. **Même_Caus**: Même Jean a interrompu Pierre hier parce qu'il a l'habitude de
d. **Même_Conce**: Même Jean a interrompu Pierre hier bien qu'il ait l'habitude de
e. **Seul_Caus**: Seul Jean a interrompu Pierre hier parce qu'il a l'habitude de
f. **Seul_Conce**: Seul Jean a interrompu Pierre hier bien qu'il ait l'habitude de
'(Even/Only) Jean interrupted Pierre yesterday because/although he has the habit of'

[1] The version in the indicative mood (*a l'habitude de*) followed the connective *parce que;* the connective *bien que* requires the following verb to be in the subjunctive mood, hence it was followed by the *ait l'habitude de* version.

In addition to the experimental items, 54 filler items were included in order to draw participants' attention away from the phenomenon under investigation. Half of the filler items were sentences consisting of two human referents (proper name or profession) followed by a relative clause that was unambiguously attached to the second referent. The relative clause could be introduced by the relative pronoun *qui* 'who' or by the phrase *qui a l'habitude de* 'who has the habit of', as in (5.2a). The other half of the filler items were sentences consisting of a matrix clause containing a human referent (proper name or profession) in relation with a negated event that featured two objects of the same grammatical gender. The matrix clause was followed by the subordinating connectives *parce que* 'because' and *bien que* 'although' and a 3rd person singular pronoun that could ambiguously refer to either object in the matrix clause, as in (5.2b).

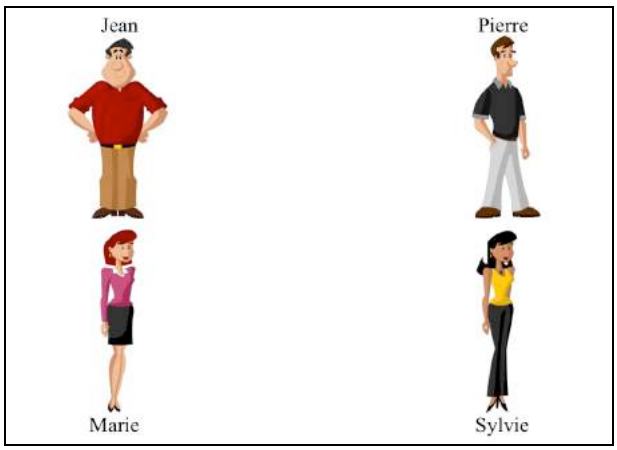
(5.2) a. Même Patrick fait la fête avec le pompier qui/qui a l'habitude de
'Even Patrick parties with the fireman who/who has the habit of'
b. Jean n'a pas fait une pizza mais une tarte ce matin parce/bien qu'elle
'Jean didn't prepare a pizza but a cake this morning because/although it'

The accompanying visual display for the critical items contained four cartoon characters, two masculine and two feminine, situated on the corners of the screen at the same distance from a center point, as Figure 5.1 shows. All cartoon characters were Clipart images freely available on the Internet (http://www.cliparts.co). Each critical sentence was preceded by an introductory sentence that presented the four characters (*Voici Jean, Pierre, Marie, et Sylvie* 'This is Jean, Pierre, Marie, and Sylvie'). In order to avoid potential problems with reference assignment due to memory limitations, the names of the characters were visible next to the cartoon image. The position of the two referents on the screen, and thus, in the presentation sentence (characters were always named starting by the one on top left-hand side corner and clockwise), was balanced across items so that they could appear in all four positions. Six presentation lists were created such that each item appeared in a different condition across lists, but only once in each list. Participants were first presented with four practice items followed by one of the eight lists. Items were randomized individually.

All items were previously recorded by a female French native speaker who was unaware of the phenomenon under investigation. She was instructed to read the sentence onsets normally. In order to avoid unnatural prosodic patterns due to the fact that the sentences were incomplete, the informant added the verb *chanter* 'to sing' after the *avoir*

l'habitude de phrase. The recordings were subsequently spliced out on Praat and the final verb removed. The resulting audio files of the critical sentences were then double-checked to control for prosodic anomalies. Although we made sure that the pitch accent after the focus particles always fell on its associate (i.e. the subject antecedent), the fact that the particles only appeared before the subject antecedent would prevent any potential scope ambiguities.

Figure 5.1: Sample visual display employed in Experiment 14



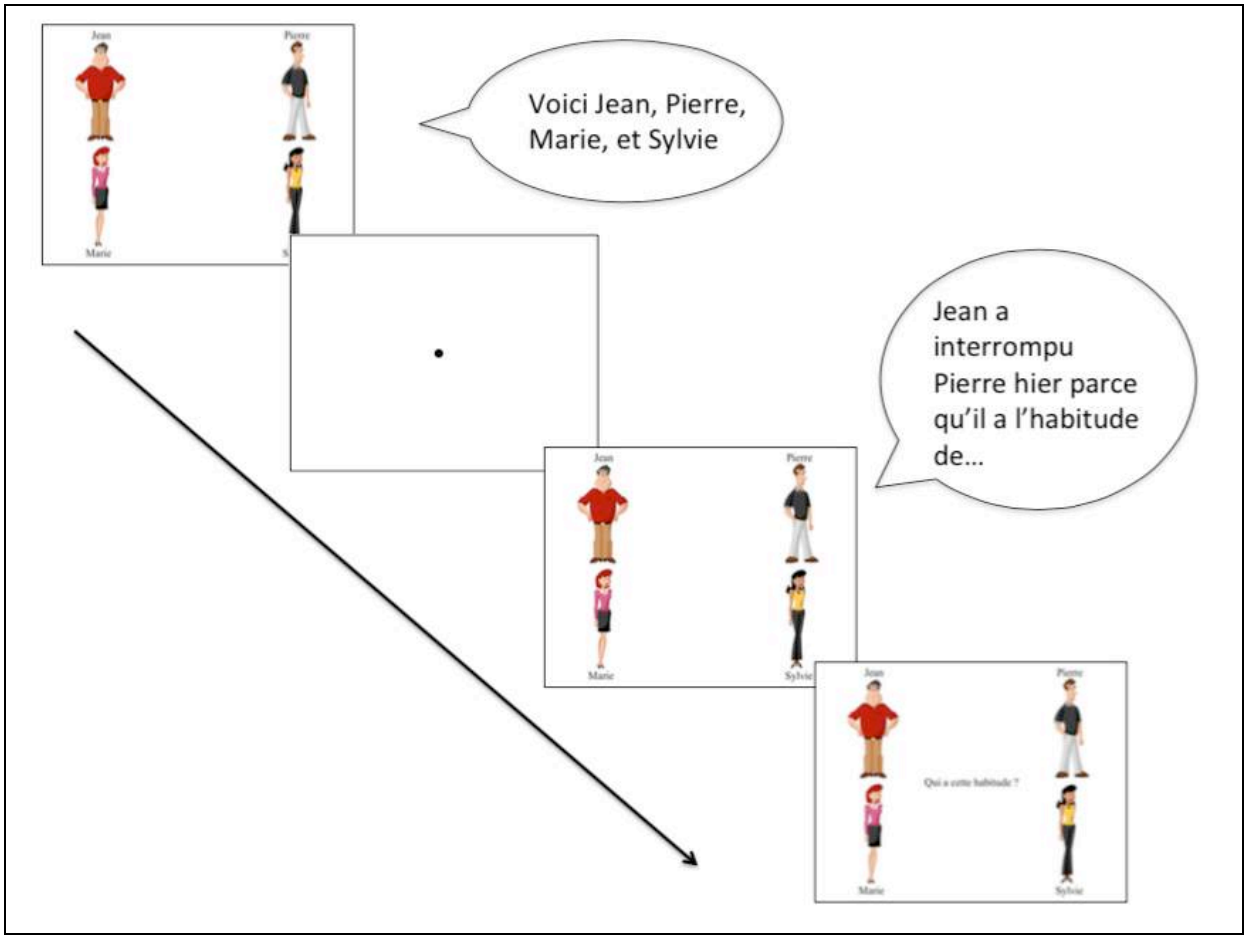
2.4. Apparatus and procedure

Participants were seated comfortably in front of a 17-inch computer screen inside a sound-attenuated experimental booth. Their eye movements were monitored with a SR research Eyelink II head-mounted eye-tracker. The visual and auditory stimuli were presented on a PC running Experiment Builder (SR Research). Participants were calibrated using Eyelink's 9-point calibration and validation procedure and, after reading the instructions, they completed four practice items.

The experiment unfolded as follows (Figure 5.2): the visual display with the four characters appeared at the same time as the presentation sentence. The display then disappeared and a central fixation target (a black dot) appeared to control eye position at the start of each trial. Participants could only move forward if they fixated this point and pressed the space bar at the same time. The display with the four characters reappeared and participants heard a sentence onset (eye-movements started to be recorded at this point). After hearing the sentence onset, they had to complete the sentence with a made-up continuation orally in order to form a natural-sounding complete sentence. Continuations were recorded with a microphone. Once they had provided their continuation they pressed the space bar and a sentence asking who/what their continuation was about (*Qui a cette habitude?* 'Who has

that habit?' in the case of the critical items) appeared in the center of the screen. In order to answer the question, participants had to click on one of the four characters. Eye movements from the onset of the sentence to the end of the participants' continuations, as well as the continuation themselves and the referent choices, were recorded. Only the eye-movements and the referent choices were subsequently analyzed (the content of continuations was irrelevant for the purposes of the current study). Participants could take a break after having completed half of the trials (n=45). If they took a break, calibration and validation was performed a second time before resuming the experiment. Once the eye-tracking experiment was completed, participants completed a language background questionnaire and a Reading-span test for working-memory capacity (based on the French adaptation of the Reading-span test by Desmette et al., 1995, the complete materials employed in this test can be found in Appendix C).

Figure 5.2: Experimental setting employed in Experiment 14



2.5. Results

2.5.1. Eye movements

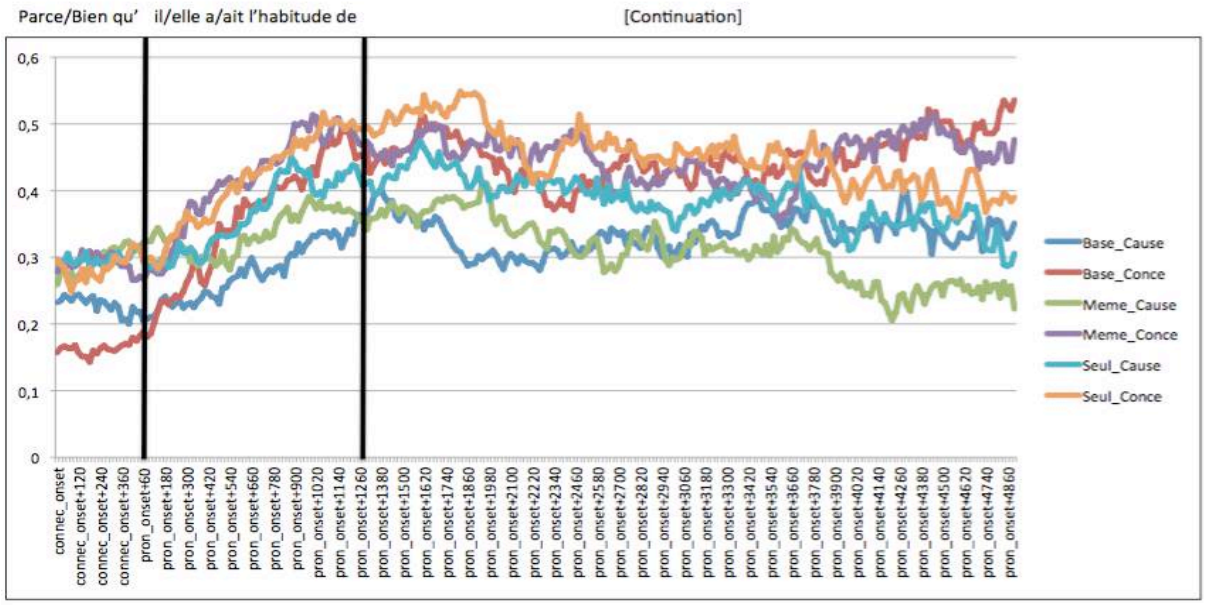
We calculated the probability of fixation (in %) on either of the three picture elements (the two distractor images were combined) by time steps of 20ms starting from 400ms before the onset of the pronoun (which constitutes the region of the connectives *parce que/bien que*) and ending 4900ms after (which was on average the total length of the critical sentence including the continuation provided across items and across participants).

Figure 5.3 shows the overall pattern of probabilities of fixations to the subject antecedent across all time windows (the vertical lines reflect the three main regions – connective, pronoun+*l'habitude de,* and continuation –that we will also use for the statistical analyses). The first observation to be made is that fixations to the subject antecedent increase gradually from the onset of the connective to the onset of the continuation. Moreover, in the connective region, there are more fixations to the subject antecedent in the focus particle conditions than in the two baseline conditions, and within the two baseline conditions, there are more looks to the subject antecedent in the causal than in the concessive conditions. In the pronoun region, we observe that participants look at the subject antecedent more often in the concessive conditions than in the causal conditions. Finally, in the continuation region, we observe a more intricate pattern of fixations starting from the middle of the region. Below, we analyze these results in more detail region by region. As a way of comparison, in Appendix D, we include the pattern of fixations to the two distractor images combined.

For statistical analyses, we aggregated the 20ms time segments into time windows of 200ms until 2500ms into the continuation (from the pronoun onset) and of 400ms from that point until 4900ms. Therefore, the pre-critical region (the connective region) was 400ms long, the critical region (pronoun + *a l'habitude de*) was 1200ms long, and the post-critical region (the continuation region) was 3700ms long. From these aggregated data, we calculated logodds using the natural logarithm: LN((P(SUBJ)+0.5)/(P(OBJ)+P(DIS)+0.5)) with P(SUBJ) = probability of fixations to subject antecedent, P(OBJ) = probability of fixations to object antecedent, and P(DIS) = probability of fixations to the two distractor images. We added 0.5 to the probabilities to avoid zero values (see Barr et al., 2011). Figures 5.4, 5.5, and 5.6 below present the detailed time course of fixations to the subject antecedent calculated this way for the connective region, for the pronoun+habitude de region, and for the

continuation region. Higher logodds mean more looks to the subject antecedent, while lower logodds mean more looks to the object antecedent or the two distractors[2].

Figure 5.3: Probabilities of fixations to subject antecedent



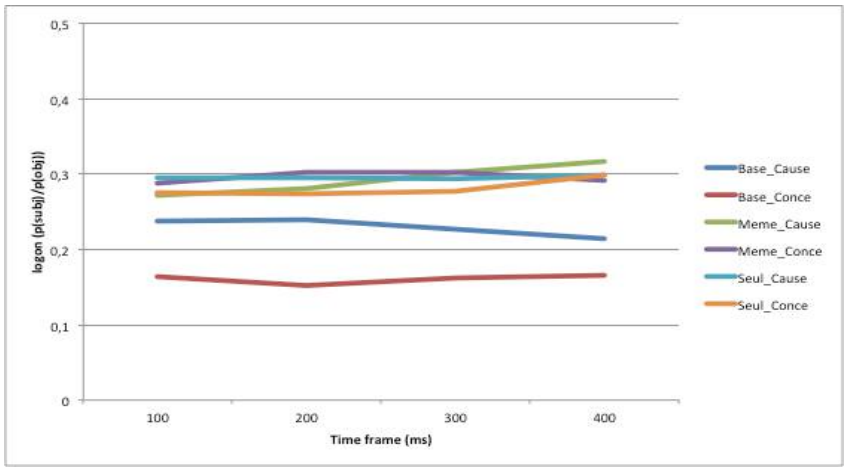
All linear mixed-effects models were fit using the *lmer* function of the R package *lme4* (Bates, Maechler, & Bolker, 2011). Participants and items were treated as a crossed-random effect in order to accommodate by-subject and by-item variation in one model (Baayen, 2008; Barr, 2008; Jaeger, 2008). Focus particle (Baseline vs. *Même* vs. *Seul*) and Connective (*parce que* vs. *bien que*) were treated as fixed-effect factors. All effects were confirmed by model comparisons using likelihood radio tests.

Analyses on Pre-critical region (connective)

We ran statistical analyses on two 200ms long time windows from the connective onset to the pronoun onset. Fixed effects for the models as well as model estimates with standard errors and t-values are given in Appendix E. In all analyses of the eye-tracking data, we used sum coding for the contrasts. Estimates of the experimental factors correspond to deviations from the general mean in this analysis as in all following analyses.

[2] As Figures 5.4-5.6 show, looks to the subject antecedent are for the most part below 50%, which means that participants fixated the object antecedent (less so the two distractors, cf. Appendix D) more often across conditions and across regions. This tendency is not surprising given the aural nature of the experiment, as participants tend to look more at what they heard last. It is the variation within this general pattern what is interesting for the purposes of our study.

Figure 5.4: Log-odds on probabilities of fixations to Subject antecedent across conditions on Pre-critical region (Connective onset – 400ms)



For clarity purposes, Tables 5.1, 5.2, and 5.4 only show degrees of freedom, chi-square and p-values obtained from the model comparisons using likelihood ration tests on the data sets. As Table 5.1 indicates, the analyses on the Pre-critical region, which corresponds to the connectives *parce que* and *bien que,* yielded highly significant differences between the full model (including the fixed factors Connective, Focus particle, and their interaction) and the maximally reduced model (including only the random factors for items and participants), indicating that the experimental manipulations had an effect on participants' fixation patterns. This comparison was run for all regions in this experiment.

Table 5.1: Model comparisons (chi-square and p-values) for the Connective region

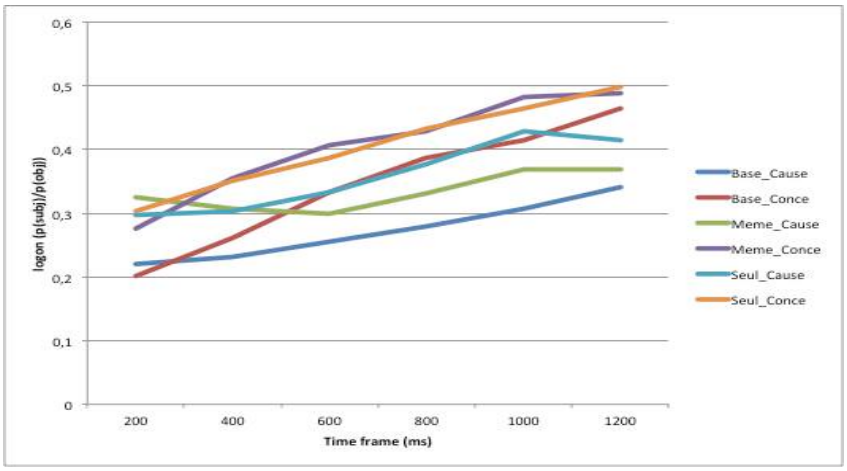
Region		Full vs. reduced models (Df: 5)	Focus particle (Df: 2)	Connective (Df: 1)	Interaction (Df: 2)
Connective	200ms	25.314 **(p<.001)**	20.819 **(p<.001)**	1.3871 (p>.05)	3.034 (p>.05)
	400ms	26.999 **(p<.001)**	25.662 **(p<.001)**	0.6014 (p>.05)	0.6541 (p>.05)

Moreover, the analyses on the connective region revealed highly significant main effects of Focus particle but no significant main effect of Connective. Participants looked significantly more often to the subject antecedent when it was in the scope of a focus particle than when it was not (200ms: baseline vs. *même* t=3.932, baseline vs. *seul* t=3.965; 400ms: baseline vs. *même* t=4.59, baseline vs. *seul* t=4.152). The interaction between both factors was

not significant either. Given that the interaction between the two experimental factors did not come out significant, we did not run any further subset analyses of these data.

Analyses on the Critical region (Pronoun+habitude de)

Figure 5.5: Log-odds on probabilities of fixations to Subject antecedent across conditions on Critical region (Pronoun onset – 1200ms)



For the Critical region, we ran statistical analyses on six 200ms long time windows from the pronoun onset to the end of the *a/ait l'habitude de* phrase (which corresponds to the beginning of the oral continuation). Given the short duration of pronouns and the 150-200ms required to program and launch a saccade (Matin et al., 1993), 200ms is the earliest point where we would expect to see signal-driven fixations associated with the interpretation of the ambiguous pronoun. Fixed effects for the models as well as model estimates with standard errors and t-values are also given in Appendix E.

As Table 5.2 indicates, the analyses on the Critical region yielded highly significant differences between the full and the reduced models, indicating that the experimental manipulations also had an effect on participants' fixation patterns. In addition to this, the analyses on the Critical region revealed highly significant main effects of Focus particle on the earlier time-windows (200ms to 400ms) and highly significant main effects of Connective on posterior time-windows (600ms to 1200ms). These effects suggest that participants continued to fixate more often on the subject antecedent when it was in the scope of a focus particle than when it was not (cf. Table 5.3), especially in the earlier time windows of the region, while in later time windows, they fixated the subject antecedent more often in the concessive conditions than in the causal conditions. The interaction between both factors was

not significant. Given that the interaction between the two experimental factors did not come out as significant, we did not run any further subset analyses of these data.

Table 5.2: Model comparisons (chi-square and p-values) for the Pronoun region

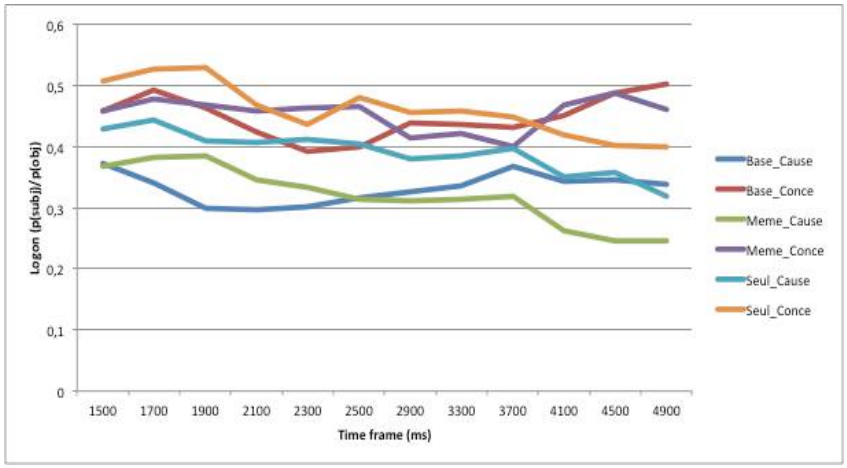
Region		Full vs. reduced models (Df: 5)	Focus particle (Df: 2)	Connective (Df: 1)	Interaction (Df: 2)
Pronoun (a/ait l'habitude de)	200ms	21.084 **(p<.001)**	19.576 **(p<.001)**	0.108 (p>.05)	1.3728 (p>.05)
	400ms	16.985 **(p<.01)**	13.285 **(p<.01)**	3.541 (p<.1)	0.287(p>.05)
	600ms	23.19 **(p<.001)**	9.1243 **(p<.05)**	13.776 **(p<.001)**	0.4241 (p>.05)
	800ms	26.221 **(p<.001)**	7.3891 **(p<.05)**	16.035 **(p<.001)**	2.7968 (p>.05)
	1000ms	26.201 **(p<.001)**	8.1269 **(p<.05)**	16.247 **(p<.001)**	1.918 (p>.05)
	1200ms	28.918 **(p<.001)**	3.6063 (p>.05)	24.603 **(p<.001)**	0.7485 (p>.05)

Table 5.3: T-values for model comparisons between baseline and focus particle conditions in the Pronoun region

Region	Baseline vs. *même*	Baseline vs. *seul*
200ms	3.878	3.769
400ms	3.084	3.173
600ms	2.293	2.804
800ms	1.744	2.671
1000ms	2.052	2.706

Analyses on Continuation

Figure 5.6: Log-odds on probabilities of fixations to Subject antecedent across conditions on Post-critical region (1200ms – 4900ms)



For the Post-critical region, we ran statistical analyses on six 200ms long time windows, and six 400ms long time windows from the onset of the oral continuation to 4900ms after (a time frame that corresponds to the average length of continuations across items and across participants). Fixed effects for the models as well as model estimates with standard errors and t-values are also given in Appendix E.

As Table 5.4 indicates, the analyses on the Post-critical region yielded highly significant differences between the full and the reduced models, indicating that the experimental manipulations had an effect on participants' fixation patterns as in the earlier regions. Moreover, the analyses on the continuation region revealed a very stable pattern of highly significant main effects of Connective throughout the duration of the continuation. Participants consistently fixated the subject antecedent more often after *bien que* than after *parce que.* Regarding the effect of Focus particle, this pattern was less homogenous reaching significance sporadically throughout the time windows analyzed. As Table 5.5 shows, these effects are mainly driven by the fact that participants fixate the subject antecedent less in the baseline conditions (especially the baseline causal condition) than in the two *seul* conditions. The interaction between both factors reached significance at 4500ms after the onset of the continuation. In order to explore this interaction, we ran additional subset analyses for the Connective factor for the focus particles (baseline, *même, seul*) that revealed, in the Causal conditions, significant differences between the baseline and *même* (t=2.192) and *même* and *seul* (t=2.5) but no significant differences between the baseline and *seul* (t=0.211). In the Concessive conditions, the analyses revealed significant differences between the baseline and *seul* (t=2.144) but no significant differences between the baseline and *même* (t=0.299), or between *même* and *seul* (t=1.669).

Table 5.4: Model comparisons (chi-square and p-values) for the Continuation region

	Region	Full vs. reduced models (Df: 5)	Focus particle (Df: 2)	Connective (Df: 1)	Interaction (Df: 2)
Continuation	1500ms[3]	19.737 **(p<.01)**	3.9634 (p>.05)	15.29 **(p<.001)**	0.0298 (p>.05)
	1700ms	25.456 **(p<.001)**	6.0274 **(p<.05)**	17.156 **(p<.001)**	1.7301 (p>.05)
	1900ms	29.403 **(p<.001)**	5.9106 (p<.1)	22.414 **(p<.001)**	0.655 (p>.05)
	2100ms	28.892 **(p<.001)**	8.3156 **(p<.05)**	19.396 **(p<.001)**	1.1205 (p>.05)
	2300ms	26.043 **(p<.001)**	8.3896 **(p<.05)**	13.6 **(p<.001)**	3.8456 (p>.05)
	2500ms	29.632 **(p<.001)**	10.606 **(p<.01)**	15.921 **(p<.001)**	2.8954 (p>.05)
	2900ms	19.275 **(p<.01)**	2.9361 (p>.05)	15.387 **(p<.001)**	0.6543 (p>.05)
	3300ms	24.318 **(p<.001)**	4.0001 (p>.05)	19.365 **(p<.001)**	0.7059 (p>.05)
	3700ms	19.144 **(p<.01)**	6.2191 **(p<.05)**	11.756 **(p<.001)**	0.718 (p>.05)
	4100ms	21.063 **(p<.001)**	2.0498 (p>.05)	15.416 **(p<.001)**	3.2281 (p>.05)
	4500ms	42.912 **(p<.001)**	3.4013 (p>.05)	30.361 **(p<.001)**	8.8909 **(p<.05)**
	4900ms	35.523 **(p<.001)**	7.0041 **(p<.05)**	23.662 **(p<.001)**	4.5372 (p>.05)

Table 5.5: T-values for model comparisons between baseline and focus particle conditions in the Continuation region

Region	Baseline vs. *même*	Baseline vs. *seul*
1700ms	0.165	2.16
2100ms	1.747	2.866
2300ms	1.303	2.932
2500ms	1.486	3.291
3700ms	0.925	1.66
4900ms	2.623	1.865

2.5.2. Final antecedent interpretation choices

For the antecedent interpretation choices (mouse clicks), subject antecedent choices were assigned a 1 and object antecedent choices were assigned a 0 for a log-linear mixed-effects model analysis containing a fixed effect of Condition (with 6 levels) and random intercepts for Participants and Items. The statistical comparison between the full and the reduced models yielded a highly significant effect ($\chi^2(5)=156.18$, $p<.001$), which indicates that the experimental manipulations had a systematic effect on our participants' antecedent choices. Table 5.6 gives the fixed effects yielded by this analysis.

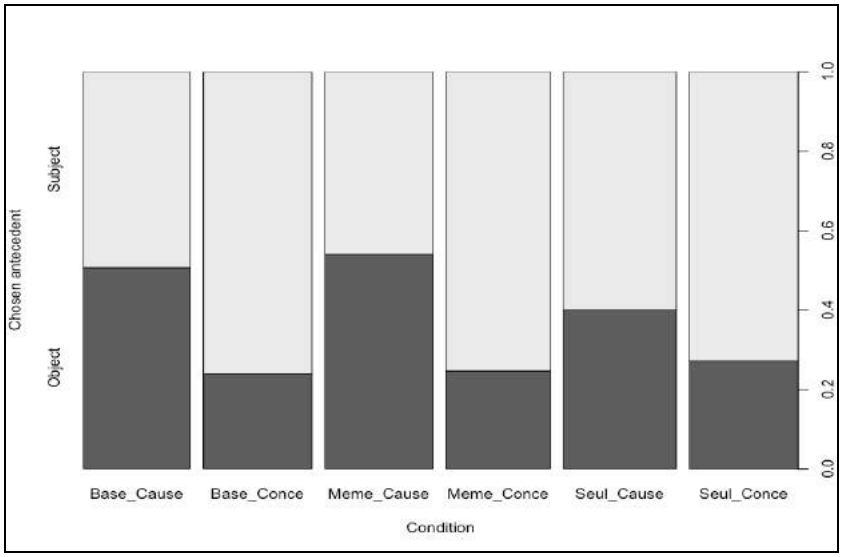
[3] This region is 300ms long (from 1200ms to 1500ms)

Table 5.6: Fixed effects for antecedent choices in Experiment 14

	Estimate	Std. Error	z value	Pr(>|z|)
(Intercept)	-0.09203	0.20313	-0.453	0.650500
Baseline_Concessive	1.49564	0.18966	7.886	3.13e-15 ***
Même_Causal	-0.16286	0.17243	-0.945	0.344909
Même_Concessive	1.37080	0.19282	7.109	1.17e-12 ***
Seul_Causal	0.60997	0.17587	3.468	0.000524 ***
Seul_Concessive	1.29706	0.18504	7.010	2.39e-12 ***

Let us start with a descriptive analysis of these results, illustrated in Figure 5.7. The results of the antecedent choices for the Baseline conditions show that, while the concessive connective triggers a robust Subject antecedent preference, this preference is less strong with the causal connective. As far as the focus-sensitive particles are concerned, in the Causal conditions there was a robust preference for the antecedent that was *within* the scope of the focus particle *seul* (the subject), whereas this preference was less strong for *même*. Interestingly, however, while this pattern is reversed in the Concessive conditions for *même,* which triggered more Subject antecedent choices (that is, the antecedent *within* its scope), the pattern was not reversed for *only* that also triggered more subject antecedent choices in the Concessive condition.

Figure 5.7: Antecedent choices (subject or object) for Experiment 14



These results were confirmed by a second log-linear mixed-effects model analysis with Focus-sensitive particle and Connective as fixed effects and random intercepts for Participants and Items yielded a significant main effect of Focus-sensitive particle ($\chi^2(2)=9.3844$, $p<.01$), due to the difference in antecedent choices between *seul*, on the one hand, and *même* and the baseline, on the other. The analysis also revealed a highly significant main effect of Connective ($\chi^2(1)=131.41$, $p<.001$) due to the higher number of subject antecedent choices in the concessive conditions than in the causal conditions. However, as shown in Figure 5.7, while the concessive connective triggers a robust subject antecedent preference, this preference is less strong with the causal connective. The interaction between both factors was also significant ($\chi^2(2)=13.101$, $p<.01$).

In order to perform a direct comparison between these results and those of previous experiments, we ran further subset analyses excluding the Baseline conditions. These analyses yielded the same results: a significant main effect of Focus-sensitive particle ($\chi^2(1)=9.6105$, $p<.01$), a highly significant main effect of Connective ($\chi^2(1)=65.604$, $p<.001$), and a significant interaction between both factors ($\chi^2(1)=10.493$, $p<.01$). This interaction is due to the fact that a highly significant difference was established between *seul* and *même* for the Causal conditions ($\beta= 0.8033$, SD=0.1883, $z=4.266$, $p<.001$), while the difference between *seul* and *même* in the two Concessive conditions was not significant ($\beta= -0.06519$, SD=0.20945, $z=-0.311$, $p>.05$).

2.6. Discussion

Summarizing the results of the eye-movements, at the pre-critical region (the connective region), there was a general effect of Focus particle, with significantly more fixations to the subject antecedent in the four focus particle conditions than in the two baseline conditions. At the critical region (the pronoun + *l'habitude de* region), there was a general effect of Connective, with significantly more fixations to the subject antecedent in the concessive conditions than in the causal conditions. Finally, at the post-critical region (the continuation region), there was a general effect of Connective throughout the region and a general effect of Focus particle at the earlier time frames of the region. Moreover, there was a significant interaction between both factors at the 4500ms time frame, driven mainly by the difference in the number of fixations to the subject antecedent in the two *Même* conditions.

As for the final antecedent choices, there was a stronger preference for the subject antecedent in the concessive conditions than in the causal conditions. Furthermore, in the

causal conditions there was a robust preference for the antecedent that was *within* the scope of the focus particle *seul* (the subject), whereas this preference was less strong with *même*. While this pattern is reversed in the concessive conditions for *même,* which triggered more subject antecedent choices, the same was not true with *only* which also triggered more subject antecedent choices in the concessive condition.

The results of the eye movements are interesting in that they show how the different sources of information exert their effects at different points in time during language processing. At the pre-critical region, the fact that participants looked at the subject antecedent more often in the conditions with focus particles than in the baseline conditions before they had time to process the connective provides evidence for a clear effect of focus: *even* and *only*, regardless of their distinctive semantic/pragmatic characteristics, enhance the accessibility of their associate. This may be due to higher accessibility of focused antecedents between DUs or to the fact that the associate of a focus particle is perceptually more salient because it carries a higher pitch accent than the antecedent outside their scope[4]. At the critical region, participants have already processed the information contained at the connective, which exerts its effect at that point. The higher number of fixations to the subject antecedent in the concessive conditions than in the causal conditions can be explained as follows: given the general preference to look at the object antecedent, the concessive connective *bien que* 'although', which has been shown to deny listeners' expectations in previous studies, might have shifted the focus to the other antecedent (the subject), at least temporarily. It is not until participants have had time to process the information contained in the *avoir l'habitude de* phrase, which includes the ambiguous pronoun, and they are confronted with having to provide a continuation to the sentence onset, that the information from both sources starts to interact. That is precisely what we see at the post-critical region. In line with the results of Experiments 12 and 13 in Chapter 4, we observe that, in the causal conditions, participants fixated on the subject antecedent more often in the condition with *seul* than in the condition with *même,* where there was a stronger preference for the object antecedent. As expected, this preference was reversed in the concessive condition with *même,* where there was a strong preference for the subject antecedent. Unlike previous experiments, however, the predicted preference for the antecedent outside the scope of *seul* (i.e. the object) with *bien que* did not arise in this condition, where there was also a stronger preference for the subject antecedent.

[4] These two possibilities are impossible to disentangle since the associate usually carries the pitch accent.

The same interaction observed from the eye-movement data in the post-critical region was attested in the participants' final antecedent interpretation choices, which is further evidence in favor of the hypothesis that the interaction of the information from both sources does not seem to have an effect until a later stage, after participants have built a mental representation of the sentence onset, which they have also used to provide a continuation to the sentence. In the causal conditions, participants picked the subject antecedent significantly more often in the condition with *seul* than in the condition with *même,* where there was a stronger preference for the object antecedent. This pattern was reversed in the concessive condition with *même,* where participants preferred the subject antecedent. Also in line with the results of the eye movements, there was no preference for the antecedent outside the scope of *seul* in the concessive condition (i.e. the object), but rather a strong preference for the subject antecedent.

Even if *a priori* the results of the present experiment, both online and offline, are in line with the results from previous questionnaires presented in Chapter 4, there are two findings that need to be accounted for. The first one has to do with the fact that the final antecedent interpretation choices seem to indicate that participants take into account the information of the focus particles (which we also see in the late interaction in the fixation data) but, nevertheless, the effect of the particles is not very robust in the post-critical condition, compared to that of the connective. The second finding has to do with the results for the *Seul Concessive* condition where subject antecedent preferences are a lot stronger, both in the fixations and in the final interpretation choices, in this experiment than in previous offline experiments.

Given that this was a complex experiment combining three different methodologies (VWP eye tracking, continuation task and sentence-interpretation task), we tested the possibility that processing capacity limitations were responsible for the absence of robust effects of focus particle and significant interactions at earlier time frames in the post-critical region. For that, we used our participants' scores on the working-memory span test to divide them into a high-span group and a low-span group. We subsequently performed the same statistical analyses described above to see if there were significant differences between both groups that could explain our results. We provide a description of those analyses below.

With regard to the divergent results on the *Seul Concessive* condition in this experiment, we tested whether the presence of the *avoir l'habitude de* phrase, which was the only difference between the items used in this experiment and those used in previous

experiments, had any bearing on the observed pattern of results (e.g. boosting subject interpretation preferences across conditions, but especially in the *Seul Concessive* condition). To test this possibility, we ran two additional experiments, Experiments 14.1 and 14.2 that we present after the processing-capacity analyses that follow.

2.7. Processing capacity analyses

Three participants did not complete the working memory span test and were thus excluded from these analyses. Out of the remaining 56 participants, two groups were created according to their scores on this test. We divided participants in two halves and set a cut-off point at 44 points out of 60. Since there were several participants with that score, 29 participants were allocated to the high-span group, and 27 participants to the low-span group. High-span participants were assigned a 1, and low-span participants were assigned a 2 for subsequent analyses.

2.7.1. Eye movements

The same kind of linear-mixed models on fixations logodds as in the previous analyses were run for each memory group separately on the same time-windows within each region. For clarity purposes, Table 5.7 below only shows the degrees of freedom, chi-square and p-values obtained from the linear mixed models run on the two data sets. Fixed effects for the models as well as model estimates with standard errors are given in Appendix E.

As Table 5.7 below shows, the only striking differences between both groups is, on the one hand, the persistent main effect of Focus particle across regions in the high-span group, which is only observable in the Connective region in the low-span group, and, on the other hand, the timing of the interaction between both factors, which shows in the high-span group 2000ms earlier than in the low-span group.

In order to compare both groups directly, we subsequently ran the same type of linear models including Memory (high '1' vs. low '2') as an additional fixed factor. Crucially, these analyses revealed significant interactions between Memory and the experimental factors (Connective and Focus particle) only in the continuation region at the 1500ms ($\chi^2(5)= 11.091$, $p<.05$), 1700ms ($\chi^2(5)= 10.18$, $p<.1$), 1900ms ($\chi^2(5)= 21.628$, $p<.001$), 2100ms ($\chi^2(5)= 14.957$, $p<.05$), and 4100ms ($\chi^2(5)= 12.834$, $p<.05$) time frames. As Table 5.7 shows, these interactions are most likely driven by the difference between the two groups concerning the time-course of integration of the sources of information: while the high-span group integrates them at around 1900ms, the low-span group does so at 4100ms after the onset of the pronoun.

Table 5.7: Model comparisons (chi-square and p-values) for all regions for both groups

Group	Region		Full vs. reduced models (Df: 5)	Focus particle (Df: 2)	Connective (Df: 1)	Interaction (Df: 2)
High-span group	*Connective*	200ms	16.811 **(p<.01)**	13.295 **(p<.01)**	0.3852 (p>.05)	3.1419 (p>.05)
		400ms	14.457 **(p<.05)**	13.712 **(p<.01)**	0.3451 (p>.05)	0.4181 (p>.05)
	Pronoun (a/ait l'habitude de)	200ms	11.664 **(p<.05)**	11.3 **(p<.01)**	0.323 (p>.05)	0.066 (p>.05)
		400ms	7.1733 (p>.05)	6.7527 **(p<.05)**	0.2052 (p>.05)	0.2111 (p>.05)
		600ms	14.528 **(p<.05)**	8.5148 **(p<.05)**	5.7316 **(p<.05)**	0.3267 (p>.05)
		800ms	16.392 **(p<.01)**	7.6662 **(p<.05)**	7.5133 **(p<.01)**	1.1431 (p>.05)
		1000ms	11.046 (p<.1)	5.1914 (p<.1)	5.1938 **(p<.05)**	0.5891 (p>.05)
		1200ms	15.579 **(p<.01)**	3.9589 (p>.05)	11.15 **(p<.001)**	0.3779 (p>.05)
	Continuation	1500ms	25.005 **(p<.001)**	9.9964 **(p<.01)**	12.469 **(p<.001)**	1.8661 (p>.05)
		1700ms	24.862 **(p<.001)**	13.177 **(p<.01)**	7.2363 **(p<.01)**	3.8681 (p>.05)
		1900ms	29.868 **(p<.001)**	18.855 **(p<.001)**	4.6687 **(p<.05)**	5.767 (p<.1)
		2100ms	25.841 **(p<.001)**	11.829 **(p<.01)**	7.0087 **(p<.01)**	6.4754 **(p<.05)**
		2300ms	24.101 **(p<.001)**	10.07 **(p<.01)**	6.3968 **(p<.05)**	7.2515 **(p<.05)**
		2500ms	22.773 **(p<.001)**	8.0322 **(p<.05)**	8.0408 **(p<.01)**	6.4294 **(p<.05)**
		2900ms	13.89 **(p<.05)**	3.0033 (p>.05)	9.4061 **(p<.01)**	1.2169 (p>.05)
		3300ms	7.1591 (p>.05)	1.1004 (p>.05)	4.8615 **(p<.05)**	1.0787 (p>.05)
		3700ms	11.466 **(p<.05)**	6.0872 **(p<.05)**	2.9686 (p<.1)	2.1368 (p>.05)
		4100ms	13.211 **(p<.05)**	6.9301 **(p<.05)**	5.5786 **(p<.05)**	0.3118 (p>.05)
		4500ms	26.677 **(p<.001)**	1.3504 (p>.05)	23.856 **(p<.001)**	1.1814 (p>.05)
		4900ms	18.877 **(p<.01)**	1.2455 (p>.05)	16.224 **(p<.001)**	1.3056 (p>.05)
Low-span group	*Connective*	200ms	9.239 (p<.1)	6.6802 **(p<.05)**	1.7324 (p>.05)	0.693 (p>.05)
		400ms	14.27 **(p<.05)**	11.572 **(p<.01)**	0.7811 (p>.05)	1.7689 (p>.05)
	Pronoun (a/ait l'habitude de)	200ms	11.133 **(p<.05)**	7.9934 **(p<.05)**	0.0011 (p>.05)	3.1292 (p>.05)
		400ms	8.0012 (p>.05)	3.8501 (p>.05)	3.1293 (p<.1)	1.1054 (p>.05)
		600ms	9.3073 (p<.1)	1.4678 (p>.05)	7.6372 **(p<.01)**	0.1354 (p>.05)
		800ms	8.8191 (p>.05)	0.912 (p>.05)	6.5135 **(p<.05)**	1.2986 (p>.05)
		1000ms	11.234 **(p<.05)**	1.4711 (p>.05)	8.2912 **(p<.01)**	1.4918 (p>.05)
		1200ms	13.885 **(p<.05)**	0.167 (p>.05)	12.26 **(p<.001)**	1.4236 (p>.05)
	Continuation	1500ms	10.449 (p<.1)	0.1529 (p>.05)	6.5595 **(p<.05)**	3.6742 (p>.05)
		1700ms	11.22 **(p<.05)**	0.0833 (p>.05)	9.0524 **(p<.01)**	1.993 (p>.05)
		1900ms	16.866 **(p<.01)**	1.3193 (p>.05)	13.854 **(p<.001)**	2.0421 (p>.05)
		2100ms	14.29 **(p<.05)**	5.9291 (p<.1)	8.1796 **(p<.01)**	0.733 (p>.05)
		2300ms	6.4599 (p>.05)	1.2973 (p>.05)	4.8984 **(p<.05)**	0.3951 (p>.05)
		2500ms	8.0541 (p>.05)	2.3117 (p>.05)	4.9909 **(p<.05)**	0.7447 (p>.05)
		2900ms	4.7743 (p>.05)	0.434 (p>.05)	3.9558 **(p<.05)**	0.2845 (p>.05)
		3300ms	16.154 **(p<.01)**	2.0173 (p>.05)	13.232 **(p<.001)**	0.9537 (p>.05)
		3700ms	13.135 **(p<.05)**	0.3374 (p>.05)	9.4283 **(p<.01)**	3.3222 (p>.05)
		4100ms	20.542 **(p<.001)**	2.0211 (p>.05)	9.6616 **(p<.01)**	8.874 **(p<.05)**
		4500ms	23.129 **(p<.001)**	4.4334 (p>.05)	6.8242 **(p<.01)**	11.739 **(p<.01)**
		4900ms	19.647 **(p<.01)**	8.1515 **(p<.05)**	6.2906 **(p<.05)**	5.022 (p<.1)

2.7.2. Final antecedent interpretation choices

As in the analyses with all participants, for the antecedent interpretation choices (mouse clicks), subject antecedent choices were assigned a 1 and object antecedent choices were assigned a 0 for the same kind of log-linear mixed-effects model analyses including Memory

as a fixed factor and random intercepts for Participants and Items to test the interaction of memory capacity with the experimental conditions and the two experimental factors.

As Table 5.8 shows, these analyses revealed a main effect of Memory but no significant interaction between Memory and Connective and Focus particle. A close look into the results shows that the main effect effect of memory is probably driven by the higher-number of subject antecedent choices in the high-span group compared to the low-span group (Base_Causal: high 54% - low 43%; Base_Concessive: high 82% - low 69%; Même_Causal: high 50% - low 40%; Même_Concessive: high 82% - low 63%; Seul_Causal: high 70% - low 49%; Seul_Concessive: high 78% - low 68%).

Table 5.8: Fixed effects for antecedent choices in two memory groups

	Estimate	Std. Error	z value	Pr(>|z|)
(Intercept)	0.66412	0.16405	4.048	5.16e-05 ***
connective1	-0.62740	0.05744	-10.922	< 2e-16 ***
particle1	-0.17221	0.08089	-2.129	0.0333 *
particle2	-0.03458	0.07852	-0.440	0.6597
memory1	0.39541	0.15591	2.536	0.0112 *
connective1*particle1	-0.16338	0.07925	-2.062	0.0393 *
connective1*particle2	-0.13532	0.07945	-1.703	0.0885 .
connective1*memory1	-0.03415	0.05701	-0.599	0.5492
particle1*memory1	-0.01340	0.08091	-0.166	0.8685
particle2*memory1	-0.04302	0.07862	-0.547	0.5843
connective1*particle1*memory1	-0.10552	0.07955	-1.326	0.1847
connective1*particle2*memory1	-0.03718	0.07968	-0.467	0.6407

2.7.3. Discussion

Summarizing the findings of the processing capacity analyses, the eye-tracking data shows a main effect of Focus particle across all regions in the high-span group that is absent in the low-span group. In addition to this, the interaction between both experimental factors reaches significance 2000ms earlier in the high-span group than in the low-span group. The difference between groups in the time-course of integration of the sources of information was further corroborated by significant interactions between Memory and the two experimental factors. Regarding the final interpretation choices, these analyses revealed a main effect of memory that was driven by the higher number of subject antecedent choices across conditions in the high-span group compared to the low-span group.

These findings constitute evidence in favor of our hypothesis that processing capacity limitations related to the complexity of the task might have affected our participants'

performance. Recall that this experiment was a combination of three different methodologies, where participants had to listen to the sentence onsets while looking at a visual stimulus, process the information, come up with an appropriate continuation, and decide which referent the continuation is about. High-span participants seem to retain the information from the focus particles, which appear at the beginning of the sentence, all along the construction of the mental model of the sentence and integrate it with the information from the connectives significantly earlier than the low-span group. The low-span participants, on the other hand, seem to initially only consider the most recent information source, that of the connective, and use the information from the focus particle at a later stage, shortly before they have to make a choice of antecedent. An additional way to further corroborate this finding would be by analyzing the onset of the continuations in the high-span group vs. the low-span group. If our prediction is right, we might observe a delay in the onset of continuations in the low-span group with respect to the high-span group, which would suggest that the low-span group needed more time to recall all the pertinent information before they could come up with an appropriate continuation. These analyses will be left for future stages.

In the following lines, we present the results of Experiments 14.1 and 14.2 that investigated the unexpected strong subject antecedent preference elicited in the *Seul Concessive* condition.

3. Experiment 14.1

Given the differences in the *Seul Concessive* condition between Experiment 13 in Chapter 4 and the offline interpretation choices of Experiment 14, where we observe that the subject antecedent choices are significantly higher than in Experiment 13, we wanted to test whether the use of extra material in the sentence onset prompt may underlie these results. Recall that the only difference between the stimuli used in these two experiments is that, while in Experiment 13 the sentence onset only included the connective, in Experiment 14 the connective was followed by the ambiguous pronoun and the *avoir l'habitude de* phrase. In Experiment 14.1, we tested this hypothesis by including a forced pronoun prompt, and in Experiment 14.2, we did so by including the *avoir l'habitude de* phrase prompt. We subsequently compare and discuss the results of all four tasks.

3.1. Method

Thirty-two French native speakers completed a Sentence Continuation Task (SCT) online via Ibex Farm.

The same 24 experimental items used in Experiments 13 were used in this experiment. These sentence onsets were also complex sentences that featured two human referents in the matrix clause and the connective *parce que* 'because' or *bien que* 'although'. The connective was immediately followed by the pronoun prompt giving participants the choice between the pronouns (*il* 'he' or *elle* 'she') that could refer to one of the two antecedents. In order to avoid any ambiguity in the participants' continuations, the referents were here of opposite sex. Twelve items contained masculine subjects and feminine objects, and 12 contained feminine subjects and masculine objects. The experimental items appeared in 4 different experimental conditions following a 2x2 design with Focus-sensitive particle (*même* 'even' * *seul* 'only') and Connective (*parce que* * *bien que*) as independent variables, as shown in (5.3). The same distracters used in Experiment 13 were used in this experiment. Participants were asked to read the sentence onsets carefully and to provide an appropriate continuation in order to create a natural-sounding full sentence after selecting one of the two pronouns (*il* 'he' or *elle* 'she') provided. All items appeared on the screen one by one and participants did not have the option of going back to change previous choices.

(5.3) a. **Même_Conce**: Même Jean a interrompu Marie hier soir bien qu' (il/elle)
b. **Même_Caus**: Même Jean a interrompu Marie hier soir parce qu' (il/elle)
c. **Seul_Conce**: Seul Jean a interrompu Marie hier soir bien qu' (il/elle)
d. **Seul_Caus**: Seul Jean a interrompu Marie hier soir parce qu' (il/elle)

3.2. Results

For the statistical analyses, subject antecedent choices were assigned a 1 and object antecedent choices were assigned a 0 for a log-linear mixed-effects model analysis containing a fixed effect of Condition (with 4 levels) and random intercepts for Participants and Items for all continuations (n=760). The statistical comparison between the full and the reduced models yielded a highly significant effect ($\chi^2(3)=51.37$, $p<.001$), which indicates that the experimental manipulations had a systematic effect on our participants' antecedent choices in their continuations. Table 5.9 gives the fixed effects yielded by this analysis.

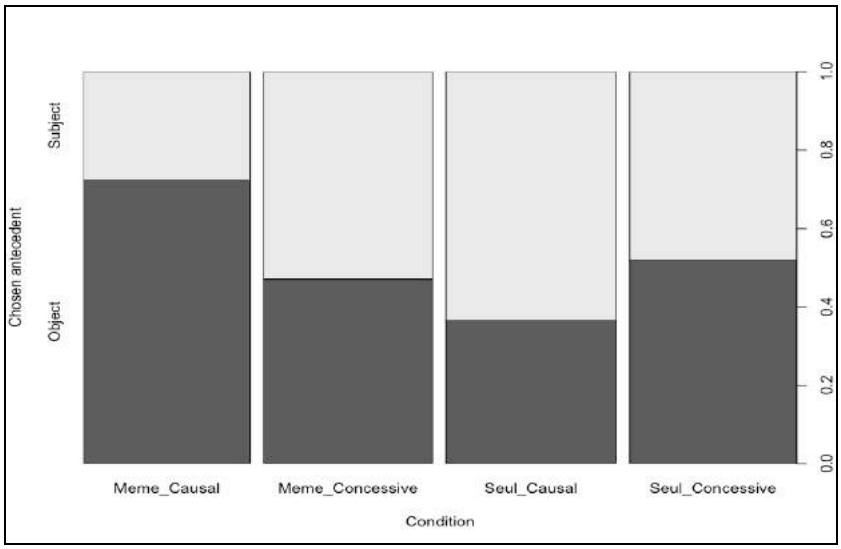
Table 5.9: Fixed effects for Experiment 14.1

	Estimate	Std. Error	z value	Pr(>|z|)
(Intercept)	-1.0682	0.2169	-4.924	8.48e-07 ***
Même_Concessive	1.1886	0.2380	4.994	5.92e-07 ***
Seul_Causal	1.6863	0.2479	6.801	1.04e-11 ***
Seul_Concessive	0.9863	0.2384	4.137	3.52e-05 ***

As Figure 5.8 shows, descriptively, the results of Experiment 14.1 replicate for the most part the results of Experiment 13 and the offline interpretations in Experiment 14, and they also go in line with the results of the previous experiment in English: *même* triggers a clear preference for the antecedent that was *outside* the scope of the focus particle (the object) in the Causal condition, whereas this pattern is reversed in the Concessive condition where there is a stronger preference for the antecedent *within* its scope (the subject). With *only,* the pattern is also reversed in the Causal condition where there are significantly more subject antecedent choices. Moreover, also in accordance with our predictions and with previous results, *seul* triggers more object antecedent choices in the Concessive condition than in the Causal condition. Interestingly, however, a direct comparison between these results and the results of Experiment 13 shows that the number of subject antecedent choices in Seul_Concessive condition has significantly decreased. This finding could be indicative that the presence of additional material in the sentence onset –in this case, the forced pronoun – could have a direct consequence on the results, at least in what concerns the condition were *seul* 'only' combines with the concessive connective *bien que* 'although'.

The descriptive analysis was confirmed by a second log-linear mixed-effects model analysis with Focus-sensitive particle and Connective as fixed effects and random intercepts for Participants and Items, which yielded a highly significant main effect of Focus-sensitive particle ($\chi^2(1)=18.073$, $p<.001$) but no main effect of Connective ($\chi^2(1)=2.0026$, $p>.05$). The interaction between both factors was highly significant ($\chi^2(1)=31.421$, $p<.001$). Additional pairwise comparisons for the Connective factor for each focus particle revealed a highly significant difference between the Causal conditions (β=1.7219, SD=0.2825, z=6.095, $p<.001$). The difference between the two Concessive conditions was not significant (β=-0.1997, SD=0.2106, z=-0.948, $p>.05$).

Figure 5.8: Antecedent choices (subject or object) in Experiment 14.1



4. Experiment 14.2

4.1. Method

Thirty-three French native speakers completed a Sentence Continuation Task (SCT) online via Ibex Farm.

The same 24 experimental items used in Experiments 13 and 14.1 were used in this experiment. These sentence onsets were also complex sentences that featured two human referents in the matrix clause and the connective *parce que* 'because' or *bien que* 'although'. The connective was immediately followed by a pronoun prompt giving participants the choice between the pronouns (*il* 'he' or *elle* 'she') that could refer to one of the two antecedents and the phrase *a/ait l'habitude de* 'has the habit of' that was used in the eye-tracking experiment. In order to avoid any ambiguity in the participants' continuations, the referents were of opposite sex. Half of the items contained masculine subjects and feminine objects, and the other half contained feminine subjects and masculine objects. The experimental items appeared in 4 different experimental conditions following a 2x2 design with Focus-sensitive particle (*même* 'even' * *seul* 'only') and Connective (*parce que* * *bien que*) as independent variables, as shown in (5.4). The same distracters used in Experiment 12 were used in this experiment. Participants were asked to read the sentence onsets carefully and to provide an appropriate continuation in order to create a natural-sounding full sentence after selecting one of the two pronouns (*il* 'he' or *elle* 'she') provided. All items appeared on the screen one by one and participants did not have the option of going back to change previous choices.

(5.4) a. **Même_Conce**: Même Jean a interrompu Marie hier soir bien que (il/elle) ait l'habitude de…

b. **Même_Cause**: Même Jean a interrompu Marie hier soir parce que (il/elle) a l'habitude de…

c. **Seul_Conce**: Seul Jean a interrompu Marie hier soir bien que (il/elle) ait l'habitude de…

d. **Seul_Cause**: Seul Jean a interrompu Marie hier soir parce que (il/elle) a l'habitude de…

4.2. Results

As for all previous experiments, for the statistical analyses, subject antecedent choices were assigned a 1 and object antecedent choices were assigned a 0 for a log-linear mixed-effects model analysis containing a fixed effect of Condition (with 4 levels) and random intercepts for Participants and Items for all continuation (n=767). The statistical comparison between the full and the reduced models yielded a highly significant effect ($\chi^2(3)=45.031$, $p<.001$), which indicates that the experimental manipulations had a systematic effect on our participants' antecedent choices in their continuations. Table 5.10 gives the fixed effects yielded by this analysis.

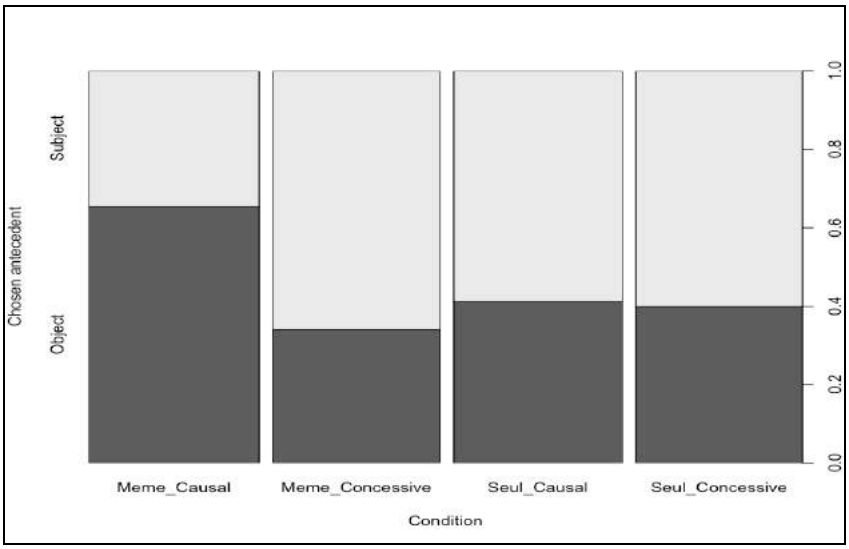
As Figure 5.9 shows, descriptively, the results of Experiment 14.2 replicate for the most part the results of Experiments 13 and 14.1 and the offline interpretations in Experiment 14: *même* triggers a clear preference for the antecedent that was *outside* the scope of the focus particle (the object) in the Causal condition, whereas this pattern is reversed in the Concessive condition where there is a stronger preference for the antecedent *within* its scope (the subject). With *only,* the pattern is also reversed in the Causal condition where there are significantly more subject antecedent choices. Crucially, however, the results of the Concessive condition for *only* go against our predictions but they replicate the pattern observe in the offline interpretation in the eye-tracking experiment (Experiment 14) where we also observed a clear preference for the antecedent *within* the scope of the particle (the subject). Interestingly, if we compare the results of Experiments 13, 14, 14.1, and 14.2 on this condition we observe that the more material the sentence onset contains (no prompt in Experiment 13, pronoun prompt in Experiment 14.1, or *l'habitude de* prompt in Experiments 14 and 14.2) the more subject antecedent preferences are elicited.

Table 5.10: Fixed effects for Experiment 14.2

	Estimate	Std. Error	z value	Pr(>|z|)
(Intercept)	-0.7257	0.1969	-3.686	0.000228 ***
Même_Concessive	1.4378	0.2431	5.916	3.31e-09 ***
Seul_Causal	1.1486	0.2406	4.773	1.81e-06 ***
Seul_Concessive	1.1618	0.2398	4.846	1.26e-06 ***

These descriptive results were corroborated by a second log-linear mixed-effects model analysis with Focus-sensitive particle and Connective as fixed effects and random intercepts for Participants and Items, which yielded a significant main effect of Focus-sensitive particle ($\chi^2(1)=7.4037$, $p<.01$) and highly significant effect of Connective ($\chi^2(1)=19.03$, $p>.001$). The interaction between both factors was highly significant ($\chi^2(1)=18.719$, $p<.001$). Additional pairwise comparisons for the Connective factor for each focus particle revealed a highly significant difference between the Causal conditions ($\beta=1.3836$, SD=0.2954, $z=4.683$, $p<.001$). The difference between the two Concessive conditions was not significant ($\beta=-0.3023$, SD=0.2580, $z=-1.172$, $p>.05$). Fixed effect values for the complete model with the two experimental factors for Experiments 14.1 and 14.2 are given in Appendix E.

Figure 5.9: Antecedent choices (subject or object) in Experiment 14.2



4.3. Discussion

Summarizing the results of Experiments 14.1 and 14.2, in line with previous findings, in the causal conditions, there was a robust preference for the antecedent that was *outside* the scope of the focus particle *même* (the object), and a clear preference for the antecedent that was *within* the scope of the focus particle *seul* (the subject). Also in line with previous findings, this pattern is reversed in the *Même Concessive* condition that triggered more subject antecedent choices (that is, the antecedent *within* the scope of the focus particle). Once again the divergent results arose at the *Seul Concessive* condition where we observe the predicted results (i.e. more object antecedent choices than in the *Seul Causal* condition) in Experiment 14.1 (pronoun prompt) and the same unexpected results elicited in the VWP experiment (i.e. the same subject antecedent preference as in the *Seul Causal* condition) in Experiment 14.2 (*avoir l'habitude de* prompt).

By way of comparison, Figures 5.10 to 5.12 show the results of Experiment 13, where no additional information is included after the connective *bien que;* Experiment 14.1, where a pronoun prompt was added after the connective; and Experiments 14 and 14.2, where the pronoun+*avoir l'habitude de* prompt was included after the connective. The first observation is that, in general, the addition of extra material to the sentence onset increased the number of subject antecedent choices across conditions. This result, however, is more robust on the *Seul Concessive* condition, where we observe a clear three-way pattern: a strong object antecedent preference (expected) in Experiment 13 (Figure 5.10)*;* a less strong object antecedent preference in Experiment 14.1 (Figure 5.11); and a strong subject antecedent preference (unexpected) in Experiments 13 and 14.1 (Figure 5.12).

Figure 5.10: Experiment 13 (no prompt) results

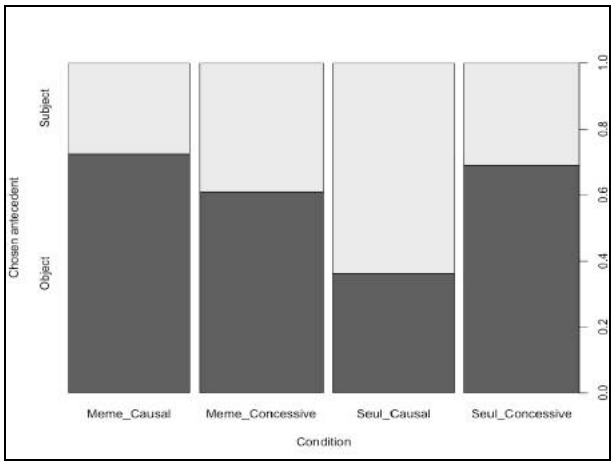


Figure 5.11: Experiment 14.1 (pronoun prompt) results

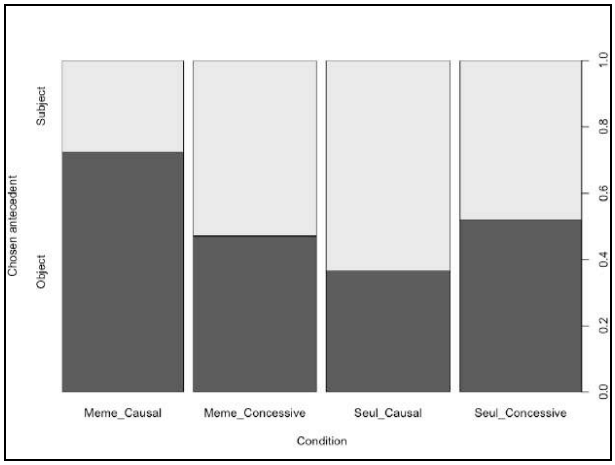
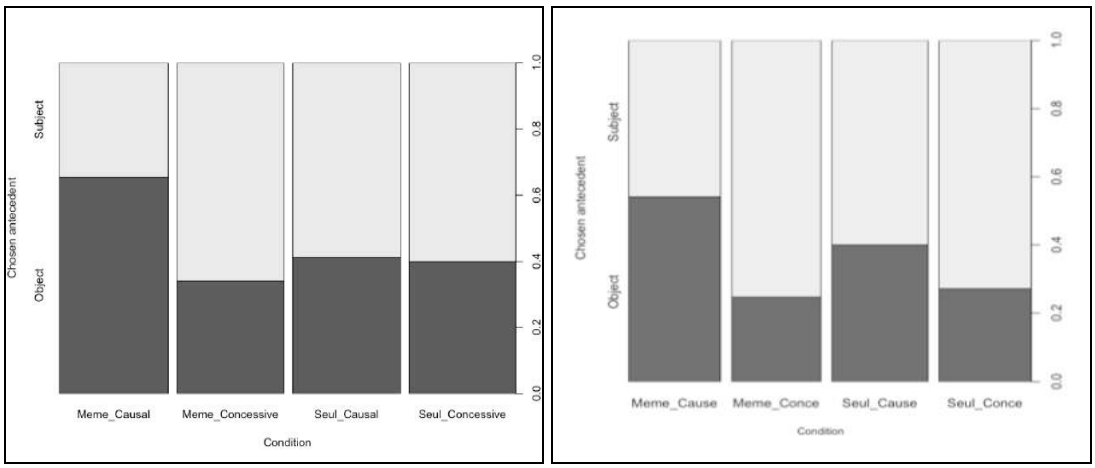


Figure 5.12: Experiment 14.2 and Experiment 14 (*avoir l'habitude de* prompt) results



These results confirm the hypothesis that the differences in the stimuli employed, namely the addition of extra material to the sentence onset is behind the divergent patterns of results in these experiments. The question is then, why?

The higher number of subject antecedent choices as a result of the addition of the extra material in the sentence onset is line with previous findings in the literature (e.g. Kehler & Rohde, 2013a,b; Rohde, 2008; Rohde & Kehler, 2014) and can be accounted for following the lines of the model proposed by Kehler and Rohde (2013a,b). Kehler and Rohde ran a series of continuation studies in which they manipulated the verb bias (subject bias, object bias, and no bias) and the content of the stimuli (free prompt vs. pronoun prompt), as in (5.5).

(5.5) a. Amanda amazed Brittany. (She)
b. Amanda detested Brittany. (She)
c. Amanda chatted with Brittany (She)

The results of the continuations showed that, in the free prompt conditions, antecedent preferences responded primarily to the verb biases, with a strong subject preference in (5.5a), a strong object antecedent preference in (5.5b), and no clear preference for either antecedent in (5.5c). These preferences, however, were overridden in the pronoun prompt conditions where a strong subject antecedent preference was elicited across conditions. In an additional experiment with similar experimental items but only free prompt conditions, they observed that when the continuations included a pronoun it was primarily to refer to the subject antecedent (around 75% of the pronouns, non-subject antecedents did not reach 25% of pronominalization).

These results confirm the validity of their probabilistic model in which the interpretation bias for a given pronoun is determined, on the one hand, by the expectations that comprehenders have about what coherence relations will follow, which in turn condition top-down expectations about the next mention referent (regardless of the referring expression used), and, on the other hand, by centering-style constraints on pronoun production, which constitute bottom-up evidence about the topical status of referents that are closely related to the speaker's decision to use a pronoun. In other words, these results are consistent with a scenario in which semantics/coherence relations affect primarily the probability of next-mention, while grammatical biases affect the choice of referential expression. This last claim

is in turn in line with the predictions of Centering Theory that posit that the use of a pronoun to realize the Cb (the backward-looking center i.e. the entity that the utterance is about) signals the hearer that the speaker is continuing to talk about the same thing (Grosz et al., 1995).

In line with the results above and the account proposed by Kehler and Rohde, our results show that in the absence of extra material in the sentence onset (Experiment 13), participants' next mention biases are primarily guided by the semantic content of the focus particles as well as the connectives; yet when a pronoun prompt is provided, the role of the syntactic function of the referents seems to increase, as evidenced by the higher number of subject antecedent choices in Experiments 14, 14.1, and 14.2. Contrary to earlier results, the use of the pronoun prompt does not fully mask next mention preferences. Further research is necessary before making any robust claims.

Kehler and Rhode's account, however, fails to account for the difference in subject antecedent choices in the *Seul Concessive* condition in Experiments 14.1, where a pronoun prompt was included, with respect to Experiments 14 and 14.2, where, besides the pronoun, the *avoir l'habitude de* phrase was given. This difference suggests that, in addition to the presence of the pronoun, it is the interaction of the semantics of the *avoir l'habitude de* phrase with that of the connective *bien que* what is driving the strong subject antecedent preference in this condition.

We hypothesize that a closer look into the semantics of *although* can potentially provide an explanation for the differences in the result patterns. Some authors claim that a sentence like 'Q although P', where P and Q are taken as the propositional content of the clauses connected by *although*, has two main types of interpretations: a *concessive* interpretation that we already discussed in Chapter 4 and an *adversative* interpretation (Iten, 1998; König, 1986). A sentence like (5.6) is a classical example of the concessive interpretation of *although.*

(5.6) We found a table although the café was crowded.

In (5.6) there seems to be a direct incompatibility between the two clauses. In more theoretical terms, a sentence like (5.6) is claimed to carry an implicature in the lines of (5.7) (König, 1985, 1986, 1988, 1989; Sidiropoulou, 1992; Winter & Rimon, 1994).

(5.7) Normally, if P then not Q.

As we saw in Chapter 4, many theorists have argued for a close connection between causality and concessivity. This analysis, advocated e.g. by König (1991) and by König and Siemud (2000), means that the concessive "q although p" implies the same counterfactual as the entailed by the causal "~q because p", as in (5.8).

(5.8) a. The burglars were caught although they were not monitored.
b. The burglars did not escape because they were not monitored.

The example in (5.9) is an example of the adversative interpretation of *although.*

(5.9) The café was crowded although John did not show up on time.

As Iten (1998) notes, a sentence like (5.9) taken out of context sounds rather strange. However, if a context is provided, its interpretation seems to be more straightforward: imagine a scenario where someone, e.g. Mary, predicted that, on a given day, certain café would be crowded and that John would show up on time to a certain meeting. A third person that was aware of Mary's predictions, e.g. Paul, points out to Mary after the meeting has passed and John was late to it that John was in fact late and, thus, she was wrong. In reply, Mary can utter (5.9) to imply that she was still right about part of her predictions. Note that (5.9) is equivalent in meaning to (5.10), where *although* has been replaced by the coordinating connective *but*.

(5.10) The café was crowded *but* John did not show up on time.

Unlike in the case of the concessive interpretation of *although,* in (5.9) there is not direct incompatibility between the two clauses. Rather the incompatibility is between an implication of the first clause and an implication of the second clause. In more formal terms, some authors argue that the adversative reading of 'Q although P' carries an implicature like (5.11).

(5.11) If P then not R. If Q then R. Q carries more weight than P.

Applying the implicature in (5.11) to the sentence in (5.9), this example would work as follows: if the café is crowded on that given day (=Q), Mary is right (=R), if John did not show up on time (=P), Mary is wrong (=not R). The relationship between P and Q in this case is not a direct one, they are related to each other via R. R can be a belief, a conclusion or a speech act. However, it is not part of the actual utterance.

Bearing in mind the two possible interpretations of *although,* concessive and adversative, we hypothesize that our results could be potentially accounted for in the following terms:

i. In a sentence like *Only Peter called John although…,* it is asserted that it is noteworthy that Peter and nobody else called John. An explanation of why nobody else called is expected. In this case *although* is taken as a concessive and that exact reason is given, for example "although it was his birthday", where a clear incompatibility between the two clauses is established. This should result in the expected preference for *John* attested in Experiment 13.

ii. In a sentence like *Only Peter called John although…,* it is asserted that it is noteworthy that Peter and nobody else called. In this case *although* is taken as an adversative, denying just that noteworthiness. A hypothetical scenario can be thought where there is nothing surprising about only Peter calling, since that's what he is like. This inference could easily be triggered by *avoir l'habitude de*. A plausible continuation would be "although everybody knows that's what he is like", where there is no incompatibility between both clauses. This should result in the preference for *Peter* attested in Experiments 14 and 14.2.

Here, too, further research is necessary to test these hypotheses in more detail.

General discussion & conclusions

Two research questions guided the experiments presented in Chapter 5. The first question asked whether the same semantic and pragmatic information that guided resolution in the offline experiments in Chapter 4, namely that of focus sensitive particles and connectives, would arise during online language processing. In case of an affirmative answer to this question, the second research question asked what is the time-course of integration of these semantic and pragmatic constraints.

The answer to the first research question is indeed affirmative: we observe the effects of the focus sensitive particles *même* and *seul,* and of the connectives *parce que* and *bien que* exert their influence as participants build the mental representation of the experimental items they are presented with. Interestingly, answering the second research question, these factors do not exert their effects at the same point in time: we observe an early effect of the focus particles at the point where participants encounter the connectives, which means at a point where only the focus particles have been fully processed. Focus particles seem to enhance the accessibility of their associate, as evidenced by the significantly higher number of fixations to the subject in the focus particle conditions with respect to the baseline conditions. The effect of the focus particles is followed by a general effect of connective that arises at the onset of the 'pronoun+*avoir l'habitude de*' phrase, that is, right after the connective itself. This effect is evidenced by the significantly higher number of fixations to the subject in the concessive conditions than in the causal conditions. Given the general preference to look at the more recent antecedents that is commonplace in VSP studies, we argued that the robust preference for the subject antecedent in the concessive conditions could be due to a (temporary) shift of focus of attention to the other antecedent (the subject) driven by the concessive connective *bien que* 'although', which has been previously shown to deny listeners' expectations. Interestingly, it seems that it is not until participants have to perform some kind of task with the information gathered up that point (provide a continuation and select an antecedent) that the interaction between the semantic/pragmatic information from both sources comes into play. This finding is evidenced by the divergent patterns of fixations and antecedent choices that emerge as a function of the focus particle-connective combinations. Ultimately, in line with interactive accounts on language processing, the results of Experiment 14 show that detailed semantic and pragmatic representations interact to create interpretation preferences incrementally.

Discourse units and pronoun resolution

The eye movements and the final interpretation choices are in line with the results of the series of experiments presented in Chapter 4 and, thus, constitute further evidence for our proposal that, in those contexts where the matrix clause and the subordinate clause constitute two separate DUs, as it is the case with relational causal and concessive adverbial clauses, resolution preferences come about in the process of *establishing* coherence between units,

which is achieved through the focusing effects of the semantics of certain elements in the proposition, here connectives and focus particles. In particular, we argued that in our experimental items, the focus particles *even* and *only* in combination with the connectives *because* and *although* behave like Implicit Causality verbs in that they create expectations for specific explanations to avoid leaving missing causal content unspecified and that these expectations vary as a function of the semantic/pragmatic characteristics of the particles (exhaustiveness in relation to alternatives in the case of *only*, and unlikeliness in relation to alternatives in the case of *even*). As was previously observed with IC verbs, these expectations for certain explanations result in the preferences for continuations about one of the two referents available in the immediately preceding context. See the conclusions section in Chapter 4 for a more extensive discussion on the implications of these results with respect to our proposal on DU and their role in pronoun interpretation.

General conclusions

This thesis highlights the importance of the experimental paradigm in the investigation of linguistic phenomena, along with the importance of performing experiments that are comprehensively and thoroughly informed by findings in theoretical linguistics. It is through this approach that we have been able to produce findings that, we believe, are interesting for linguists and psycholinguists alike. Our research should be interesting for linguists in that in a domain where intuitions cannot possibly provide decisive evidence for linguistically motivated hypotheses, we obtained empirical evidence by running a series of experiments, which, put together, shed light on the complex process of pronoun resolution across languages. Likewise, our findings should be of relevance for psycholinguists in that our results show that pronoun resolution does not exclusively obey general processing mechanisms. The attested cross-linguistic differences suggest that language-specific variations in grammar also play a role in this process. These findings imply that the modeling of pronoun resolution cannot be achieved in cognitive terms (such salience) only as it is biased/constrained by the language of the speaker. While proposing a model of pronoun resolution that could account for all the facts observed in the ever-growing literature on this phenomenon was not the goal of the present thesis, we strongly believe that the factors investigated here –the syntactic, semantic, and pragmatic cues affecting resolution and the contexts where they exert their effects –must be taken into consideration in the construction of future discourse model or be implemented in existing ones (e.g. SDRT, Asher & Lascarides, 2003; DRT, Kamp, 1981, Kamp & Reyle, 1993; or Ginzburg, 2012).

The main empirical findings from Experiments 1 to 14.2 presented in this thesis are summarized below:

1. Structures usually associated with the information status of discourse referents (HTLD to mark topic and *it-clefts* to mark focus) have an effect on antecedent accessibility. This effect, however, is not the same for each construction, at least in the contexts investigated here (i.e. matrix and temporal subordinate clause): there is a general preference for left-dislocated antecedents but a dispreference for clefted antecedents, or an *anti-focus effect*, a pattern that had been established for subject pronouns in French and in German (Colonna et al., 2012, 2015) in intra-sentential pronoun resolution and that also generalizes to null pronouns and object clitic pronouns in Spanish. Crucially, this *anti-focus effect* is neither exclusive to one type of focus nor to the *it-cleft* construction, as evidenced by the similar results

obtained with the focus-sensitive particles *even, only,* and *also* in English and in Spanish.

2. In the context of a matrix and a causal subordinate clause, the *anti-focus effect* attested with focus particles gives way to a more complex pattern of antecedent preferences that results from the interaction of the semantic/pragmatic content of focus particles and connectives. We observe that focus particles behave like Implicit Causality verbs in that they create expectations for specific explanations to avoid leaving missing causal content unspecified. These expectations vary as a function of the semantic/pragmatic characteristics of *even* and *only* and their equivalents in Spanish and French (i.e. the relation between their associate and its alternatives).
3. The different semantic/pragmatic factors investigated here affect participants' interpretations incrementally at the point when or shortly after they come in.

When we apply these findings to our proposal on Discourse Units from Chapter 2, we come to the following conclusions:

1. Putting forward a list of factors that affect pronoun resolution is not enough. We need to incorporate an in-depth analysis of the domain of resolution (the context) as a key aspect of the study of pronoun interpretation. Our proposal is that the DU is the optimal domain for the study of pronoun resolution.
2. Previous accounts that define DUs in purely syntactic terms, equating this notion to either the sentence or the clause, cannot account for all the facts. We proposed a "relational" definition of DU, according to which the shape of the unit (e.g. sentence, clause) depends on the semantic content of the subordinate clause itself and the relation established between matrix and subordinate clause. Based on Johnston (1994), we provide evidence from contexts consisting of a matrix and a subordinate adverbial adjunct: non-relational adjuncts (e.g. temporal clauses) are processed as part of the same DU as the matrix clause (DU=sentence); relational adjuncts (e.g. causal and concessive clauses) are processed as a separate DU from the matrix clause (DU=clause).
3. The DU configuration of the utterance will have an impact on pronoun interpretation preferences: factors affecting interpretation will not exert the same effects within a DU as across two DUs.

4. We propose that pronoun resolution aims for a maximum of coherence and that interpretation preferences will come about within the process of maintaining coherence (intra-unit) or establishing coherence (inter-unit). We hypothesized, and our experiments confirmed, that referring back to topic or topic-like antecedents is one of the preferred strategies to maintain coherence, whereas preferences that conform to the semantic/pragmatic content of certain elements of the utterances are the result of a mechanism that establishes coherence.
5. Our experiments have additionally shown that the role of some of the factors investigated in pronoun resolution is subject to cross-linguistic variability.

The role of context in pronoun resolution

The studies reviewed in Chapter 1 explore the role of the prominent status of the antecedent in pronoun resolution. One possibility to render an antecedent prominent is by making it the explicit focus of the sentence by means of a cleft construction. Indeed, some studies find that focused/clefted entities are more accessible antecedents for pronouns than non-focused ones (Almor, 1999; Arnold, 1998; Cowles et al., 2007; Ellert, 2013; Foraker, 2004; Foraker & McElree, 2007; Kaiser, 2011). However, other studies find that focused antecedents are generally dispreferred in certain contexts (Colonna et al., 2012, 2015; Järvikivi et al., 2014). In line with Colonna and colleagues, we argued that the difference between the studies that show a preference for clefted antecedents and those that show a dispreference for clefted antecedents is due to contextual differences: while the former investigate resolution *across* sentence boundaries, the latter investigate resolution *within* sentence boundaries.

Colonna and colleagues propose that, within a sentence, having the pronoun co-refer with an antecedent that is part of the presupposed (topic) part of the matrix sentence makes the sentence more coherent by keeping the sentence topic constant between the matrix and the subordinate clause. On the contrary, having the pronoun co-refer with the clefted (focus) antecedent would imply a topic shift within the sentence, reducing the intra-sentential coherence. Between sentences, focusing an antecedent by clefting in a given sentence may be taken as a cue for an upcoming topic-shift, establishing this referent as a potential topic of the following sentence. A pronoun in the following sentence may, therefore, access the clefted antecedent more easily because it has been introduced as a potential new topic of the upcoming discourse.

The results of the experiments presented in Chapter 3 that investigated the role of the information status of the antecedent in pronoun resolution in Spanish and English constitute

further evidence for the preference for topic and topic-like antecedents (or entities within the part of the utterance that constitutes presupposed, known, given information), and a dispreference for focused antecedents, clefted or within the scope of a focus particle, (or entities within the part of the utterance that constitutes asserted, new, unexpected information), in contexts where the antecedent and the pronoun are in the same sentence.

The divergent results for the role of focus in pronoun resolution elicited in these studies can only be accounted for if the context where the pronominal dependency is established –in this case the opposition within/between-sentence –is taken into account. This finding stresses the importance of taking the domain of dependency into account to weigh the various factors involved in pronoun resolution.

The DU as the optimal domain for the study of pronoun resolution

Crucially, in the present thesis, we have claimed that a better way to account for the observed interpretation patterns is in terms of Discourse Units (DU), rather than in purely syntactic terms (e.g. sentences or clauses). In other words, we claimed that the DU is the optimal domain for the study of pronoun resolution. Our proposal agrees with previous accounts that also try to explain the differences observed between intra- and inter-sentential pronoun resolution and that are rooted in the notion of DU. In particular, we reviewed Miltsakaki's (2002) theory of pronoun resolution, according to which these two processes are subject to different resolution mechanisms.

Unlike Miltsakaki's and other accounts that equate the DU to either the sentence or the clause, we argued that DUs cannot be defined based on purely syntactic distinctions. We claimed that the shape of a DU (e.g. sentence, clause) depends on the semantic content of the subordinate clause itself and the relation established between main and subordinate clause. Our evidence comes from contexts that consist of a matrix clause and an adverbial adjunct. Based on Johnston (1994), we claimed that the characteristics of these subordinate adjuncts play a role in the establishment of DUs: non-relational adjuncts (e.g. temporal clauses introduced by *when*) are processed as part of the same DU as the matrix clause, while relational adjuncts (e.g. causal clauses introduced by *because*) are processed as a separate DU from the matrix clause. These predictions were confirmed by the divergent interpretation patterns obtained in the experiments presented in Chapter 3, where all items contained temporal clauses (1 DU), and those in Chapter 4, where all items contained causal clauses (2 DUs).

If we were to adopt Miltsakaki's definition of DU as a matrix clause and all dependent subordinate clauses (regardless of the type of subordinate clause), a possible alternative explanation to the divergent resolution patterns elicited in the contexts explored in Chapters 3 and 4 is that they are due to the effects exerted by the specific coherence relations involved (temporal vs. causal). We do not think that this proposal can work for several reasons. First, it falls short in accounting for the differences in antecedent preferences elicited by Colonna et al. (2012, 2015) in inter- and intra-sentential pronoun resolution. Recall that, in their materials, both the temporal subordinate clause and the independent second sentence provide (temporal) background information for the event described in the matrix clause or in the first sentence, respectively. Second, the actual status of temporal relations as a coherence relation is not completely clear and it has never been included in previous coherence-driven proposals, at least in the psycholinguistic literature. Third, according to some accounts on DUs, by definition, the function of coherence relations is to link units together and, thus, it does not make sense to speak of coherence *relations* within a DU.

We believe that our proposal whereby DUs cannot be defined exclusively in syntactic terms, but rather multiple factors contribute to their establishment is a more complete proposal. It brings together some key aspects of previous accounts: like previous accounts on DUs, our proposal defends that DUs can take the form of both a sentence or a clause, unlike these proposals, it claims that the DU cannot be exclusively equated to these two notions; in line with previous accounts on coherence relations, our proposal argues that coherence relations play an important role by linking DUs together, but they do not operate within a single DU; based on previous accounts on subordinate clauses, our proposal predicts that their intrinsic syntactic, semantic, and pragmatic characteristics will necessarily play a role in the construction of DUs in contexts consisting of a matrix and a subordinate clause.

The weight of factors affecting resolution as a function of DU configuration

We argued that the direct consequence of the DU configuration of the utterance is that factors affecting pronoun resolution will exert their effects differently as a function of whether resolution occurs intra-unit vs. inter-unit. Unlike previous accounts (cf. Miltsakaki, 2002), we do not think it is necessary to assume different processing strategies for these two processes, but rather that different factors have a different weight depending on the contextual circumstances.

We proposed that pronoun resolution is firmly rooted in the maxim of discourse coherence and that interpretation preferences will come about in the process of maintaining

coherence within the unit or establishing coherence relations between units. Based on previous studies, we predicted that referring back to topic or topic-like entities is one of the preferred mechanisms guiding pronoun interpretation within the DU, while the semantic and pragmatic content of certain elements of the utterance is behind interpretation preferences in the context of two DUs, as part of the process of establishing coherence between units. The general preference for non-clefted entities and for entities outside the scope of focus particles elicited in the experiments in Chapter 3, as well as the different interpretation patterns as a function of the semantic/pragmatic content of the focus particles *even* and *only*, on the one hand, and that of the connectives *because* and *although,* on the other, constitute evidence in line with the abovementioned predictions.

Our predictions concerning within-DU preferences should hold for other types of subordinate clauses as long as they are introduced by a connective that typically specifies topic time or space. Future research will have to show whether or not we can, for example, replicate the patterns we found with temporal subordinates introduced by the connectives *after* or *before*. Similarly, the predictions for pronoun resolution across two DUs should hold, for example, for sentence coordinations.

With respect to the factors affecting pronoun resolution investigated here, our results have yielded two important findings. The first one is the relative impact of salience in discourse processing, in general, and in pronoun resolution, in particular. Recall from the theories on the choice of a referential expression and antecedent accessibility reviewed in Chapter 1 that the prominent status of discourse entities in the speaker/hearer's mental representation was of central importance, following the general claim that the more prominent a given entity is, the more reduced the referential expression to refer back to it will be, and, likewise, the more likely and the faster it will be retrieved as the antecedent for a given pronoun. Recent psycholinguistic studies, as well as our own experiments, show that topic (and topic-like) entities enjoy a special status in pronoun resolution as they are preferentially chosen as antecedents for ambiguous pronominal expressions. Our results also show that topic and focus have different effects on pronoun interpretation, at least within sentence boundaries, which suggests that these notions need to be kept separate from the notion of salience –a notion that tends to use very lightly and, sometimes, in a misleading way. Crucially, once again context plays a major role here, as evidenced by the fact that the differential impact of information structural effects such as focus and background is relegated to the level of the utterance and, more specifically, to intra-unit contexts, outside of which its effects are attenuated or absent altogether. Across DUs, there is much less evidence available that

information structural devices work differently. The available findings suggest that they have a similar accessibility-enhancing effect (see below).

The second important (and, to the best of our knowledge, novel) finding is that focus sensitive particles, in interaction with certain connectives, behave in a similar fashion to Implicit Causality verbs in that they create expectations about the upcoming discourse, which, just like with IC verbs, result in preferences for some discourse referents over others in relation to the eventuality described by the proposition. This finding is important because it highlights the central role of expectations in discourse processing, a factor that has only started to be taken into account in studies on discourse processing in recent years. It is surely uncontroversial that both linguistic and extra-linguistic factors (e.g. world knowledge) are used to anticipate how discourse is likely to continue. However, the nature of their interaction is still an open question. With the present study we believe to have contributed to the ongoing research on this topic. Furthermore, our findings constitute evidence in favor of an account of language processing according to which interpretation is not something that occurs when linguistic material is encountered, but rather what happens when top-down expectations about the upcoming discourse interact with bottom-up linguistic evidence (Kehler & Rohde, 2013a,b; Rohde & Kehler, 2014).

Reconciling our proposal with previous results on inter-sentential pronoun resolution

While our proposal makes predictions for contexts consisting of both a single and two DUs, the items employed in our experiments were mostly examples of one-sentence contexts. The question that arises is: how can we reconcile our proposal on DUs with previous findings on inter-sentential pronoun resolution that find that topic by dislocation and focus by clefting have similar effects on participants' antecedent choices across sentence boundaries? Our account on DUs assumes that the unit always conforms to the sentence boundary (cf. examples 2.26 and 2.28 p. 91). This assumption implies that, while (1a) constitutes a single DU, (1b) constitutes 2 separate DUs. Even though both the subordinate clause in (1a) and the second sentence in (1b) convey the same type of (temporal) information, we assume that in (1a) the subordinate clause is filling the time slot of the event (but it is not a coherence relation, as these do not operate within the unit), while in (1b) we need a coherence relation to link both DUs (in this case background, elaboration, or narration, depending on the theoretical framework). The sentences in (2), on the other hand, are both examples of two DU contexts.

(1) a. It was John who slapped Paul when he was a student.
b. It was John who slapped Paul. At the time, he was a student.

(2) a. It was John who interrupted Paul because he wanted to be the center of attention.
b. It was John who interrupted Paul. He wanted to be the center of attention.

If these assumptions are correct, one can explain the preference for *Paul* in (1a), which is part of the presupposed, topic-like part of the utterance, and which, we have argued, responds to a tendency to maintain coherence by keeping the sentence topic constant, as well as the preference for *John* in (1b), which obeys a similar mechanism whereby the clefted antecedent is more easily accessed as it has been introduced as a potential new topic for the upcoming discourse (a potential topic-shift). Following our proposal that pronoun resolution between DUs occurs within the process of establishing coherence relations we predict that the preference for antecedents which have been introduced as an explicit topic in the preceding sentence or as a potential new topic by a cleft-construction will only apply for particular coherence relations, such as background, elaboration, or narration relations. In the examples in (2) the elicited preference for *John* in (2a), which is guided by the interaction of the semantics of the cleft construction and the connective *because,* should also extend to (2b), as previous studies on Implicit Causality (IC) have found that these effects occur within and across sentence boundaries. Here, too, the predictions of our proposal for resolution across DUs can easily account for these results. These predictions should, nonetheless, be corroborated by future research directly comparing one and two-sentence contexts (either making explicit the discourse relation with a connective or without a connective).

Cross-linguistic variability

One important contribution of the present dissertation is the cross-linguistic comparison of the phenomenon under investigation in English, French, and Spanish. This comparison has revealed that both the factors that contribute to the establishment of DUs and some of the factors that affect resolution in the contexts investigated have similar effects in all three languages. Critically, however, the cross-linguistic comparison has also revealed that, in the same way that factors affecting pronoun resolution exert their effects differently based on the contextual circumstances, the weight of some of these factors also varies from one language to another. Evidence for this comes from our results in French where the role of the syntactic function of the antecedent plays a bigger role in the resolution preferences than in English and

in Spanish. The strong preference for object antecedents observed in our experiments and in previous studies (cf. Colonna et al., 2012), and which has been analyzed as being the result of the existence of alternative non-ambiguous constructions in this language, suggests that, although all the factors considered are valid across languages, their manifestation depends on variations of grammar of any particular language.

To conclude, we have proposed an explanation of pronoun resolution strategies that can answer some of the questions related to inconsistencies in the psycholinguistic literature as well as results from our own experiments. However, it also makes a number of predictions that will have to be tested in future work.

Bibliography

Alexiadou, A. (2005). Left dislocation (including CLLD). In M. Everaert & H. van Riemsdijk (Eds.), *Blackwell companion to Syntax 2* (pp. 668-699). Malden, MA: Blackwell.

Alexiadou, A. & Anagnostopoulou, E. (1998). Parametrizing AGR: Word order, V-movement, and EPP-checking. *Natural Language and Linguistic Theory*, 16, 491-540.

Allopena, P.D., Magnuson, J.S., & Tanenhaus, M.K. (1998). Tracking the time course of spoken word recognition using eye movements: Evidence for Continuous Mapping models. *Journal of Memory and Language*, 38, 419-439.

Almor, A. (1999). Noun-phrase anaphora and focus: The Informational Load Hypothesis. *Psychological Review*, 106(4), 748-765.

Alonso-Ovalle, L., Fernandes-Solera, S., Frazier, L., & Clifton, C. (2002). Null vs. overt pronouns and the Topic-Focus articulation in Spanish. *Rivista di Linguistica*, 14(2), 1–19.

Altmann, G.T.M., & Kamide, Y. (1999). Incremental interpretation at verbs: Restricting the domain of subsequent reference. *Cognition*, 73(3), 247-264.

Antomo, M. (2010, November). Anaphoric adverbials. A discourse analysis of asserted and presupposed adverbial clauses. Paper presented at the 6th International Symposium of Cognition, Logic and Communication, Riga.

Antomo, M. (2011, January). Accommodation via discourse attachment. On the presupposition of temporal clauses. Paper presented at ConSOLE XIX, Groningen.

Antomo, M. (2012). Interpreting embedded Verb Second. Causal modifiers in German. In C. Constantinescu, B. Le Bruyn, & K. Linke (Eds.), *Proceedings of ConSOLE XVII* (pp. 27-51).

Ariel, M. (1990). *Accessing Noun Phrase Antecedents*. London: Routledge.

Ariel, M. (1994). Interpreting anaphoric expressions: A cognitive versus a pragmatic approach. *Journal of Linguistics*, 30, 3–42.

Arnold, J.E. (1998). *Reference Form and Discourse Patterns*. PhD dissertation, Stanford University.

Arnold, J.E. (1999). Marking salience: The similarity of topic and focus. Unpublished manuscript, University of Pennsylvania.

Arnold, J.E. (2001). The effects of thematic roles on pronoun use and frequency of reference. *Discourse Processes*, 31(2), 137-162.

Arnold, J.E., Eisenband, J.G., Brown-Schmidt, S., & Trueswell, J.C. (2000). The immediate use of gender information: eyetracking evidence of the time-course of pronoun resolution. *Cognition*, 76, B13-B26.

Asher, N. (1993). *Reference to Abstract Objects in Discourse*. Dordrecht – Boston – London : Kluwer.

Asher, N., & Lascarides, A. (1998). The Semantics and Pragmatics of Presupposition. *Journal of Semantics*, 15, 239-299.

Asher, N., & Lascarides, A. (2003). *Logics of conversation*. Cambridge: Cambridge University Press.

Atlas, J.D. (1993). The Importance of Being 'Only': Testing the Neo-Gricean Versus Neo- Entailment Paradigms. *Journal of Semantics*, 10, 301–318.

Au, T.K. (1986). A verb is worth a thousand words: The causes and consequences of interpersonal events implicit in language. *Journal of Memory and Language*, 25, 104-122.

Baayen, R.H. (2008). *Analyzing linguistic data: A practical introduction to statistics*. Cambridge: Cambridge University Press.

Baayen, R.H. (2009). Corpus linguistics in morphology: morphological productivity. In A. Luedeling & M. Kyto (Eds.), *Corpus Linguistics. An international handbook* (pp. 900-919). Berlin: Mouton De Gruyter.

Baayen, R.H., Davidson, D.J., & Bates, D.M. (2008). Mixed-effects modeling with crossed random effects for subjects and items. *Journal of Memory and Language*, 59, 390-412.

Barr, D.J. (2008). Analyzing 'visual world' eyetracking data using multilevel logistic regression. *Journal of Memory and Language*, 59, 457–474

Barr, D.J., Gann, T.M., & Pierce, R.S. (2011). Anticipatory baseline effects and information integration in visual world studies. *Acta Pyschologica*, 137(2), 201-207.

Bateman, J., & Rondhuis, K.J. (1997). Coherence relations: Toward a General Specification. *Discourse Processes*, 24(1), 5-50.

Bates, D., & Maëchler, M. (2009). Lme4: linear mixed-effects models using S4 classes. R package version 0.999375-27.
Bates, D., Maechler, M., & Bolker, B. (2011). Lme4: Linear mixed-effects models using S4 classes. R package version 0.999375-41. http://CRAN.R-Project.org/package=lme4.
Beaver, D. (2001). *Presupposition and Assertion in Dynamic Semantics*. Studies in Logic, Language and Information. Stanford, CA.: CSLI Publications.
Beaver, D., & Clark, B. (2003). Always and Only: Why not all Focus Sensitive Operators are Alike. *Natural Language Semantics*, 11(4), 323-362.
Belletti, A. (2005). Answering with a 'cleft': the role of the null subject parameter and the vp periphery. In L. Brugè, G. Giusti, N. Munaro, W. Schweikert, & G. Turano (Eds.), *Proceedings of the Thirtieth 'Incontro di Grammatica Generativa'* (pp. 63-82). Venezia: Cafoscarina.
Beyssade, C. (2013). *Sous le sens : recherche sur la modélisation des aspects dynamiques de la communication et de l'interprétation*. HDR dissertation, Université de Paris 8.
Beyssade, C., Marandin, J.M., & Rialland, A. (2001). Ground/Focus: A perspective from French. In R. Nuñez-Cedeño, L. López & R. Cameron (Eds.), *Selected papers from the 31st Linguistic Symposium on Romance Languages (LSRL)*. Amsterdam: John Benjamins.
Beyssade, C., Delais, E., Marandin, J.M., Rialland, A., & de Fornel, M. (2004). Le sens des contours intonatifs en français : croyances compatibles ou conflictuelles ? In B. Bel & I. Marlien (Eds.), *Actes des XXVes Journées d'Étude sur la Parole* (pp. 73-76). Fès, Morocco.
Beyssade, C., Hemforth, B., Marandin, J.M., & Portes, C. (2009). Prosodic markings of information focus in French. In H.Y. Yoo & E. Delais-Roussarie (Eds.), *Actes d'Interface Discours & Prosodie 2009* (pp. 109-122). Paris, France.
Bott, O., & Solstad, T. (2014). From verbs to discourse: A novel account of Implicit Causality. In B. Hemforth, B. Schmiedtová, & C. Fabricius-Hansen (Eds.), *Psycholinguistic approaches to meaning and understanding across languages* (pp. 213-251). Munich: Springer.
Brown, R. & Fish, D. (1983). The psychological causality implicit in language. *Cognition*, 14, 237–273.
Büring, D., & Hartmann, K. (2001). The Syntax and Semantics of Focus-Sensitive Particles in German. *Natural Language and Linguistic Theory*, 19, 229-281.
Caramazza, A., Grober, E., Garvey, C., & Yates, J. (1977). Comprehension of anaphoric pronouns. *Journal of Verbal Learning & Verbal Behavior*, 16, 601-609.
Cardinaletti, A. (1996). Subjects and clause structure. *University of Venice Working Papers in Linguistics*, 6, 55–95.
Carlson, L. (1983). *Dialogue Games: An approach to discourse analysis*. Dordrecht: Reidel.
Carminati, M.N. (2002). *The processing of Italian subject pronouns*. PhD dissertation, University of Massachusetts, Amherst.
Chafe, W.L. (1976). Givenness, contrastiveness, definiteness, subjects, topics and points of view. In C.N. Li (Ed.), *Subject and Topic* (pp.26-55). New York: Academic Press.
Chomsky, N. (1971). Deep structure, surface structure and semantic interpretation. In D. Steinberg & L. Jakobovits (Eds.), *Semantics, an Interdisciplinary Reader in Linguistics, Philosophy and Psychology* (pp.183-216). Cambridge: CUP.
Chomsky, N. (1981). *Lectures in Government and Binding*. Studies in generative grammar 9. Dordrecht: Foris.
Cinque, G. (1990). *Types of A'-dependencies*. Cambridge, MA: MIT Press.
Clackson, K., Felser, C., & Clahsen, H. (2011). Children's processing of reflexives and pronouns in English: Evidence from eye movements during listening. *Journal of Memory and Language*, 65, 128-144.
Clark, H.H., & Haviland, S.E. (1977). Comprehension and the given-new contract. In R.O. Freedle (Ed.), *Discourse production and comprehension* (pp. 1-40). Hillsdale, NJ: Erlbaum
Clech-Darbon, A., Rebuschi, G., & Rialland, A. (1999). Are there cleft sentences in French? In G. Rebuschi & L. Tuller (Eds.), *The Grammar of Focus* (pp. 83-113). Amsterdam: John Benjamins.
Colinet, M., & Winterstein, G. (2013, July). Juste, marqueur scalaire d'exclusion. Paper presented at the 6e Rencontres de Sémantique et Pragmatique (RSP 6), Université d'Orléans.
Collingwood, R. (1940). *An Essay on Metaphysics*. Oxford: Clarendon Press.

Colonna, S., Schimke, S., & Hemforth, B. (2010). Le rôle de la structure informationnelle dans l'interprétation d'une anaphore pronominale inter-phrastique. In F. Neveu, V. Muni Toke, J. Durand, T. Klingler, L. Mondada & S. Prévost (Eds.), *Actes du Congrès Mondial de Linguistique Française* (pp. 1489-1499). Paris, France.

Colonna, S., Schimke, S., & Hemforth, B. (2012). Information structure effects on anaphora resolution in German and French: A cross-linguistic study of pronoun resolution. *Linguistics*, 50(5), 991-1013.

Colonna, S., Schimke, S., & Hemforth, B. (2014). Information structure and pronoun resolution in German and French: Evidence from the visual-world paradigm. In B. Hemforth, B. Schmiedtová, & C. Fabricius-Hansen (Eds.), *Psycholinguistic approaches to meaning and understanding across languages* (pp. 175-195). Munich: Springer.

Colonna S., Schimke S., & Hemforth B. (2015). Different effects of focus in intra- and intersentential pronoun resolution in German. *Language, Cognition and Neuroscience*. DOI: 10.1080/23273798.2015.1066510

Contreras, H. (1976). *A theory of word order with special reference to Spanish*. Amsterdam: North Holland.

Cooper, R.M. (1974). Control of eye fixation by meaning of spoken language: New methodology for real-time investigation of speech perception, memory, and language processing. *Cognitive Psychology*, 6, 84-107.

Cowles, H.W. (2003). *Processing information structure: Evidence from comprehension and production*. PhD dissertation, UCSD.

Cowles, H.W., Walenski, M., & Kluender, R. (2007). Linguistic and cognitive prominence in anaphor resolution: Topic, contrastive focus and pronouns. *Topoi*, 26, 3–18.

Crain, S., Ni, W., & Conway, L. (1994). Learning, Parsing and Modularity. In C. Clifton, L. Frazier, & K. Rayner (Eds.), *Perspectives on Sentence Processing* (pp- 443-467). Hillsdale, NJ: Lawrence Erlbaum Associates, Inc.

Crawley, R.A., Stevenson, R. J., & Kleinman, D. (1990). The use of heuristic strategies in the interpretation of pronouns. *Journal of Psycholinguistic Research*, 19, 245-264.

De Cat, C. (2002). *French Dislocation*. PhD dissertation, University of York.

Degand, L., & Simon, A.C. (2005). Minimal Discourse Units: Can we define them, and why should we? In M. Aurnague, M. Bras, A. Le Draoulec, & L. Vieu (Eds.), *Proceedings of SEM-05. Connectors, discourse framing and discourse structure: from corpus-based and experimental analyses to discourse theories* (pp. 65-74). Biarritz, France.

Desmette, D., Hupet M., Schelstraete, M.A., & Van Der Linden, M. (1995). Adaptation en Langue Française du "Reading Span Test" de Daneman et Carpenter (1980). *L'Année Psychologique*, 95(3), 459-482.

Destruel, E. (2013). *An empirical investigation of the meaning and use of the French c'est-cleft*. PhD dissertation, University of Texas, Austin.

Di Eugenio, B. (1990). Centering Theory and the Italian Pronominal System. In H. Karlgren (Ed.), *Proceedings 13th International Conference on Computational Linguistics (COLING90)* (pp. 270-275). Helsinki, Finland.

Di Eugenio, B. (1998). Centering in Italian. In E. Prince, A. Joshi, & L. Walker (Eds.), *Centering in Discourse*. Oxford: Oxford University Press.

Doetjes, J., Delais-Roussarie, E., & Sleeman, P. (2002). The prosody of left detached constituents in French. In B. Bell & I. Marlien (Eds.), *Proceedings of Speech Prosody 2002* (pp. 247-250). Aix-en-Provence, France.

Doetjes, J., Rebuschi, G., & Rialland, A. (2004). Cleft Sentences. In F. Corblin & H. De Swart (Eds.), *Handbook of French Semantics*. Stanford: CSLI Publications.

Dowty, D.R. (1991). Thematic Proto-Roles and Argument Selection. *Language*, 67, 547-619.

Drenhaus, H., Zimmermann, M., & Vasishth, S. (2011). Exhaustiveness effects in clefts are not truth-functional. *Journal of Neurolinguistics*, 24, 320-337.

Duchowski, A.T. (2007). *Eye tracking methodology: Theory and practice*. London: Springer.

É. Kiss, K. (1998). Identificational focus versus information focus. *Language*, 74(2), 245–273.

É. Kiss, K. (1999). The English cleft construction as a focus phrase. In L. Mereu (Ed.), *Boundaries of Morphology and Syntax* (pp. 217-229). Amsterdam: John Benjamins.
Eberhard, K., Spivey-Knowlton, M., Sedivy, J., & Tanenhaus, M. (1995). Eye movements as a window into real-time spoken language comprehension in natural contexts. *Journal of Psycholinguistic Research*, 24, 409–436.
Ehrlich, K. (1980). Comprehension of pronouns. *Quaterly Journal of Experimental Psychology*, 32, 247-255.
Ellert, M. (2013). Resolving ambiguous pronouns in a second language: A visual-world eye-tracking study with Dutch learners of German. *International Review of Applied Linguistics in Language Teaching*, 51(2), 171–197.
Erlewine, M.Y. (2015). Minimality and focus-sensitive adverb placement. In T. Bui & D. Özyıldız (Eds.), *NELS 45: Proceedings of the 45th North East Linguistics Society* (pp. 193-202).
Erteschik-Shir, N. (1997). *The Dynamics of Focus Structure*. Cambridge: CUP.
Erteschik-Shir, N., Ibnbari, L., & Taube, S. (2013). Missing objects as topic drop. *Lingua*, 136, 145–169.
Ferreira, F. (1994). Choice of passive voice is affected by verb type and animacy. *Journal of Memory and Language*, 33, 715-736.
Ferstl, E., Garnham, A., & Manouilidou, C. (2011). Implicit causality bias in English: a corpus of 300 verbs. *Behavioral Research*, 43, 124–135.
Filiaci, F. (2010). Null and overt subject biases in Spanish and Italian: a cross-linguistic comparison. In C. Borgonovo, M. Español-Echevarría, & Ph. Prévost (Eds.), *Selected Proceedings of the 12th Hispanic Linguistic Symposium* (pp. 171–182). Somerville, MA: Cascadilla Proceedings Project.
Filiaci, F., Sorace, A., & Carreiras, M. (2013). Anaphoric biases of null and overt subjects in Italian and Spanish: a cross-linguistic comparison. *Language, Cognition, and Neuroscience*, 29, 825–843.
Filik, R., Paterson, K.V., & Liversedge, S.P. (2009). The influence of only and even on online semantic interpretation. *Psychonomic Bulletin & Review*, 16(4), 678-83.
Foraker, S. (2004). *The mechanisms involved in the prominence of referent representations during pronoun coreference*. PhD dissertation, New York University.
Foraker, S. & McElree, B. (2007). The role of prominence in pronoun resolution: Active versus passive representations. *Journal of Memory and Language*, 56, 357–383.
Fradin, B. (1988). Approche des constructions à détachement : la reprise interne. *Langue francaise*, 78, 26-56.
Fradin, B. (1990). Approche des constructions à détachement : inventaire. *Revue Romane*, 25(1), 3-34.
Frana, I. (2008). The role of discourse prominence in the resolution of referential ambiguities: Evidence from co-reference in Italian. *University of Massachusetts Occasional Papers in Linguistics 37: Semantics and Processing*. Amherst: GLSA.
Frascarelli, M., & Hinterhölzl, R. (2007). Types of topics in German and Italian. In K. Schwabe & S. Winkler (Eds.), *On information structure, meaning and form: Generalizations across languages*. Amsterdam: John Benjamins.
Frazier, L. (1979). *On comprehending sentences: Syntactic parsing strategies*. PhD dissertation, University of Connecticut.
Frazier, L. (1987). Sentence processing: a tutorial review. In M. Coltheart (Ed.), *Attention and performance XII: The Psychology of Reading* (pp. 559-586). Hillsdale, NJ: Lawrence Erlbaum Associates.
Frazier, L., Pacht, J.M., & Rayner, K. (1999). Taking on semantic commitments, II: Collective versus distributive readings. *Cognition*, 70(1), 87-104.
Frey, W. (2003). Syntactic conditions on adjunct classes. In E. Lang, C. Maienborn & C. Fabricius-Hansen (Eds.), *Modifying Adjuncts* (Interface Explorations 4) (pp. 163-209). Berlin: Mouton de Gruyter.
Garvery, C., & Caramazza, A. (1974). Implicit causality in verbs. *Linguistic Inquiry*, 5(3), 459–464.
Garvey, C., Caramazza, A., & Yates, J. (1976). Factors influencing assignment of pronoun antecedents. *Cognition*, 3, 227-243.
Geis, M.L. (1970). *Adverbial subordinate clauses in English*. PhD dissertation, MIT.

Gelormini-Lezama, C., & Almor, A. (2011). Repeated names, overt pronouns and null pronouns in Spanish. *Language and Cognitive Processes*, 26(3), 437-454.
Gernsbacher, M.A. (1989). Mechanisms that improve referential access. *Cognition*, 32, 99-156.
Gernsbacher, M.A., & Hargreaves, D.J. (1988). Accessing sentence participants: the advantage of first mention. *Journal of Memory and Language*, 27, 699-717.
Geurts, B., & van der Sandt, R. (2004) Interpreting focus. *Theoretical Linguistics*, 30, 1–44.
Ginzburg, J. (1996). Dynamics and the semantics of dialogue. In J. Seligman (Ed.), *Language, Logic and Computation 1*, CSLI Lecture Notes (pp. 221-237). Standford: CSLI.
Ginzburg, J. (2012). *The Interactive Stance: Meaning for Conversation*. Oxford: Oxford University Press.
Givón, T. (1983). *Topic Continuity in Discourse*. Amsterdam: John Benjamins.
Goikoetxea, E., Pascual, G., & Acha, J. (2008). Normative study of implicit causality in 100 interpersonal verbs in Spanish. *Behavior Research Methods, Instruments, & Computers*, 40, 760-772.
Gordon, P.C., Grosz, B.J., & Gilliom, L.A. (1993). Pronouns, names, and the centering of attention in discourse. *Cognitive Science*, 17, 311-347.
Greene, S. B., & McKoon, G. (1995). Telling something we can't know: Experimental approaches to verbs exhibiting implicit causality. *Psychological Science*, 6(5), 262-270.
Grice, H.P. (1975). Logic and Conversation. In P. Cole & J. Morgan (Eds.), *Syntax and Semantics 3: Speech Acts* (pp. 41-58). London: Academic Press.
Grober, E.H., Beardsley, W., & Caramazza, A. (1978). Parallel function strategy in pronoun assignment. *Cognition*, 6, 117-133
Grosz, B.J., & Snider, C.L. (1986). Attention, intentions, and the structure of discourse. *Computational Linguistics*, 12(3), 175-204.
Grosz, B.J., Weinstein, S., & Joshi, A.K. (1995). Centering: A framework for modeling the local coherence of discourse. *Computational Linguistics*, 21, 203-225.
Grüter, T., Hurtado, N., & Fernald, A. (2012). Interpreting object clitics in real-time: eye-tracking evidence from 4-year-old and adult speakers of Spanish. In A.K. Biller, E.Y. Chung & A.E. Kimball (Eds.), *Proceedings of the 36th Annual Boston University Conference on Language Development* (pp. 213-225). Somerville, MA: Cascadilla Press.
Gundel, J.K. (1988). Universals of topic–comment structure. In M. Hammond, E. Moravcsik & J. Worth (Eds.), *Studies in Syntactic Typology* (pp. 209-239). Amsterdam: John Benjamins.
Gundel, J.K. (2003). Information structure and referential givenness/newness : How much belongs in the grammar? In S. Müller (Ed.), *Proceedings of the 10th International Conference onHead-Driven Phrase Structure Grammar* (pp. 122-142). Standford, CA: CSLI publications.
Gundel, J.K., Hedberg, N., & Zacharski, R. (1993). Cognitive status and the form of referring expressions in discourse. *Language and Cognitive Processes*, 69, 274-307.
Haegeman, L. (2003). Conditional clauses: External and internal syntax. *Mind & Language*, 18(4), 317-339.
Haegeman, L. (2009). The movement analysis of temporal adverbial clauses. *English Language & Linguistics*, 13(3), 385-408.
Haegeman, L. (2010). The internal syntax of adverbial clauses. *Lingua*, 120(3), 628-648.
Haegeman, L., Meinunger, A., & Vercauteren, A. (2014). The architecture of it clefts. *Journal of Linguistics*, 50(2), 269-296.
Halliday, M.A.K. (1967). Notes on transitivity and theme in English, Part 2. *Journal of Linguistics*, 2, 199-244.
Halliday, M.A.K., & Ruqaiya, H. (1976). *Cohesion in English*. London: Longman.
Halvorsen, P.-K. (1976). Syntax and semantics of cleft sentences. In S. Mufwene, C. Walker & S. Steever (Eds.), *Papers from the 12th Regional Meeting of the Chicago Linguistic Society* (pp. 217-286). Chicago, IL.
Halvorsen, P.-K. (1978). *The syntax and semantics of cleft constructions*. PhD dissertation, University of Texas, Austin.
Hamlaoui, F. (2007). French cleft sentences and the syntax-phonology interface. In M. Radišić (Ed.), *Proceedings of the 2007 Annual Conference of the Canadian Linguistic Association*.

Harris, J.A., & Carlson, K. (2014, March). Focus preferences for focus-sensitive particles (and why). Poster presented at the 27th Annual CUNY Conference on Human Sentence Processing, Ohio State University.
Hartshorne, J. (2013). What is implicit causality? *Language, Cognition and Neuroscience*, 29(7), 804-824.
Hedberg, N. (2000). The referential status of clefts. *Language*, 76: 891-920.
Hemforth, B., Konieczny, L., Scheepers, C., Colonna, S., Schimke, S., & Pynte, J. (2010). Language specific preferences in anaphor resolution: Exposure or gricean maxims? In S. Ohlsson, S & R. Catrambone (Eds.), *Proceedings of the 32nd Annual Conference of the Cognitive Science Society* (pp. 2218-2223), Portland, OR.
Hendriks, P. (2004). Coherence relations, ellipsis, and contrastive topics. *Journal of Semantics,* 21, 133-153.
Hernanz, M.L., & Brucart, J.M. (1987). *La sintaxis*. Barcelona: Editorial Crítica.
Heycock, C. (2005). Embedded Root Phenomena. In M. Everaert & H. van Riemsdijk (Eds.), *The Blackwell Companion to Syntax* (pp. 174-209). Oxford: Blackwell.
Hobbs, J.R. (1979). Coherence and coreference. *Cognitive Science*, 3, 67-90.
Hobbs, J.R. (1990). *Literature and cognition*. Menlo Park, CA: CSLI.
Hobbs, J.R., Stickel, M.E., Douglas, E.A., & Martin, P. (1993). Interpretation as abduction. *Artificial Intelligence*, 63, 69-142.
Hooper, J.B., & Thompson, S.A. (1973). On the applicability of root transformations. *Linguistic Inquiry*, 4, 465-497.
Horn, L. (1969). A presuppositional analysis of only and even. In *CLS 5: Papers from the 5th Regional Meeting of the Chicago Linguistic Society* (pp. 97-107). Chicago, IL.
Horn, L. (1981). Exhaustiveness and the semantics of clefts. In V. Burke & J. Pustejovsky (Eds.), *Papers from the 11th Annual Meeting of NELS* (pp. 124-142). Amherst: GLSA.
Horn, L. (2002). Assertoric Inertia and NPI Licensing. In *The Panels, Chicago Linguistic Society, 38*, (pp. 55-82). Chicago, IL.
Hualde, J.I. (2005). *The sounds of Spanish*. Cambridge: CUP.
Huber, S. (2006). On the theory of presentation. In F. Heinat, E. Klingvall & S. Manninen (Eds.), *The Department of English: Working Papers in English Linguistics, volume VI*. Lund University.
Huettig F., Rommers J., & Meyer A.S. (2011). Using the visual world paradigm to study language processing: a review and critical evaluation. *Acta Psychologica*, 137, 151-171.
Ippolito, M. (2008). On the meaning of Only. *Journal of Semantics*, 25(1), 45-91.
Iten, C. (1998). The meaning of although: A Relevance Theoretic account. In J. Harris & C. Iten (Eds.), *UCL Working Papers in Linguistics*, 10.
Jackendoff, R.S. (1972). *Semantic Interpretation in Generative Grammar*. Cambridge, MA: MIT Press.
Jacobs, J. (1983). *Fokus und Skalen. Zur Syntax und Semantik der Gradpartikeln im Deutschen*. Tübingen: Niemeyer.
Jaeger, T.F. (2008). Categorical data analysis: Away from ANOVAs (transformation or not) and towards Logit mixed models. *Journal of Memory and Language*, 59(4), 434–446.
Jaeggli, O., & Safir, K.J. (1989). *The Null Subject Parameter*. Dordrecht: Reidel.
Järvikivi, J., Pyykkönen-Klauck, P., Schimke, S., Colonna, S., & Hemforth, B. (2014). Information structure cues for 4-year- olds and adults: Tracking eye movements to visually pre- sented anaphoric referents. *Language, Cognition and Neuroscience*, 29(7), 877–892.
Jegerski, J., VanPatten, B., & Keating, G.D. (2011). Cross-linguistic variation and the acquisition of pronominal reference in L2 Spanish. *Second Language Research*, 33(2), 193-221.
Jespersen, O. (1937/1969). *Analytic syntax*. New York: Holt, Rinehart and Winston.
Johnston, M. (1994). *The syntax and semantics of adverbial adjuncts*. PhD dissertation, UCSC.
Kaiser, E. (2011). Focusing on pronouns: Consequences of subjecthood, pronominalisation, and contrastive focus. *Language and Cognitive Processes*, 26, 1625–1666.
Kaiser, E., & Trueswell, J.C. (2008). Interpreting pronouns and demonstratives in Finnish: Evidence for a form-specific approach to reference resolution. *Language and Cognitive Processes*, 23(5), 709–748.

Kaiser, E., Runner, J.T., Sussman, R.S., & Tanenhaus, M.K. (2009). Structural and semantic constraints on the resolution of pronouns and reflexives. *Cognition*, 112, 55-80.

Kameyama, M. (1993). Intrasentential centering. In *Proceedings of the Workshop on Centering Theory in Naturally Occurring Discourse*. Institute for Resarch Cognitive Science, University of Pennsylvania.

Kameyama, M. (1998). Intrasentential centering: A case study. In M. Walker, A. Joshi, & E. Prince (Eds.), *Centering Theory in Discourse*. Oxford: Clarendon Press.

Kamp, H. (1981). A theory of truth and semantic representation. In J.A.G. Groenendijk, T.M.V. Janssen & M.B.J. Stokhof (Eds.), *Formal Methods in the Study of Language* (pp. 483-512). Amsterdam: Mathematical Centre Tracts.

Kamp, H., & Reyle, U. (1993). *From Discourse to Logic*. Dordrecht: Kluwer.

Kato, M. A. (1999). Strong and weak pronominals and the null subject parameter. *Probus*, 11(1), 1-38.

Katz, S. (2000). Categories of C'est-Cleft Constructions. *Revue Canadienne de Linguistique*, 45(3/4), 1001–1021.

Keating, G.D., VanPatten, B., & Jegerski, J. (2011). Who was walking on the beach? Anaphora resolution in Spanish heritage speakers and adult second language learners. *Studies in Second Language Acquisition*, 33(2), 193-221.

Kehler, A. (2002). *Coherence, Reference, and the Theory of Grammar*. CSLI Publications.

Kehler, A. (2005). Coherence-Driven Constraints on the Placement of Accent. In E. Georgala & J. Howell (Eds.), *Proceedings of the 15th Conference on Semantics and Linguistic Theory (SALT-15)* (pp. 98-115). University of California, Los Angeles.

Kehler, A. (2008). Rethinking the SMASH approach to pronoun interpretation. In J. Gundel & N. Hedberg (Eds.), *Interdisciplinary perspectives on reference processing* (pp. 95-122). Oxford: Oxford University Press, New Directions in Cognitive Science Series.

Kehler, A. (2012). *Cohesion and Coherence*. In C. Maienborn, K. von Heusinger & P. Portner (Eds.), *Semantics: An International Handbook of Natural Language Meaning* (pp. 1963-1987). Berlin – New York: de Gruyter.

Kehler, A., & Rohde, H. (2013a). A Probabilistic Reconciliation of Coherence-Driven and Centering-Driven Theories of Pronoun Interpretation. *Theoretical Linguistics*, 39, 1-37.

Kehler, A., & Rohde, H. (2013b). Aspects of a theory of pronoun interpretation. *Theoretical Linguistics*, 39(3-4), 295-309.

Kehler, A., Kertz, L., Rohde, H., & Elman, J. (2008). Coherence and Coreference Revisited. *Journal of Semantics* (Special Issue on Processing Meaning), 25(1), 1–44.

Kim, S. (2011). *Focus particles at syntactic, semantic and pragmatic interfaces: The acquisition of only and even in English*. PhD dissertation, University of Hawai'i.

Kim, C. (2012). *Generating Alternatives: Interpreting Focus in Discourse*. PhD dissertation, University of Rochester.

Kim, C., Gunlogson, C., Tanenhaus, M.K., & Runner, J.T. (2015). Context-driven expectations about focus alternatives. *Cognition* 139, 28-49.

Kiparsky, P. & Kiparsky, C. (1970). Fact. In M. Bierwisch & K.E. Heidolph (Eds.), *Progress in Linguistics* (pp. 143-173). The Hague: Mouton.

König, E. (1985). On the history of concessive connectives in English. Diachronic and synchronic evidence. *Lingua*, 66, 1-19.

König, E. (1986). Conditionals, concessive conditionals, and concessives: areas of contrast, overlap, and neutralization. In E.C. Traugott, A. ter Meulen, J. Snitzer Reilly & C.A. Ferguson (Eds.), *On Conditionals* (pp. 229-246). Cambridge: CUP.

König, E. (1988). Concessive connectives and concessive sentences. Crosslinguistic regularities and pragmatic principles. In J. Hawkins (Ed.), *Explaining Language Universals* (pp. 145-166). Oxford: Basil Blackwell.

König, E. (1989). On the historical development of focus particles. In H. Weydt (Ed.), *Sprechen mit Partikeln* (pp. 318-329). Berlin: de Gruyter.

König, E. (1991). *The meaning of focus particles. A comparative perspective*. London: Routledge.

König, E., & Siemund, P. (2000). Causal and concessive clauses: Formal and semantic relations. In E. Couper-Kuhlen & B. Kortmann (Eds.), *Cause, Condition, Concession, Contrast: Cognitive and Discourse Perspectives* (pp. 341-360). Berlin: Mouton.

Koornneef, A.W. & Sanders, T.J.M. (2013). Establishing coherence relations in discourse: the influence of implicit causality and connectives on pronoun resolution. *Language and Cognitive processes*, 28, 1169-1206.

Koornneef, A.W. & van Berkum, J.J.A. (2006). On the use of verb-based implicit causality in sentence comprehension: Evidence from self-paced reading and eye tracking. *Journal of memory and language*, 54, 445-465.

Krifka, M. (1999). Additive particles under stress. In D. Strolovitch & A. Lawson (Eds.), *Proceedings of Semantics and Linguistic Theory (SALT) 8* (pp. 111-128). Cornell University: CLC Publications.

Krifka, M. (2007). Basic notions of information structure. In C. Fery & M. Krifka (Eds.), *Interdisciplinary Studies on Information Structure 6* (pp. 13-56). Potsdam: Universitätsverlag.

Krifka, M. (2008). Information structure Notional distinctions, ways of expression. In P. van Sterkenburg (Ed.), *Unity and diversity of languages* (pp. 123-136). Amsterdam: John Benjamins.

Kuno, S. (1972). Functional sentence perspective. *Linguistic Inquiry*, 3, 269-320.

Kuno, S. (1978). Generative discourse analysis in America. In W. Dressler (Ed.), *Current Trends in Text Linguistics* (pp. 275-295). Berlin – New York: de Gruyter.

Lambrecht, K. (1987). Sentence focus, information structure, and the thetic-categorical distinction. In J. Aske, N. Beery, L. Michaelis & H. Filip (Eds.), *Proceedings of the Thirteenth Annual Meeting of the Berkeley Linguistics Society* (pp. 366-382). Berkeley, California.

Lambrecht, K. (1988). Presentational cleft constructions in spoken French. In J. Haiman & S. Thompson (Eds.), *Clause combining in grammar and discourse* (pp. 135-180). Amsterdam: John Benjamins.

Lambrecht, K. (1994). *Information structure and sentence form: Topic, focus, and the mental representations of discourse referents*. Cambridge: Cambridge University Press.

Lambrecht, K. (2001). A framework for the analysis of cleft con- structions. *Linguistics*, 39(3), 463–516.

Larson, R.K., & Sawada, M. (2012). Root transformations and quantificational structure. In L. Haegeman, R. Nye & L. Aelbrecht (Eds.), *Main Clause Phenomena: New Horizons* (pp. 47-77). Amsterdam: John Benjamins.

Levin, B., & Rappaport Hovav, M. (2005). *Argument Realization*. Cambridge: Cambridge University Press.

Luján, M. (1985). Binding properties of overt pronouns in null pronominal languages. *Chicago Linguistic Society 21* (pp. 424-438). Chicago, IL.

Luján, M. (1986). Stress and binding of pronouns. Papers from the Parasession on Pragmatics and Grammatical Theory. *Chicago Linguistic Society*, 22(2) (pp. 248-262). Chicago, IL.

Luján, M. (1987). Los pronombres implícitos y explícitos del español. *Revista Argentina de Lingüística*, 3, 19-54.

Luján, M. (1999). Expresión y Omisión del Pronombre Personal. In I. Bosque & V. Demonte (Eds.), *Gramática Descriptiva de la Lengua Española*. Real Academia Española: Colección Nebrija & Bello. Fundación Ortega y Gasset (pp. 1276-1315). Madrid: Espasa-Calpe.

MacDonald, M.C., Pearlmutter, M., & Seidenberg, M. (1994).The Lexical Nature of Ambiguity Resolution. *Psychological Review*, 101: 676–703.

Mak, W.M., & Sanders, T.J.M. (2010). Incremental discourse processing: How coherence relations influence the resolution of pronouns. In M. Everaert, T. Lentz, H. de Mulder, Ø. Nilsen & A. Zondervan (Eds.), *The Linguistics Enterprise: From knowledge of language to knowledge in linguistics* (pp. 167-182). Amsterdam: John Benjamins.

Matin, E., Shao, K.C., & Boff, K.R. (1993). Saccadic overhead: Information-processing time with and without saccades. *Perception & Psychophysics*, 53, 372-380

McKoon, G., Greene, S.B., & Ratcliff, R. (1993). Discourse models, pronoun resolution, and the implicit causality of verbs. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, 19, 1040-1052.

Miles, W.R. (1930). Ocular dominance in human adults. *Journal of General Psychology*, 3, 412-429.

Miltsakaki, E. (2002). Toward an aposynthesis of topic continuity and intrasentential anaphora. *Computational Linguistics*, 28(3), 319–355.

Montalbetti, M. (1984). After binding: *On the interpretation of pronouns*. PhD dissertation, MIT.
Nicol, J.L., & Swinney, D.A. (2003). The pyscholinguistics of anaphora. In A. Barrs (Ed.), *Anaphora. A reference guide* (pp. 140-171). Oxford: Blackwell Press.
Olarrea, A. (1996). *Pre and postverbal subjects in Spanish: A minimalist account*. PhD dissertation, University of Washington, Seattle.
Olarrea, A. (2012). Word order and information structure. In J.I. Hualde, A. Olarrea & E. O'Rourke (Eds.), *The Handbook of Hispanic Linguistics* (pp. 603-628). Malden, MA & Oxford: Wiley-Blackwell.
Ordoñez, F., & Treviño, E. (1999). Left-dislocated subjects and the pro-drop parameter: A case-study of Spanish. *Lingua*, 107, 39-68.
Ortega-Santos, I. (2005). On locative inversion and the EPP in Spanish. In R.M. Ortiz Ciscomani (Ed.), *Actas del VIII Encuentro Internacional de Lingüistica del Noroeste de la Universidad de Sonora* (pp. 131-150). Universidad de Sonora, México.
Paterson, K.B., Liversedge, S.P., Filik, R., Juhasz, B.J., White, S.J., & Rayner, K.(2007). Processing contrastive focus during silent reading: Evidence from eyemovements. *Quarterly Journal of Experimental Psychology*, 60, 1423-1445.
Percus, O. (1997). Prying Open the Cleft. In K. Kusumoto (Ed.), *Proceedings of the 27th Annual Meeting of the North-East Linguistics Society (NELS)* (pp. 337–351). Amherst, MA: GLSA Publications.
Prince, E.F. (1978). Acomparison of wh-clefts and it-clefts in discourse. *Language*, 54, 883-906.
Prince, E.F. (1981). Toward a taxonomy of given-new information. In Cole, P. (ed.), *Radical Pragmatics* (pp. 223-256). New York: The Academic Press.
Prince, E.F. (1985). Fancy syntax and shared knowledge. *Journal of Pragmatics*, 9(1), 65-81.
Prince, E.F. (1986). On the syntactic marking of presupposed open propositions. In A.M. Farley, P.T. Farley & K.-E. McCullough (Eds.), In *Proceedings of CLS 22*: Papers from the parasession on pragmatics and grammatical theory (pp. 208-222). Chicago: IL.
Prince, E.F. (1998). On the limits of syntax, with reference to topicalization and left-dislocation. In P. Culicover & L. McNally (Eds.), *Syntax and Semantics, 29: The limits of Syntax* (pp. 281-302). New York: Academic Press.
Quirk, R., Greenbaum, S., Leech, G., & Svartvik, J. (1985). *A comprehensive grammar of the English language*. London: Longman.
R Development Core Team (2009). R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria. URL http://www.R-project.org.
Reinhart, T. (1976). *The Syntactic Domain of Anaphora*. PhD dissertation, MIT.
Reinhart, T. (1981). Pragmatics and linguistics: an analysis of sentence topics. *Philosophica*, 27(1), 53-94.
Reinhart, T. (1983). *Anaphora and semantic interpretation*. Chicago: The University of Chicago Press.
Reinhart, T. (2006). *Interface Strategies: Reference-set Computation*. Cambridge, MA: MIT Press.
Repp, S., & Drenhaus, H. (2011, September). Working memory effects of information structure in German left dislocation (GLD). Poster presented at Architectures and Mechanisms of Language Processing 2011, Université Paris-Descartes.
Roberts, C. (1996). Information structure in discourse: Towards an integrated formal theory of pragmatics. In J.H. Yoon & A. Kathol (Eds.), *OSUWPL Volume 49: Papers in Semantics* (pp. 1-69). The Ohio State University Department of Linguistics.
Roberts, C. (1998). Focus, the flow of information, and Universal Grammar. In P. Culicover & L. McNally (Eds.), *Syntax and Semantics, 29: The limits of Syntax* (pp. 109-160). New York: Academic Press.
Roberts, C. (2012). Information structure in discourse: Towards an integrated formal theory of pragmatics. *Semantics and Pragmatics*, 5, 1-69.
Rochemont, M.S. (1986). *Focus in generative grammar*. Amsterdam: John Benjamins.
Rohde, H. (2008). *Coherence-Driven Effects in Sentence and Discourse Processing*. PhD dissertation, University of California, San Diego.

Rohde, H. & Kehler, A. (2014). Grammatical and information-structural influences on pronoun production. *Language, Cognition, and Neuroscience*, Special Issue on Production of Referring Expressions: Models and Empirical Data, 912-927.

Rooth, M. (1985). *Association with Focus*. PhD dissertation, University of Massachusetts, Amherst.

Rooth, M. (1992). A theory of focus interpretation. *Natural Language Semantics*, 1, 75–116.

Runner, J.T., & Ibarra, A. (in press). Information structure effects on null and overt subject comprehension in Spanish. In A. Holler, C. Göb & K. Suckow (Eds.), *Empirical perspectives on anaphora resolution: Information structural evidence in the race for salience*. Berlin: de Gruyter.

Runner, J.T., Sussman, R.S., & Tanenhaus, M.K. (2003). Assignment of Reference to Reflexives and Pronouns in Picture Noun Phrases: Evidence from Eye Movements. *Cognition*, 89, B1- B13.

Sæbø, K.J. (2011). Adverbial Clauses. In K. von Heusinger, C. Maienborn & P. Portner (Eds.), *Semantics. An International Handbook of Natural Language Meaning, 2* (pp. 1420-1441). Berlin: Mouton de Gruyter.

Sanders, T.J.M. (2005). Coherence, causality and cognitive complexity in discourse. In M. Aurnague & M. Bras (Eds.), *Proceedings of the First International Symposium on the Exploration and Modelling of Meaning* (pp. 105-114). Université de Toulouse-le-Mirail, France.

Sawada, M., & Larson., R.K. (2004). Presupposition & root transforms in adjunct clauses. In M. Wolf & K. Moulton (Eds.), *Proceedings of NELS 34* (pp. 517-528). UMASS: GLSA.

Sekerina, I. (2012). The Effect of Grammatical Gender in Russian Spoken-Word Recognition. In V. Makarova (Ed.), *Russian Language Studies in North America. New Perspectives in Theoretical and Applied Linguistics* (pp. 107-132). London – New York: Anthem Press.

Sgall, P., & Hajičová, E. (1977). Focus on focus I. *Prague Bulletin of Mathematical Linguistics*, 28, 5-54.

Sgall, P., & Hajičová, E. (1978). Focus on focus II. *Prague Bulletin of Mathematical Linguistics*, 29, 23-41.

Sgall, P., Hajicová, E., & Panevová, J. (1986). *The meaning of the sentence in its semantic and pragmatic aspects*. Praha: Academia.

Sheldon, A. (1974). The role of parallel function in the acquisition of relative clauses in English. *Journal of Verbal Learning and Verbal Behavior*, 13, 278-281.

Sidiropoulou, M. (1992). On the connective although. *Journal of Pragmatics*, 17, 201-221.

Smyth, R. (1994). Grammatical determinants of ambiguous pronoun resolution. *Journal of Psycholinguistic Research*, 23(3), 197-229.

Solstad, T. (2010). Some new observations on 'because (of)'. In M. Aloni, H. Bastiaanse, T. de Jager & K. Schulz (Eds.). *Logic, Language, and Meaning*. The 17th Amsterdam Colloquium. Lecture Notes in Artificial Intelligence (pp. 436-445). Berlin: Springer.

Spalek, K., Gotzner, N., & Wartenburger, I. (2014). Not only the apples: Focus sensitive particles improve memory for information-structural alternatives. *Journal of Memory and Language*, 70, 68-84.

Stalnaker, R. (1978). Assertion. In P. Cole (Ed.), *Syntax and Semantics, 9* (pp. 315-322). New York: Academic Press.

Stalnaker, R. (2002). Common Ground. *Linguistics and Philosophy*, 25(5-6), 701-721.

Stevenson, R.J., Nelson, A.W.R., & Stenning, K. (1993). Strategies in pronoun comprehension. In *Proceedings of the 15th annual conference of the Cognitive Science Society* (pp. 976-981). Hillsdale, NJ: Lawrence Erlbaum Associates Inc.

Stevenson, R.J., Crawley, R.A., & Kleinman, D. (1994). Thematic roles, focus and the representation of events. *Language and Cognitive Processes*, 9(4), 519-548.

Stevenson, R.J., Nelson, A.W.R., & Stenning, K. (1995). The role of parallelism in strategies of pronoun comprehension. *Language and Speech*, 38, 393-418.

Stewart, A.J., Pickering, M.J., & Sanford, A J. (2000). The time course of the influence of implicit causality information: Focusing versus integration accounts. *Journal of Memory and Language*, 42(3), 423-443.

Suñer, M. (2003). The Lexical Preverbal Subject in a Romance Null Subject Language: Where Art Thou? In R. Núñez-Cedeño, L. López & R. Cameron (Eds.), *A romance perspective on*

language knowledge and use: Selected papers from the 31st Linguistic Symposium on Romance Languages (LSRL) (pp. 341-357). Amsterdam – Philadelphia: John Benjamins.
Tanenhaus, M.K., & Spivey-Knowlton, M.J. (1996). Eye-tracking. *Language and Cognitive Processes*, 11(6), 583-588.
Tanenhaus, M.K., & Trueswell, J.C. (2006). Eye movements and spoken language comprehension. In M.J. Traxler & M.A. Gernsbacher (Eds.), *Handbook of psycholinguistics* (2nd ed.) (pp. 863-900). New York: Academic Press/Elsevier.
Tanenhaus, M.K., Spivey-Knowlton, M.J., Eberhard, K.M., & Sedivy, J.C. (1995). Integrative of visual and linguistic information in spoken language comprehension. *Science*, 117(3046), 528–529.
Tavano, E., & Kaiser, E. (2008, March). Effets of stress and coherence on pronoun interpretation. Poster presented at CUNY Conference on Human Sentence Processing. The University of North Carolina at Chapel Hill.
Tomlin, R.S., Forrest, L., & Pu, M.M. (1997). Discourse semantics. In T. Van Dijk (Ed.), *Discourse as structure and process* (pp. 63-111). London: Sage.
Toribio, A.J. (2000). Setting parametric limits on dialectal variation in Spanish. *Lingua*, 110, 315-341
Townsend, D.J., & Bever, T.G. (1978). Inter-clause relations and clausal processing. *Journal of Verbal Learning and Verbal Behavior*, 17, 509-521.
Trueswell, J.C. (2008). Using eye movements as a developmental measure within psycholinguistics. In I.A. Sekerina, E.M. Fernández & H. Clahsen (Eds.), *Language Processing in Children* (pp. 73-96). Amsterdam: John Benjamins
Trueswell, J.C., Tanenhaus, M.K., & Garnsey, S. (1994). Semantic influences on parsing: Use of thematic role information in syntactic ambiguity resolution. *Journal of Memory and Language*, 33, 285-318.
Tyler, L.K., & Marslen-Wilson, W.D. (1977). The on-line effects of semantic context on syntactic processing. *Journal of Verbal Learning and Verbal Behavior*, 16, 683-692.
Vallduví, E. (1990). *The Informational Component*. PhD dissertation, University of Pennsylvania.
Van Dijk, T.A. (1999). Context models in discourse processing. In H. van Oostendorp & S.R. Goldman (Eds.), *The construction of mental representations during reading* (pp. 123-148). Mahwah, NJ: Lawrence Erlbaum Associates.
van Rooij, R., & Schulz, K. (2004). Exhaustive Interpretation of Complex Sentences. *Journal of Logic, Language and Information*, 13(4), 491-519.
Villa-García, J. (2013). On the status of preverbal subjects in Spanish: Evidence for a dedicated subject position. In S. Keine & S. Sloggett (Eds.), *NELS 42*: *Proceedings of the 42nd meeting of the North East Linguistic Society* (pp. 245-256). Amherst, MA: GLSA Publications.
Walker, M.A., & Prince, E.F. (1996). A bilateral approach to Givenness: A hearer-status algorithm and a centering algorithm. In T. Freitheim & J. Gundel (Eds.), *Reference and referent accessibility* (pp. 291-306). Amsterdan: John Benjamins.
Weil, H. (1844). *De l'ordre des mots dans les langues anciennes comparées aux langues modernes*. Paris: L'imprimerie de Crapelet.
Winograd, T. (1972). *Understanding Natural Language*. New York: Academic Press.
Winter, Y., & Rimon, M. (1994). Contrast and implication in natural language. *Journal of Semantics*, 11, 365-406.
Winterstein, G. (2012). 'Only' without its scales. *Sprache und Datenverarbeitung*, 35–36, 29–47.
Wolf, F., Gibson, E., & Desmet, T. (2004). Discourse coherence and pronoun resolution. *Language and Cognitive Processes*, 19(6), 665-675.
Zeevat, H. (2009). Only as a mirative particle. *Sprache und Datenverarbeitung*, 33, 179-196.
Zimmermann, M. (2008). Contrastive Focus and Emphasis. *Acta Linguistica Hungarica*, 55: 347-360.
Zimmermann, M. (2011). Discourse Particles. In P. Portner, C. Maienborn & K. von Heusinger (Eds.), *Semantics*. (Handbücher zur Sprach- und Kommunikationswissenschaft HSK 33.2) (pp. 2011-2038). Berlin: Mouton de Gruyter.
Zimmermann, M., & Vasishth, S. (2010). Clefting and focus: Syntactic, semantic, and psycholinguistic aspects. Course taught at the University of Pötsdam.
Zubizarreta, M.L. (1998). *Prosody, Focus, and Word Order*. Cambridge: MIT Press.

Zubizarreta, M.L. (1999). Las funciones informativas: tema y foco. In I. Bosque & V. Demonte (Eds.), *Gramática descriptiva de la lengua española*, vol. 3 (pp. 4215-4244). Madrid: Espasa Calpe.

Zubizarreta, M.L. (2012). A note on the Spanish left-periphery. In L. Brugè, A. Cardinaletti, G. Giusti, N. Munaro & C. Poletto (Eds.), *Functional Heads. The Cartography of Syntactic Structures, 7*. Oxford: Oxford University Press.

Zwart, C.J.W. (1998). Where is Syntax? Syntactic Aspects of Left Dislocation in Dutch and English. In P. Culicover & L. McNally (Eds.), *Syntax and Semantics, 29: The limits of Syntax* (pp. 365-393). New York: Academic Press.

Appendix A

Experimental materials Experiments 1 – 14.2

For reasons of space, we present all items in the baseline form only. For an overview of the different conditions of one item, refer to the description of the experiment in question (pages given between parentheses).

Experiments 1 and 3 materials
(Item #25 not included in Exp. 3 – p. 112 and 122)

1. Pedro golpeó a Juan cuando (él) era joven.
2. Eduardo llamó a Samuel cuando (él) estaba en la oficina.
3. Alfredo abrazó a Julio cuando (él) volvió de su viaje.
4. Roberto invitó a César cuando (él) estaba de vacaciones.
5. Mateo detuvo a Camilo cuando (él) regresó a Barcelona.
6. Carlos escondió a Felipe cuando (él) era militar.
7. Álvaro curó a Ricardo cuando (él) se instaló en Marsella.
8. Pablo ayudó a Julián cuando (él) trabajaba en IBM.
9. Alberto visitó a Sebastián cuando (él) era estudiante.
10. Bruno alojó a Daniel cuando (él) estaba soltero.
11. Gerardo denunció a Francisco cuando (él) volvió a la ciudad.
12. Raúl maltrató a Miguel cuando (él) era adolescente.
13. María abofeteó a Julia cuando (él) salió de clase.
14. Sofía escribió a Patricia cuando (ella) vivía en Italia.
15. Mariela contrató a Cristina cuando (ella) pasaba una temporada en Francia.
16. Ángela amenazó a Natalia cuando (ella) pasaba por su calle.
17. Martina conoció a Carolina cuando (ella) ya estaba jubilada.
18. Gisela vio a Manuela cuando (ella) se asomó por la ventana.
19. Ana acusó a Laura cuando (ella) era empleada del ayuntamiento.
20. Beatriz vio a Juana cuando (ella) paseaba por la playa.
21. Verónica peinó a Marta cuando (ella) estaba de vacaciones.
22. Valeria visitó a Mónica cuando (ella) se encontraba deprimida.
23. Sandra empujó a Cecilia cuando (ella) trabajaba como modelo.
24. Paulina felicitó a Clara cuando (ella) estaba de paso por Madrid.
25. Bernardo empujó a Mauricio cuando (él) estaba borracho.

Experiment 2 materials
(p. 116)

1. Alejandro golpeó a Alfonso antes de que Julia lo llamara.
2. Adela abofeteó a Silvia antes de que Juan se la cruzara.
3. Andrés apuñaló a Víctor antes de que Patricia se lo encontrara.
4. Sofía regañó a Adriana antes de que Vicente la llamara.
5. Ángel llamó a Antonio antes de que Cristina lo reconociera.
6. Alicia vio a Sara antes de que Pablo la denunciara.
7. Rafael invitó a Félix antes de que Natalia lo previniera.
8. Amanda amenazó a Rocío antes de que Sebastián la traicionara.
9. Lucas felicitó a Tomás antes de que Paula lo corrompiera.
10. Bárbara informó a Raquel antes de que César la robara.

11. Fernando escondió a Gonzalo ante de que Celia lo denunciara.
12. Belén escribió a Pilar antes de que Martín la asesinara.
13. Óscar molestó a Rubén antes de que Julieta lo persiguiera.
14. Berta influenció a Miriam antes de que Lucas la desanimara.
15. Hugo ayudó a Lucas antes de que Matilde lo ridiculizara
16. Celia acusó a Lorena antes de que Sergio la defendiera.
17. David cubrió a Diego antes de que Lola lo hiriera.
18. Cloe retrató a Jennifer antes de que Sebastián la molestara.
19. Javier recibió a Jorge antes de que Bárbara lo convocara.
20. Claudia peinó a Irene antes de que Pascual la recibiera.
21. José alojó a Manuel antes de que Mónica lo incomodara.
22. Elisa insultó a Verónica antes de Mauricio la contradijera.
23. Gabriel persiguió a Mariano antes de que Cecilia lo llamara.
24. Diana empujó a Esther antes de que Francisco la riñera.
25. Marcos maltrató a Nicolás antes de que Clara lo atormentara.

Experiment 4 materials

(p. 137)

Item #1
A : He oído que Juan, Pedro y María no se llevan muy bien.
B : Sí, Juan abofeteó a Pedro cuando era estudiante.
Item #2
A: Al parecer Samuel, Eduardo y Cristina vuelven a llevarse bien.
B: Sí, Eduardo llamó a Samuel cuando estaba en la oficina.
Item #3
A: He oído que Alfredo, Julio y Sofía han hecho las paces.
B: Sí, Alfredo abrazó a Julio cuando volvió de su viaje.
Item #4
A: Parece que César, Roberto y Sandra se reunieron recientemente.
B: Sí, Roberto invitó a César cuando estaba de vacaciones.
Item #5
A: He oído que la historia no acabó bien entre Mateo, Camilo y Claudia.
B: Sí, Mateo detuvo a Camilo cuando regresó a Barcelona.
Item #6
A: Durante la guerra Felipe, Carlos y Ana se ayudaron mutuamente.
B: Sí, Carlos escondió a Felipe cuando era militar.
Item #7
A: Tras el accidente, Álvaro, Ricardo y Natalia se volvieron inseparables.
B: Lo sé. Álvaro curó a Ricardo cuando se instaló en Marsella.
Item #8
A: La amistad entre Julián, Pablo y Patricia viene de mucho tiempo atrás.
B: Sí, Pablo ayudó a Julián cuando trabajaba en IBM.
Item #9
A: Parece que Alberto, Sebastián y Marisa siempre han sido cómplices.
B: Sí, Alberto visitó a Sebastián cuando necesitaba ayuda.
Item #10
A: He oído que Daniel, Bruno y Berta se han ayudado en incontables ocasiones.
B: Lo sé. Bruno alojó a Daniel cuando estaba soltero.

Item #11
A: Al parecer la historia entre Gerardo, Francisco y Maite no ha tenido un final feliz.
B: Sí, Gerardo denunció a Francisco cuando volvió a la ciudad.
Item #12
A: He oído que Miguel, Raúl y Carlota siempre se han detestado.
B: Lo sé. Raúl maltrató a Miguel cuando era adolescente.
Item #13
A: He oído que hubo un incidente entre María, Julia y Carlos.
B: Sí, María abofeteó a Julia cuando salió de clase.
Item #14
A: Parece que Patricia, Sofía y Diego son buenos amigos de nuevo.
B: Lo sé. Sofía escribió a Patricia cuando vivía en Italia.
Item #15
A: Al parecer Mariela, Cristina y Raúl se conocen desde hace muchos años.
B: Sí, Mariela contrató a Cristina cuando pasaba una temporada en Francia.
Item #16
A: Parece que el drama entre Natalia, Ángela y Guillermo continúa.
B: Lo sé. Ángela amenazó a Natalia cuando bajó del coche.
Item #17
A: Al parecer Martina, Carolina y Alfonso van de excursión todos las semanas.
B: Sí, Martina conoció a Carolina cuando ya estaba jubilada.
Item #18
A: He oído que Manuela, Gisela y Marcos tuvieron una pelea el otro día.
B: Gisela insultó a Manuela cuando se asomó por la ventana.
Item #19
A: He oído que Ana, Laura y Santiago no se dirigen la palabra.
B: Ana acusó a Laura cuando era empleada del ayuntamiento.
Item #20
A: He oído que Juana, Beatriz y Ernesto hablaron recientemente.
B: Sí, Beatriz vio a Juana cuando paseaba por la playa.
Item #21
A: Parece que Verónica, Marta y Fernando se echan una mano siempre que lo necesitan.
B: Sí, Verónica peinó a Marta cuando estaba de vacaciones.
Item #22
A: He oído que Mónica, Valeria y Alejandro se apoyan mucho mutuamente.
B: Lo sé. Valeria visitó a Mónica cuando se encontraba deprimida.
Item #23
A: Al parecer Sandra, Cecilia y Jaime no se soportan desde hace ya tiempo.
B: Sí, Sandra empujó a Cecilia cuando trabajaba como modelo.
Item #24
A: A pesar de la distancia, Clara, Paula y Sergio siguen manteniendo el contacto.
B: Lo sé. Paula felicitó a Clara cuando estaba de paso por Madrid.
Item #25
A: He oído que ayer hubo un incidente entre Bernardo, Mauricio y Laura.
B: Sí, Bernardo gritó a Mauricio cuando estaba borracho.

Experiment 5 materials
(p. 142)

1. Eduardo llamó a Samuel cuando estaba en la oficina.
2. Alfredo abrazó a Julio cuando volvió de su viaje.
3. Roberto invitó a César cuando estaba en vacaciones.
4. Mateo detuvo a Camilo cuando regresó a Barcelona.
5. Alberto visitó a Sebastián cuando era estudiante.
6. Bruno alojó a Daniel cuando estaba soltero.
7. Pablo ayudó a Julián cuando trabajaba en IBM.
8. Sofía escribió a Patricia cuando vivía en Italia.
9. Mariela contrató a Cristina cuando pasaba una temporada en Francia
10. Gerardo denunció a Francisco cuando volvió a la ciudad.
11. Ana acusó a Laura cuando era empleada del ayuntamiento.
12. Beatriz vio a Juana cuando paseaba por la playa.
13. Paulina felicitó a Clara cuando estaba de paso por Madrid.
14. Martina conoció a Carolina cuando ya estaba jubilada.
15. Valeria visitó a Mónica cuando se mudó a Londres.
16. Juan abofeteó a Pedro cuando era estudiante.
17. Carlos escondió a Felipe cuando era militar.
18. Álvaro curó a Ricardo cuando se instaló en Marsella.
19. Alberto visitó a Sebastián cuando necesitaba ayuda.
20. Raúl maltrató a Miguel cuando era adolescente.
21. María abofeteó a Julia cuando salió de clase.
22. Ángela amenazó a Natalia cuando bajó del coche.
23. Gisela insultó a Manuela cuando se asomó por la ventana.
24. Verónica peinó a Marta cuando estaba de vacaciones.
25. Valeria visitó a Mónica cuando se encontraba deprimida.
26. Sandra empujó a Cecilia cuando trabaja como modelo.
27. Bernardo gritó a Mauricio cuando estaba borracho.
28. Matilde visitó a Camila cuando se recuperó de la enfermedad.

Experiment 6 materials
(p. 146)

1. Edward called Samuel when he was in the office.
2. Alfred hugged Julian when he came back from Africa.
3. Robert invited Charles over when he was on holidays.
4. Matt sued George when he was back in town.
5. Albert visited Sebastian when he was a student.
6. Brian accommodated Daniel when he was single.
7. Paul helped Jonathan when he worked at IBM.
8. Sophia wrote Patricia when she lived in Italy.
9. Mary hired Christine when she was living in France.
10. Gerard punched Francis when he went back to school.
11. Anne prosecuted Laura when she worked at the Town Hall.
12. Beatrice saw Johanna when she was walking on the beach.
13. Chelsea congratulated Clara when she was in Madrid for work.
14. Maurine met Carol when she was already retired.
15. Valerie visited Monica when she moved to London.

16. John bullied Peter when he was a student.
17. Charles sheltered Philip when he was in the army.
18. Steve healed Richard when he settled in Marseille.
19. Anthony visited Stephen when he needed help.
20. Ralph abused Michael when he was a teenager.
21. Mary slapped Julie when she got out of class.
22. Amanda threatened Natalie when she got out of the car.
23. Gillian insulted Stephanie when she looked out of the window.
24. Heather tutored Martha when she was on holidays.
25. Sarah visited Monica when she was depressed.

Experiments 7, 8, 9, and 12 materials
(Item #25 not included in Exp. 8, 9, and 12 – p. 164, 169, 174, and 185)

1. Edward called Sophie because…
2. Alice hugged Julian because...
3. Robert invited Chloe because...
4. Mary sued George because...
5. Albert visited Susan because...
6. Betty accommodated Daniel because...
7. Paul helped Jenny because...
8. Sophia wrote Peter because...
9. Mark hired Christine because...
10. Gerard punched Cindy because...
11. Anne prosecuted William because...
12. Peter saw Johanna because...
13. Chelsea texted Charles because...
14. Maurice met Carol because...
15. Valerie visited Matt because...
16. John bullied Patricia because...
17. Christine sheltered Philip because...
18. Steve healed Rebecca because...
19. Annie visited Stephen because...
20. Ralph abused Michelle because...
21. Mary slapped Julian because...
22. Anthony threatened Natalie because...
23. Gillian insulted Stephan because...
24. Hugh tutored Martha because...
25. Sarah e-mailed Matthew because...

Experiments 10, 11, 13, 14.1, and 14.2
(p. 176, 180, 187, 224, and 227)

1. Pierre a giflé Julie parce que…
2. Edouard a appelé Patricia parce que…
3. Alfred a étreint Christine parce que…
4. Robert a invité Nathalie parce que…
5. Mathieu a insulté Caroline parce que…
6. Olivier a visité Stéphanie parce que…
7. Stéphane a soigné Laura parce que…

8. Thibault a aidé Janine parce que…
9. Albert a visité Elise parce que…
10. Bernard a logé Chloé parce que…
11. Benoît a poursuivi Cécile parce que…
12. Raphaël a harcelé Claire parce que…
13. Marie a frappé Jean parce que…
14. Sophie a recruté Samuel parce que…
15. Gabrielle a embauché Julien parce que…
16. Delphine a menacé Charles parce que…
17. Martha a rencontré Gérard parce que…
18. Géraldine a vu Philippe parce que…
19. Anne a dénoncé Richard parce que…
20. Béatrice a contacté Jonathan parce que…
21. Véronique a renseigné Sébastian parce que…
22. Valérie a appelé Daniel parce que…
23. Sandrine a poussé George parce que…
24. Pauline a félicité Michaël parce que…

Experiment 14

(Introductory sentences not given – p. 205)

1. Jean a interrompu Pierre hier parce qu'il a l'habitude de...
2. Julien a appelé Patrick hier soir parce qu'il a l'habitude de...
3. Christophe a vu Guillaume le week-end dernier parce qu'il a l'habitude de...
4. David a invité Pascal samedi dernier parce qu'il a l'habitude de...
5. Eric a logé Frédéric la semaine dernière parce qu'il a l'habitude de...
6. Jean a parlé à Patrick ce matin parce qu'il a l'habitude de...
7. Julien a attaqué Guillaume hier parce qu'il a l'habitude de...
8. Christophe a défendu Pascal hier soir parce qu'il a l'habitude de...
9. David a évité Frédéric pendant le week-end parce qu'il a l'habitude de...
10. Eric a harcelé Pierre le mois dernier parce qu'il a l'habitude de...
11. Guillaume a frappé Jean la semaine dernière parce qu'il a l'habitude de...
12. Pascal a cogné Julien ce matin parce qu'il a l'habitude de...
13. Frédéric a interrogé Christophe hier parce qu'il a l'habitude de...
14. Pierre a humilié David hier soir parce qu'il a l'habitude de...
15. Patrick a encouragé Eric le week-end dernier parce qu'il a l'habitude de...
16. Pascal a giflé Jean le mois dernier parce qu'il a l'habitude de...
17. Frédéric a soigné Julien la semaine dernière parce qu'il a l'habitude de...
18. Pierre a téléphoné à Christophe ce matin parce qu'il a l'habitude de...
19. Marie a malmené Sylvie hier parce qu'elle a l'habitude de...
20. Sophie a claqué Véronique hier soir parce qu'elle a l'habitude de...
21. Monique a hébergé Sandrine le week-end dernier parce qu'elle a l'habitude de...
22. Céline a contacté Stéphanie le mois dernier parce qu'elle a l'habitude de...
23. Catherine a tapé Valérie la semaine dernière parce qu'elle a l'habitude de...
24. Marie a blessé Véronique ce matin parce qu'elle a l'habitude de...
25. Sophie a amoché Sandrine hier parce qu'elle a l'habitude de...
26. Monique a calmé Stéphanie hier soir parce qu'elle a l'habitude de...
27. Céline a amusé Valérie pendant le week-end parce qu'elle a l'habitude de...
28. Catherine a réconforté Sylvie le mois dernier parce qu'elle a l'habitude de...
29. Sandrine a bousculé Marie la semaine dernière parce qu'elle a l'habitude de...

30. Stéphanie a aidé Sophie ce matin parce qu'elle a l’habitude de...
31. Valérie a menacé Monique hier parce qu'elle a l’habitude de...
32. Sylvie a insulté Céline hier soir parce qu'elle a l’habitude de...
33. Véronique a affronté Catherine le week-end dernier parce qu'elle a l’habitude de...
34. Stéphanie a consolé Marie le mois dernier parce qu'elle a l’habitude de...
35. Valérie a soutenu Sophie la semaine dernière parce qu'elle a l’habitude de...
36. Sylvie a discrédité Monique ce matin parce qu'elle a l’habitude de...

Appendix B

Experiment 14 -- participants' age, sex, memory-span test and recorded eye

Subject ID	Age	Sex	Memory score (/60)	Eye recorded	Subject ID	Age	Sex	Memory score (/60)	Eye recorded
FR001	20	F	N/A	R	FR031	25	M	47	R
FR002	19	F	59	R	FR032	20	F	31	R
FR003	21	F	44	R	FR033	38	F	37	L
FR004	19	F	46	L	FR034	23	F	38	R
FR005	19	F	N/A	L	FR035	20	F	40	R
FR006	21	F	N/A	R	FR036	31	F	46	R
FR007	20	F	47	L	FR037	59	M	36	R
FR008	19	F	N/A	R	FR038	27	F	47	L
FR009	20	M	42	R	FR039	22	F	48	L
FR010	19	F	45	R	FR040	21	F	34	L
FR011	19	F	47	L	FR041	25	F	46	L
FR012	20	F	36	L	FR042	23	F	45	R
FR013	27	M	49	R	FR043	23	F	48	R
FR014	23	M	52	L	FR044	27	F	45	R
FR015	19	F	43	R	FR045	25	F	28	R
FR016	21	M	44	L	FR046	21	M	43	L
FR017	26	M	50	R	FR047	21	M	47	L
FR018	20	F	54	R	FR048	19	F	34	R
FR019	21	M	40	L	FR049	23	F	38	R
FR020	27	M	49	R	FR050	24	F	44	R
FR021	27	M	37	R	FR051	27	F	35	R
FR022	21	F	45	R	FR052	23	F	51	R
FR023	21	F	55	R	FR053	33	M	37	L
FR024	25	M	40	L	FR054	23	M	30	R
FR025	23	F	45	R	FR055	24	F	31	R
FR026	22	F	50	R	FR056	23	F	35	R
FR027	24	M	35	L	FR057	20	F	43	R
FR028	20	F	41	R	FR058	26	F	47	R
FR029	20	F	40	R	FR059	21	F	34	R
FR030	27	M	46	L	FR060	23	M	37	L

Appendix C

Working memory test materials

Training
abeilles
cravate

matinée
fortune
guichet

Test
2 words
ivrogne
cité

île
astres

maître
faiblesse

3 words
sortie
policier
poires

hercules
cuisine
ombre

huile
demeure
règlement

4 words
magasin
rocher
cercle
but

horizon
soin
dessert
chagrin

pauvres
sport
ferme
équilibre

5 words
éclat
angoisses
large
banane
problèmes

succès
jouet
ventre
qualité
sommet

bouche
ténèbres
leçon
volonté
sol

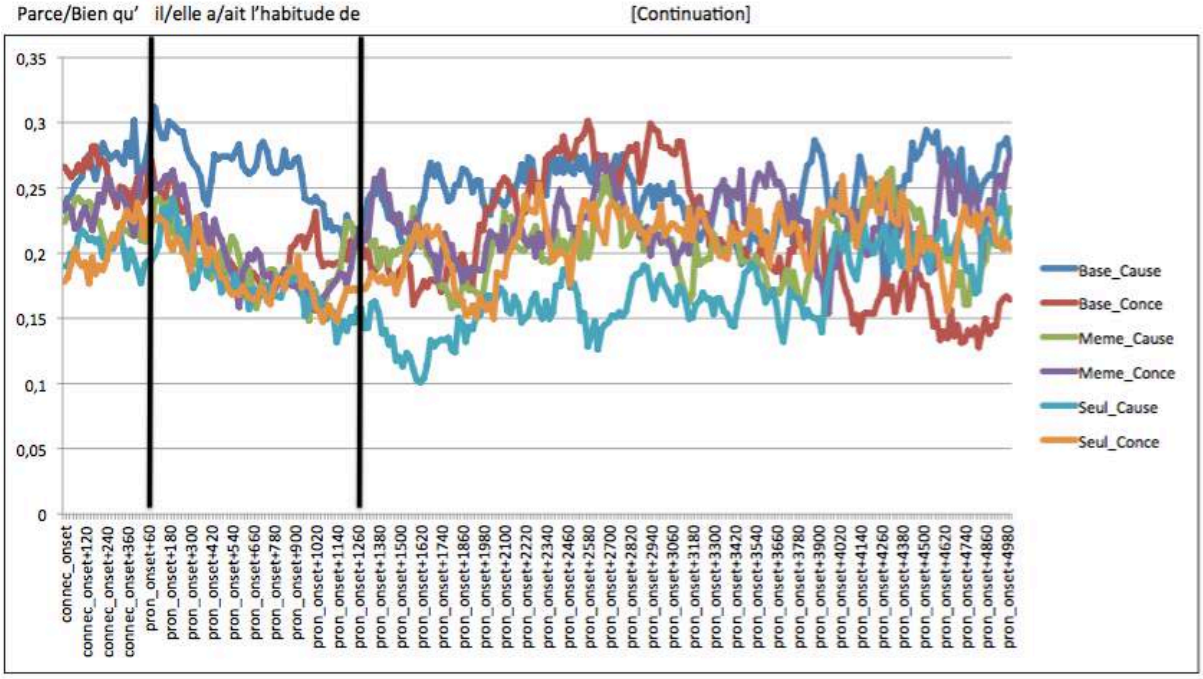
6 words
regret
bouteilles
toiles
pont
sentiment
avenir

vallée
son
village
patte
tempête
facilité

pantalon
mur
océan
divan
malaise
poings

Appendix D

Probabilities of fixations to the two distractor images in Experiment 14



Appendix E

Fixed effects from full models on Experiments 1-14.2

Experiment 1

mfull = glmer(Value~ gramFunc*infStruc+(1|Subject)+(1|ItemNumber), family=binomial (link="logit"), data=clsubset)

	Estimate	Std. Error	z value	Pr(>|z|)
(Intercept)	0.7048	0.2339	3.012	0.00259 **
gramFuncSubj	-1.5689	0.3120	-5.029	4.93e-07 ***
infStrucDisloc	-1.3181	0.3049	-4.322	1.54e-05 ***
gramFuncSubj:infStrucDisloc	2.0584	0.4312	4.774	1.81e-06 ***

Experiment 2

mfull = glmer(Value~ gramFunc*infStruc+(1|Subject)+(1|ItemNumber), family=binomial (link="logit"), data=clsubset)

	Estimate	Std. Error	z value	Pr(>|z|)
(Intercept)	-0.2566	0.2278	-1.126	0.2600
gramFuncSubj	-0.4715	0.2384	-1.978	0.0479 *
infStrucDisloc	-1.3365	0.2649	-5.046	4.52e-07 ***
gramFuncSubj:infStrucDisloc	2.1042	0.3615	5.821	5.84e-09 ***

Experiment 4

mfull = glmer(Value~ gramFunc*focustype+(1|Participant)+(1|Item), family=binomial(link="logit"), data=datasubset)

	Estimate	Std. Error	z value	Pr(>|z|)
(Intercept)	0.8074	0.2953	2.734	0.00626 **
gramFuncSubj	-0.8925	0.3335	-2.676	0.00745 **
focustypeNarrow	-0.2741	0.3303	-0.830	0.40666
gramFuncSubj:focustypeNarrow	0.3473	0.4619	0.752	0.45218

Experiment 5

mfull = glmer(Value~ gramFunc*particle+(1|Participant)+(1|Item), family=binomial(link="logit"), data=datasubset)

	Estimate	Std. Error	z value	Pr(>|z|)
(Intercept)	0.01326	0.26791	0.050	0.96053
gramFuncSubj	-0.37107	0.27484	-1.350	0.17696
particleEven	0.27396	0.27433	0.999	0.31796
particleOnly	0.57903	0.27697	2.091	0.03656 *
gramFuncSubj:particleEven	-0.23150	0.38808	-0.596	0.55083
gramFuncSubj:particleOnly	-1.20917	0.39878	-3.032	0.00243 **

Experiment 6

mfull = glmer(Value~ gramFunc*particle+(1|Participant)+(1|Item), family=binomial(link="logit"), data=datasubset)

	Estimate	Std. Error	z value	Pr(>|z|)
(Intercept)	0.90932	0.43027	2.113	0.0346 *
gramFuncSubject	-1.87729	0.43436	-4.322	1.55e-05 ***
particleOnly	0.06755	0.40930	0.165	0.8689
gramFuncSubject:particleOnly	-0.48274	0.58095	-0.831	0.4060

Experiment 7

mfull = glmer(Value~ gramFunc*particle+(1|Participant)+(1|Item), family=binomial(link="logit"), data=datasubset)

	Estimate	Std. Error	z value	Pr(>|z|)
(Intercept)	0.9466	0.2274	4.163	3.15e-05 ***
gramFuncSubject	-1.5937	0.2588	-6.159	7.32e-10 ***
particleOnly	-1.2200	0.2464	-4.951	7.38e-07 ***
gramFuncSubject:particleOnly	2.2965	0.3652	6.288	3.22e-10 ***

Experiment 8

mfull = lmer(Value~ particle*position+(1|Participant)+(1|Item), data=data)

	Estimate	Std. Error	t value
(Intercept)	3.3500	0.1464	22.883
particleOnly	1.1313	0.0970	11.662
positionSubject	1.5042	0.0970	15.507
positionVerb	1.6500	0.0970	17.010
particleOnly:positionSubject	-1.2437	0.1372	-9.067
particleOnly:positionVerb	-0.7583	0.1372	-5.528

Experiment 9

mfull = glmer(Value~ connective*particle+(1|Participant)+(1|Item), family=binomial(link="logit"), data=data)

	Estimate	Std. Error	z value	Pr(>|z|)
(Intercept)	-1.0509	0.2164	-4.857	1.19e-06 ***
connectiveTemporal	-0.5820	0.2023	-2.878	0.00401 **
particleOnly	1.2739	0.1897	6.714	1.89e-11 ***
connectiveTemporal:particleOnly	-1.6172	0.2936	-5.508	3.62e-08 ***

Experiment 10

mfull = glmer(Value~ connective*particle+(1|Participant)+(1|Item), family=binomial(link="logit"), data=data)

	Estimate	Std. Error	z value	Pr(>|z|)
(Intercept)	-1.4449	0.1961	-7.367	1.75e-13 ***
connectiveTemporal	-0.5139	0.1741	-2.952	0.00315 **
particleSeul	0.7982	0.1547	5.159	2.49e-07 ***
connectiveTemporal:particleSeul	-0.6866	0.2389	-2.874	0.00405 **

Experiment 11

mfull = glmer(Value~ connective*grammFunc+(1|Participant)+(1|Item), family=binomial (link="logit"), data=data)

	Estimate	Std. Error	z value	Pr(>|z|)
(Intercept)	-0.6334	0.3147	-2.013	0.044131 *
connectiveTemporal	1.1531	0.3221	3.580	0.000344 ***
grammFuncSubject	0.6518	0.3233	2.016	0.043807 *
connectiveTemporal:grammFuncSubject	-2.1014	0.4480	-4.691	2.73e-06 ***

Experiment 12

mfull = glmer(Value~ connective*particle+(1|Participant)+(1|Item), family=binomial(link="logit"), data=data)

	Estimate	Std. Error	z value	Pr(>|z|)
(Intercept)	-0.7070	0.2857	-2.475	0.0133 *
connectiveConcessive	1.7916	0.3219	5.566	2.61e-08 ***
particleOnly	1.6957	0.2845	5.961	2.50e-09 ***
connectiveConcessive:particleOnly	-2.8950	0.4526	-6.396	1.59e-10 ***

Experiment 13

mfull = glmer(Value~ connective*particle+(1|Participant)+(1|Item), family=binomial(link="logit"), data=data)

	Estimate	Std. Error	z value	Pr(>|z|)
(Intercept)	-1.1345	0.4071	-2.787	0.005320 **
connectiveConcessive	0.7816	0.4433	1.763	0.077864 .
particleOnly	1.7021	0.4456	3.820	0.000134 ***
connectiveConcessive:particleOnly	-2.2502	0.6353	-3.542	0.000397 ***

Experiment 14.1

mfull = glmer(Value~ connective*particle+(1|Participant)+(1|Item), family=binomial(link="logit"), data=data)

	Estimate	Std. Error	z value	Pr(>|z|)
(Intercept)	-1.0682	0.2169	-4.924	8.48e-07 ***
connectiveConcessive	1.1886	0.2380	4.994	5.92e-07 ***
particleOnly	1.6863	0.2479	6.801	1.04e-11 ***
connectiveConcessive:particleOnly	-1.8886	0.3372	-5.600	2.14e-08 ***

Experiment 14.2

mfull = glmer(Value~ connective*particle+(1|Participant)+(1|Item), family=binomial(link="logit"), data=data)

	Estimate	Std. Error	z value	Pr(>|z|)
(Intercept)	-0.7257	0.1969	-3.686	0.000228 ***
connectiveConcessive	1.4378	0.2431	5.915	3.31e-09 ***
particleOnly	1.1486	0.2406	4.773	1.82e-06 ***
connectiveConcessive:particleOnly	-1.4246	0.3364	-4.235	2.28e-05 ***

Fixed effects for fixation logodds on Experiment 14

Pre-critical region (connective)

200ms after connective onset

model1 = lmer(Logodds2 ~ condition + (1|participant) + (1|item), data = data)

	Estimate	Std. Error	t value
(Intercept)	-0.52649	0.05258	-10.013
Base_Concessive	-0.13305	0.06470	-2.057
Meme_Causal	0.10448	0.06470	1.615
Meme_Concessive	0.12607	0.06592	1.912
Seul_Causal	0.12367	0.06475	1.910
Seul_Concessive	0.10593	0.06470	1.637

model2 = lmer(Logodds2 ~ connective*particle+(1|participant) + (1|item), data = data)

	Estimate	Std. Error	t value
(Intercept)	-0.47197	0.03195	-14.772
connective1	0.02153	0.01892	1.138
particle1	-0.12104	0.02642	-4.582
particle2	0.06076	0.02692	2.257
connective1:particle1	0.04499	0.02659	1.692
connective1:particle2	-0.03233	0.02658	-1.216

400ms after connective onset

model1 = lmer(Logodds2 ~ condition + (1|participant) + (1|item), data = data)

	Estimate	Std. Error	t value
(Intercept)	-0.54692	0.05419	-10.093
Base_Concessive	-0.07191	0.06492	-1.108
Meme_Causal	0.18078	0.06493	2.784
Meme_Concessive	0.17193	0.06615	2.599
Seul_Causal	0.15760	0.06498	2.425
Seul_Concessive	0.15189	0.06492	2.339

model2 = lmer(Logodds2 ~ connective*particle+(1|participant) + (1|item), data = data)

	Estimate	Std. Error	t value
(Intercept)	-0.448539	0.034355	-13.056
connective1	0.014413	0.018985	0.759
particle1	-0.134338	0.026509	-5.068
particle2	0.077973	0.027013	2.887
connective1:particle1	0.021544	0.026681	0.807
connective1:particle2	-0.009988	0.026676	-0.374

Critical region (pronoun + a/ait l'habitude de)

200ms after pronoun onset

model1 = lmer(Logodds2 ~ condition + (1|participant) + (1|item), data = data)

	Estimate	Std. Error	t value
(Intercept)	-0.53589	0.05519	-9.711
Base_Concessive	-0.01436	0.06551	-0.219
Meme_Causal	0.20660	0.06551	3.154
Meme_Concessive	0.13980	0.06678	2.093
Seul_Causal	0.14722	0.06559	2.244
Seul_Concessive	0.18884	0.06551	2.883

model2 = lmer(Logodds2 ~ connective*particle+(1|participant) + (1|item), data = data)

	Estimate	Std. Error	t value
(Intercept)	-0.4245420	0.0354603	-11.972
connective1	0.0065893	0.0191673	0.344
particle1	-0.1185307	0.0267489	-4.431
particle2	0.0618506	0.0272737	2.268
connective1:particle1	0.0005901	0.0269291	0.022
connective1:particle2	0.0268090	0.0269195	0.996

400ms after pronoun onset

model1 = lmer(Logodds2 ~ condition + (1|participant) + (1|item), data = data)

	Estimate	Std. Error	t value
(Intercept)	-0.51083	0.05795	-8.814
Base_Concessive	0.06097	0.06653	0.916
Meme_Causal	0.15092	0.06654	2.268
Meme_Concessive	0.20744	0.06788	3.056
Seul_Causal	0.12811	0.06667	1.922
Seul_Concessive	0.23016	0.06653	3.459

model2 = lmer(Logodds2 ~ connective*particle+(1|participant) + (1|item), data = data)

	Estimate	Std. Error	t value
(Intercept)	-0.381228	0.038916	-9.796
connective1	-0.036590	0.019487	-1.878
particle1	-0.099117	0.027166	-3.649
particle2	0.049583	0.027732	1.788
connective1:particle1	0.006107	0.027364	0.223
connective1:particle2	0.008329	0.027344	0.305

600ms after pronoun onset

model1 = lmer(Logodds2 ~ condition + (1|participant) + (1|item), data = data)

	Estimate	Std. Error	t value
(Intercept)	-0.48525	0.05927	-8.187
Base_Concessive	0.17718	0.06905	2.566
Meme_Causal	0.12733	0.06905	1.844
Meme_Concessive	0.28507	0.07044	4.047
Seul_Causal	0.16662	0.06919	2.408
Seul_Concessive	0.28172	0.06905	4.080

model2 = lmer(Logodds2 ~ connective*particle+(1|participant) + (1|item), data = data)

	Estimate	Std. Error	t value
(Intercept)	-0.312261	0.039067	-7.993
connective1	-0.075003	0.020222	-3.709
particle1	-0.084398	0.028193	-2.994
particle2	0.033216	0.028779	1.154
connective1:particle1	-0.013586	0.028397	-0.478
connective1:particle2	-0.003867	0.028377	-0.136

800ms after pronoun onset

model1 = lmer(Logodds2 ~ condition + (1|participant) + (1|item), data = data)

	Estimate	Std. Error	t value
(Intercept)	-0.44711	0.05901	-7.577
Base_Concessive	0.23778	0.06967	3.413
Meme_Causal	0.12182	0.06967	1.749
Meme_Concessive	0.29862	0.07109	4.201
Seul_Causal	0.21166	0.06982	3.032
Seul_Concessive	0.28652	0.06967	4.113

model2 = lmer(Logodds2 ~ connective*particle+(1|participant) + (1|item), data = data)

	Estimate	Std. Error	t value
(Intercept)	-0.254377	0.038206	-6.658
connective1	-0.081573	0.020409	-3.997
particle1	-0.073843	0.028445	-2.596
particle2	0.017487	0.029045	0.602
connective1:particle1	-0.037317	0.028654	-1.302
connective1:particle2	-0.006826	0.028633	-0.238

1000ms after pronoun onset

model1 = lmer(Logodds2 ~ condition + (1|participant) + (1|item), data = data)

	Estimate	Std. Error	t value
(Intercept)	-0.36665	0.06229	-5.886
Base_Concessive	0.20532	0.07025	2.923
Meme_Causal	0.10779	0.07025	1.534
Meme_Concessive	0.31422	0.07170	4.383
Seul_Causal	0.19176	0.07042	2.723
Seul_Concessive	0.27888	0.07025	3.970

model2 = lmer(Logodds2 ~ connective*particle+(1|participant) + (1|item), data = data)

	Estimate	Std. Error	t value
(Intercept)	-0.18366	0.04271	-4.300
connective1	-0.08315	0.02058	-4.039
particle1	-0.08034	0.02868	-2.801
particle2	0.02801	0.02930	0.956
connective1:particle1	-0.01951	0.02890	-0.675
connective1:particle2	-0.02007	0.02887	-0.695

1200ms after pronoun onset

model1 = lmer(Logodds2 ~ condition + (1|participant) + (1|item), data = data)

	Estimate	Std. Error	t value
(Intercept)	-0.31272	0.06275	-4.983
Base_Concessive	0.24731	0.07059	3.504
Meme_Causal	0.09139	0.07059	1.295
Meme_Concessive	0.29899	0.07206	4.149
Seul_Causal	0.13234	0.07077	1.870
Seul_Concessive	0.29344	0.07059	4.157

model2 = lmer(Logodds2 ~ connective*particle+(1|participant) + (1|item), data = data)

	Estimate	Std. Error	t value
(Intercept)	-0.135474	0.043153	-3.139
connective1	-0.102668	0.020692	-4.962
particle1	-0.053593	0.028821	-1.859
particle2	0.017946	0.029451	0.609
connective1:particle1	-0.020985	0.029044	-0.723
connective1:particle2	-0.001132	0.029014	-0.039

Post-critical region (continuation)

1500ms after pronoun onset

model1 = lmer(Logodds2 ~ condition + (1|participant) + (1|item), data = data)

	Estimate	Std. Error	t value
(Intercept)	-0.24321	0.06265	-3.882
Base_Concessive	0.16140	0.06984	2.311
Meme_Causal	-0.01350	0.06985	-0.193
Meme_Concessive	0.15478	0.07132	2.170
Seul_Causal	0.08577	0.07004	1.225
Seul_Concessive	0.23713	0.06984	3.395

model2 = lmer(Logodds2 ~ connective*particle+(1|participant) + (1|item), data = data)

	Estimate	Std. Error	t value
(Intercept)	-0.1389502	0.0434987	-3.194
connective1	-0.0801734	0.0204796	-3.915
particle1	-0.0235637	0.0285176	-0.826
particle2	-0.0336245	0.0291496	-1.154
connective1:particle1	-0.0005255	0.0287413	-0.018
connective1:particle2	-0.0039695	0.0287093	-0.138

1700ms after pronoun onset

model1 = lmer(Logodds2 ~ condition + (1|participant) + (1|item), data = data)

	Estimate	Std. Error	t value
(Intercept)	-0.26913	0.06107	-4.407
Base_Concessive	0.23048	0.06855	3.362
Meme_Causal	0.02919	0.06856	0.426
Meme_Concessive	0.19410	0.07001	2.773
Seul_Causal	0.16689	0.06875	2.427
Seul_Concessive	0.26982	0.06855	3.936

model2 = lmer(Logodds2 ~ connective*particle+(1|participant) + (1|item), data = data)

	Estimate	Std. Error	t value
(Intercept)	-0.1207170	0.0420874	-2.868
connective1	-0.0830538	0.0201033	-4.131
particle1	-0.0331748	0.0279906	-1.185
particle2	-0.0367669	0.0286140	-1.285
connective1:particle1	-0.0321837	0.0282111	-1.141
connective1:particle2	0.0005979	0.0281793	0.021

1900ms after pronoun onset

model1 = lmer(Logodds2 ~ condition + (1|participant) + (1|item), data = data)

	Estimate	Std. Error	t value
(Intercept)	-0.28276	0.06133	-4.611
Base_Concessive	0.22451	0.06826	3.289
Meme_Causal	0.06794	0.06826	0.995
Meme_Concessive	0.21449	0.06970	3.077
Seul_Causal	0.12870	0.06845	1.880
Seul_Concessive	0.32437	0.06826	4.752

model2 = lmer(Logodds2 ~ connective*particle+(1|participant) + (1|item), data = data)

	Estimate	Std. Error	t value
(Intercept)	-0.12276	0.04266	-2.878
connective1	-0.09445	0.02002	-4.719
particle1	-0.04775	0.02787	-1.713
particle2	-0.01879	0.02849	-0.659
connective1:particle1	-0.01780	0.02809	-0.634
connective1:particle2	0.02118	0.02806	0.755

2100ms after pronoun onset

model1 = lmer(Logodds2 ~ condition + (1|participant) + (1|item), data = data)

	Estimate	Std. Error	t value
(Intercept)	-0.34481	0.05991	-5.755
Base_Concessive	0.22506	0.06589	3.416
Meme_Causal	0.13500	0.06589	2.049
Meme_Concessive	0.26417	0.06731	3.924
Seul_Causal	0.16784	0.06610	2.539
Seul_Concessive	0.32188	0.06589	4.885

model2 = lmer(Logodds2 ~ connective*particle+(1|participant) + (1|item), data = data)

	Estimate	Std. Error	t value
(Intercept)	-0.15915	0.04220	-3.772
connective1	-0.08471	0.01933	-4.382
particle1	-0.07313	0.02690	-2.718
particle2	0.01393	0.02752	0.506
connective1:particle1	-0.02782	0.02712	-1.026
connective1:particle2	0.02013	0.02709	0.743

2300ms after pronoun onset

model1 = lmer(Logodds2 ~ condition + (1|participant) + (1|item), data = data)

	Estimate	Std. Error	t value
(Intercept)	-0.34421	0.05775	-5.961
Base_Concessive	0.19118	0.06529	2.928
Meme_Causal	0.06294	0.06529	0.964
Meme_Concessive	0.25902	0.06668	3.884
Seul_Causal	0.21061	0.06549	3.216
Seul_Concessive	0.24796	0.06529	3.798

model2 = lmer(Logodds2 ~ connective*particle+(1|participant) + (1|item), data = data)

	Estimate	Std. Error	t value
(Intercept)	-0.1822537	0.0394746	-4.617
connective1	-0.0707694	0.0191497	-3.696
particle1	-0.0663610	0.0266593	-2.489
particle2	-0.0009704	0.0272566	-0.036
connective1:particle1	-0.0248230	0.0268700	-0.924
connective1:particle2	-0.0272699	0.0268396	-1.016

2500ms after pronoun onset

model1 = lmer(Logodds2 ~ condition + (1|participant) + (1|item), data = data)

	Estimate	Std. Error	t value
(Intercept)	-0.34554	0.05646	-6.120
Base_Concessive	0.18862	0.06503	2.900
Meme_Causal	0.06540	0.06504	1.006
Meme_Concessive	0.27138	0.06638	4.088
Seul_Causal	0.21249	0.06519	3.259
Seul_Concessive	0.27554	0.06503	4.237

model2 = lmer(Logodds2 ~ connective*particle+(1|participant) + (1|item), data = data)

	Estimate	Std. Error	t value
(Intercept)	-0.1766303	0.0377530	-4.679
connective1	-0.0762748	0.0190599	-4.002
particle1	-0.0745943	0.0265536	-2.809
particle2	-0.0005153	0.0271267	-0.019
connective1:particle1	-0.0180364	0.0267546	-0.674
connective1:particle2	-0.0267175	0.0267301	-1.000

2900ms after pronoun onset

model1 = lmer(Logodds2 ~ condition + (1|participant) + (1|item), data = data)

	Estimate	Std. Error	t value
(Intercept)	-0.31213	0.05693	-5.483
Base_Concessive	0.18577	0.06566	2.829
Meme_Causal	0.02422	0.06566	0.369
Meme_Concessive	0.17942	0.06700	2.678
Seul_Causal	0.11100	0.06580	1.687
Seul_Concessive	0.22213	0.06566	3.383

model2 = lmer(Logodds2 ~ connective*particle+(1|participant) + (1|item), data = data)

	Estimate	Std. Error	t value
(Intercept)	-0.19171	0.03801	-5.043
connective1	-0.07535	0.01924	-3.917
particle1	-0.02754	0.02681	-1.027
particle2	-0.01860	0.02738	-0.680
connective1:particle1	-0.01753	0.02701	-0.649
connective1:particle2	-0.00225	0.02698	-0.083

3300ms after pronoun onset

model1 = lmer(Logodds2 ~ condition + (1|participant) + (1|item), data = data)

	Estimate	Std. Error	t value
(Intercept)	-0.31854	0.05390	-5.910
Base_Concessive	0.20761	0.06469	3.209
Meme_Causal	0.04960	0.06469	0.767
Meme_Concessive	0.20926	0.06591	3.175
Seul_Causal	0.12754	0.06475	1.970
Seul_Concessive	0.25893	0.06469	4.003

model2 = lmer(Logodds2 ~ connective*particle+(1|participant) + (1|item), data = data)

	Estimate	Std. Error	t value
(Intercept)	-0.176386	0.034078	-5.176
connective1	-0.083113	0.018916	-4.394
particle1	-0.038350	0.026413	-1.452
particle2	-0.012727	0.026914	-0.473
connective1:particle1	-0.020694	0.026583	-0.778
connective1:particle2	0.003279	0.026579	0.123

3700ms after pronoun onset

model1 = lmer(Logodds2 ~ condition + (1|participant) + (1|item), data = data)

	Estimate	Std. Error	t value
(Intercept)	-0.26496	0.05282	-5.017
Base_Concessive	0.15341	0.06364	2.411
Meme_Causal	-0.03468	0.06364	-0.545
Meme_Concessive	0.11076	0.06483	1.708
Seul_Causal	0.10824	0.06369	1.700
Seul_Concessive	0.19218	0.06364	3.020

model2 = lmer(Logodds2 ~ connective*particle+(1|participant) + (1|item), data = data)

	Estimate	Std. Error	t value
(Intercept)	-0.17664	0.03320	-5.321
connective1	-0.06380	0.01861	-3.429
particle1	-0.01162	0.02598	-0.447
particle2	-0.05028	0.02647	-1.899
connective1:particle1	-0.01291	0.02615	-0.494
connective1:particle2	-0.00892	0.02615	-0.341

4100ms after pronoun onset

model1 = lmer(Logodds2 ~ condition + (1|participant) + (1|item), data = data)

	Estimate	Std. Error	t value
(Intercept)	-0.21551	0.04973	-4.334
Base_Concessive	0.12781	0.06142	2.081
Meme_Causal	-0.09620	0.06142	-1.566
Meme_Concessive	0.13044	0.06260	2.084
Seul_Causal	0.03949	0.06148	0.642
Seul_Concessive	0.11192	0.06142	1.822

model2 = lmer(Logodds2 ~ connective*particle+(1|participant) + (1|item), data = data)

	Estimate	Std. Error	t value
(Intercept)	-0.163265	0.030021	-5.438
connective1	-0.071148	0.017966	-3.960
particle1	0.011663	0.025077	0.465
particle2	-0.035125	0.025563	-1.374
connective1:particle1	0.007241	0.025242	0.287
connective1:particle2	-0.042170	0.025236	-1.671

4500ms after pronoun onset

model1 = lmer(Logodds2 ~ condition + (1|participant) + (1|item), data = data)

	Estimate	Std. Error	t value
(Intercept)	-0.20969	0.04870	-4.305
Base_Concessive	0.20545	0.05999	3.425
Meme_Causal	-0.12899	0.05999	-2.150
Meme_Concessive	0.18761	0.06112	3.069
Seul_Causal	0.01059	0.06004	0.176
Seul_Concessive	0.07495	0.05999	1.249

model2 = lmer(Logodds2 ~ connective*particle+(1|participant) + (1|item), data = data)

	Estimate	Std. Error	t value
(Intercept)	-0.151423	0.029542	-5.126
connective1	-0.097736	0.017541	-5.572
particle1	0.044459	0.024494	1.815
particle2	-0.028962	0.024958	-1.160
connective1:particle1	-0.004991	0.024651	-0.202
connective1:particle2	-0.060565	0.024648	-2.457

4900ms after pronoun onset

model1 = lmer(Logodds2 ~ condition + (1|participant) + (1|item), data = data)

	Estimate	Std. Error	t value
(Intercept)	-0.18328	0.04603	-3.982
Base_Concessive	0.18962	0.05693	3.331
Meme_Causal	-0.12354	0.05694	-2.170
Meme_Concessive	0.10826	0.05798	1.867
Seul_Causal	-0.01631	0.05695	-0.286
Seul_Concessive	0.05082	0.05693	0.893

model2 = lmer(Logodds2 ~ connective*particle+(1|participant) + (1|item), data = data)

	Estimate	Std. Error	t value
(Intercept)	-0.14847	0.02772	-5.356
connective1	-0.08143	0.01664	-4.895
particle1	0.06000	0.02325	2.581
particle2	-0.04245	0.02367	-1.794
connective1:particle1	-0.01338	0.02339	-0.572
connective1:particle2	-0.03447	0.02339	-1.474

Fixed effects for offline antecedent choices

Baselines included: mfull = glmer(Value~ connective*particle+(1|Participant)+(1|Item), family=binomial(link="logit"), data=data)

	Estimate	Std. Error	z value	Pr(>|z|)
(Intercept)	-0.2549	0.2033	-1.254	0.20983
connectiveConcessive	1.5336	0.1935	7.924	2.31e-15 ***
particleBase	0.1628	0.1724	0.944	0.34493
particleSeul	0.7728	0.1757	4.398	1.09e-05 ***
connectiveConcessive:particleBase	-0.0380	0.2684	-0.142	0.88742
connectiveConcessive:particleSeul	-0.8465	0.2630	-3.219	0.00129 **

Baselines excluded: mfull2 = glmer(Value~ connective*particle+(1|Participant)+(1|Item), family=binomial(link="logit"), data=datasubset)

	Estimate	Std. Error	z value	Pr(>|z|)
(Intercept)	-0.2528	0.1929	-1.311	0.18997
connectiveConcessive	1.5150	0.1937	7.820	5.30e-15 ***
particleSeul	0.7767	0.1754	4.429	9.47e-06 ***
connectiveConcessive:particleSeul	-0.8462	0.2603	-3.250	0.00115 **

Fixed effects for fixation logodds on Experiment 14 for **high-span group**

Pre-critical region (connective)

200ms after connective onset

model1 = lmer(Logodds2 ~ condition + (1|participant) + (1|item), data = data)

	Estimate	Std. Error	t value
(Intercept)	-0.51042	0.07902	-6.460
Base_Concessive	-0.16948	0.09428	-1.798
Meme_Causal	0.10050	0.09430	1.066
Meme_Concessive	0.13979	0.09510	1.470
Seul_Causal	0.11407	0.09521	1.198
Seul_Concessive	0.14943	0.09428	1.585

model2 = lmer(Logodds2 ~ connective*particle+(1|participant) + (1|item), data = data)

	Estimate	Std. Error	t value
(Intercept)	-0.45470	0.05040	-9.021
connective1	0.01580	0.02753	0.574
particle1	0.06443	0.03904	1.650
particle2	-0.14046	0.03848	-3.650
connective1:particle1	-0.03545	0.03858	-0.919
connective1:particle2	0.06893	0.03876	1.778

400ms after connective onset

model1 = lmer(Logodds2 ~ condition + (1|participant) + (1|item), data = data)

	Estimate	Std. Error	t value
(Intercept)	-0.57083	0.08067	-7.077
Base_Concessive	-0.04952	0.09289	-0.533
Meme_Causal	0.16221	0.09293	1.746
Meme_Concessive	0.17993	0.09370	1.920
Seul_Causal	0.22875	0.09387	2.437
Seul_Concessive	0.16748	0.09289	1.803

model2 = lmer(Logodds2 ~ connective*particle+(1|participant) + (1|item), data = data)

	Estimate	Std. Error	t value
(Intercept)	-0.456027	0.053965	-8.450
connective1	0.015514	0.027115	0.572
particle1	0.056262	0.038488	1.462
particle2	-0.139569	0.037914	-3.681
connective1:particle1	-0.024371	0.038028	-0.641
connective1:particle2	0.009247	0.038222	0.242

Critical region (pronoun + a/ait l'habitude de)

200ms after pronoun onset

model1 = lmer(Logodds2 ~ condition + (1|participant) + (1|item), data = data)

	Estimate	Std. Error	t value
(Intercept)	-0.56212	0.08194	-6.861
Base_Concessive	-0.01199	0.09318	-0.129
Meme_Causal	0.18318	0.09318	1.966
Meme_Concessive	0.14616	0.09424	1.551
Seul_Causal	0.22342	0.09424	2.371
Seul_Concessive	0.18016	0.09318	1.933

model2 = lmer(Logodds2 ~ connective*particle+(1|participant) + (1|item), data = data)

	Estimate	Std. Error	t value
(Intercept)	-0.441970	0.055638	-7.944
connective1	0.015378	0.027307	0.563
particle1	0.044517	0.038690	1.151
particle2	-0.126149	0.038042	-3.316
connective1:particle1	0.003130	0.038114	0.082
connective1:particle2	-0.009382	0.038331	-0.245

400ms after pronoun onset

model1 = lmer(Logodds2 ~ condition + (1|participant) + (1|item), data = data)

	Estimate	Std. Error	t value
(Intercept)	-0.47218	0.08495	-5.558
Base_Concessive	-0.00396	0.09635	-0.041
Meme_Causal	0.11563	0.09636	1.200
Meme_Concessive	0.17498	0.09737	1.797
Seul_Causal	0.14439	0.09743	1.482
Seul_Concessive	0.16836	0.09635	1.747

model2 = lmer(Logodds2 ~ connective*particle+(1|participant) + (1|item), data = data)

	Estimate	Std. Error	t value
(Intercept)	-0.37228	0.05787	-6.433
connective1	-0.01323	0.02820	-0.469
particle1	0.04541	0.03998	1.136
particle2	-0.10188	0.03933	-2.590
connective1:particle1	-0.01645	0.03942	-0.417
connective1:particle2	0.01521	0.03964	0.384

600ms after pronoun onset

model1 = lmer(Logodds2 ~ condition + (1|participant) + (1|item), data = data)

	Estimate	Std. Error	t value
(Intercept)	-0.49129	0.09422	-5.215
Base_Concessive	0.15983	0.09819	1.628
Meme_Causal	0.17498	0.09824	1.781
Meme_Concessive	0.33610	0.09921	3.388
Seul_Causal	0.20899	0.09940	2.103
Seul_Concessive	0.30096	0.09819	3.065

model2 = lmer(Logodds2 ~ connective*particle+(1|participant) + (1|item), data = data)

	Estimate	Std. Error	t value
(Intercept)	-0.29448	0.06971	-4.224
connective1	-0.06882	0.02872	-2.396
particle1	0.05873	0.04078	1.440
particle2	-0.11690	0.04008	-2.917
connective1:particle1	-0.01174	0.04021	-0.292
connective1:particle2	-0.01110	0.04045	-0.274

800ms after pronoun onset

model1 = lmer(Logodds2 ~ condition + (1|participant) + (1|item), data = data)

	Estimate	Std. Error	t value
(Intercept)	-0.44913	0.09654	-4.652
Base_Concessive	0.23427	0.09859	2.376
Meme_Causal	0.18450	0.09863	1.871
Meme_Concessive	0.33753	0.09965	3.387
Seul_Causal	0.25843	0.09983	2.589
Seul_Concessive	0.34344	0.09859	3.484

model2 = lmer(Logodds2 ~ connective*particle+(1|participant) + (1|item), data = data)

	Estimate	Std. Error	t value
(Intercept)	-0.22277	0.07260	-3.068
connective1	-0.07872	0.02886	-2.728
particle1	0.03465	0.04097	0.846
particle2	-0.10923	0.04024	-2.714
connective1:particle1	0.00220	0.04037	0.054
connective1:particle2	-0.03842	0.04062	-0.946

1000ms after pronoun onset

model1 = lmer(Logodds2 ~ condition + (1|participant) + (1|item), data = data)

	Estimate	Std. Error	t value
(Intercept)	-0.31609	0.10069	-3.139
Base_Concessive	0.18617	0.09925	1.876
Meme_Causal	0.14318	0.09930	1.442
Meme_Concessive	0.27394	0.10030	2.731
Seul_Causal	0.20764	0.10051	2.066
Seul_Concessive	0.28598	0.09925	2.881

model2 = lmer(Logodds2 ~ connective*particle+(1|participant) + (1|item), data = data)

	Estimate	Std. Error	t value
(Intercept)	-0.1332709	0.0776886	-1.716
connective1	-0.0658782	0.0290384	-2.269
particle1	0.0257431	0.0412457	0.624
particle2	-0.0897347	0.0405093	-2.215
connective1:particle1	0.0004969	0.0406539	0.012
connective1:particle2	-0.0272072	0.0409030	-0.665

1200ms after pronoun onset

model1 = lmer(Logodds2 ~ condition + (1|participant) + (1|item), data = data)

	Estimate	Std. Error	t value
(Intercept)	-0.29556	0.09622	-3.072
Base_Concessive	0.23336	0.09964	2.342
Meme_Causal	0.14487	0.09968	1.453
Meme_Concessive	0.29302	0.10071	2.909
Seul_Causal	0.14934	0.10091	1.480
Seul_Concessive	0.35254	0.09964	3.538

model2 = lmer(Logodds2 ~ connective*particle+(1|participant) + (1|item), data = data)

	Estimate	Std. Error	t value
(Intercept)	-0.10003	0.07158	-1.398
connective1	-0.09745	0.02916	-3.342
particle1	0.02342	0.04142	0.566
particle2	-0.07884	0.04067	-1.939
connective1:particle1	0.02338	0.04081	0.573
connective1:particle2	-0.01923	0.04106	-0.468

Post-critical region (continuation)

1500ms after pronoun onset

model1 = lmer(Logodds2 ~ condition + (1|participant) + (1|item), data = data)

	Estimate	Std. Error	t value
(Intercept)	-0.32818	0.09712	-3.379
Base_Concessive	0.23793	0.09777	2.433
Meme_Causal	0.06508	0.09780	0.665
Meme_Concessive	0.16091	0.09890	1.627
Seul_Causal	0.17219	0.09902	1.739
Seul_Concessive	0.44640	0.09777	4.566

model2 = lmer(Logodds2 ~ connective*particle+(1|participant) + (1|item), data = data)

	Estimate	Std. Error	t value
(Intercept)	-0.14776	0.07382	-2.002
connective1	-0.10133	0.02865	-3.537
particle1	-0.06742	0.04065	-1.659
particle2	-0.06145	0.03991	-1.540
connective1:particle1	0.05341	0.04003	1.334
connective1:particle2	-0.01763	0.04028	-0.438

1700ms after pronoun onset

model1 = lmer(Logodds2 ~ condition + (1|participant) + (1|item), data = data)

	Estimate	Std. Error	t value
(Intercept)	-0.35273	0.09219	-3.826
Base_Concessive	0.29915	0.09601	3.116
Meme_Causal	0.13141	0.09602	1.369
Meme_Concessive	0.17083	0.09719	1.758
Seul_Causal	0.31574	0.09721	3.248
Seul_Concessive	0.42625	0.09601	4.440

model2 = lmer(Logodds2 ~ connective*particle+(1|participant) + (1|item), data = data)

	Estimate	Std. Error	t value
(Intercept)	-0.12883	0.06825	-1.888
connective1	-0.07484	0.02817	-2.657
particle1	-0.07278	0.03992	-1.823
particle2	-0.07432	0.03920	-1.896
connective1:particle1	0.05514	0.03928	1.404
connective1:particle2	-0.07473	0.03953	-1.891

1900ms after pronoun onset

model1 = lmer(Logodds2 ~ condition + (1|participant) + (1|item), data = data)

	Estimate	Std. Error	t value
(Intercept)	-0.38102	0.08935	-4.264
Base_Concessive	0.29211	0.09422	3.100
Meme_Causal	0.16580	0.09424	1.759
Meme_Concessive	0.14139	0.09534	1.483
Seul_Causal	0.36780	0.09545	3.853
Seul_Concessive	0.45096	0.09422	4.786

model2 = lmer(Logodds2 ~ connective*particle+(1|participant) + (1|item), data = data)

	Estimate	Std. Error	t value
(Intercept)	-0.14467	0.06546	-2.210
connective1	-0.05848	0.02762	-2.117
particle1	-0.08275	0.03919	-2.111
particle2	-0.09029	0.03846	-2.348
connective1:particle1	0.07068	0.03857	1.832
connective1:particle2	-0.08758	0.03882	-2.256

2100ms after pronoun onset

model1 = lmer(Logodds2 ~ condition + (1|participant) + (1|item), data = data)

	Estimate	Std. Error	t value
(Intercept)	-0.42209	0.08686	-4.860
Base_Concessive	0.33168	0.09245	3.588
Meme_Causal	0.17259	0.09246	1.867
Meme_Concessive	0.18808	0.09361	2.009
Seul_Causal	0.33729	0.09365	3.602
Seul_Concessive	0.41299	0.09245	4.467

model2 = lmer(Logodds2 ~ connective*particle+(1|participant) + (1|item), data = data)

	Estimate	Std. Error	t value
(Intercept)	-0.18165	0.06311	-2.878
connective1	-0.07048	0.02713	-2.598
particle1	-0.06010	0.03847	-1.562
particle2	-0.07460	0.03774	-1.977
connective1:particle1	0.06274	0.03783	1.658
connective1:particle2	-0.09536	0.03808	-2.504

2300ms after pronoun onset

model1 = lmer(Logodds2 ~ condition + (1|participant) + (1|item), data = data)

	Estimate	Std. Error	t value
(Intercept)	-0.42839	0.08140	-5.263
Base_Concessive	0.27732	0.09014	3.077
Meme_Causal	0.10141	0.09014	1.125
Meme_Concessive	0.27799	0.09125	3.047
Seul_Causal	0.36779	0.09126	4.030
Seul_Concessive	0.30942	0.09014	3.433

model2 = lmer(Logodds2 ~ connective*particle+(1|participant) + (1|item), data = data)

	Estimate	Std. Error	t value
(Intercept)	-0.20606	0.05693	-3.620
connective1	-0.06592	0.02645	-2.493
particle1	-0.03262	0.03748	-0.870
particle2	-0.08366	0.03680	-2.274
connective1:particle1	-0.02237	0.03688	-0.607
connective1:particle2	-0.07274	0.03711	-1.960

2500ms after pronoun onset

model1 = lmer(Logodds2 ~ condition + (1|participant) + (1|item), data = data)

	Estimate	Std. Error	t value
(Intercept)	-0.43291	0.08211	-5.272
Base_Concessive	0.28831	0.09010	3.200
Meme_Causal	0.13393	0.09012	1.486
Meme_Concessive	0.31896	0.09114	3.500
Seul_Causal	0.34270	0.09124	3.756
Seul_Concessive	0.31288	0.09010	3.473

model2 = lmer(Logodds2 ~ connective*particle+(1|participant) + (1|item), data = data)

	Estimate	Std. Error	t value
(Intercept)	-0.200116	0.057964	-3.452
connective1	-0.073922	0.026402	-2.800
particle1	-0.006353	0.037460	-0.170
particle2	-0.088641	0.036778	-2.410
connective1:particle1	-0.018596	0.036885	-0.504
connective1:particle2	-0.070234	0.037114	-1.892

2900ms after pronoun onset

model1 = lmer(Logodds2 ~ condition + (1|participant) + (1|item), data = data)

	Estimate	Std. Error	t value
(Intercept)	-0.37397	0.08660	-4.318
Base_Concessive	0.19243	0.09083	2.119
Meme_Causal	0.02964	0.09086	0.326
Meme_Concessive	0.24511	0.09186	2.668
Seul_Causal	0.16550	0.09198	1.799
Seul_Concessive	0.24860	0.09083	2.737

model2 = lmer(Logodds2 ~ connective*particle+(1|participant) + (1|item), data = data)

	Estimate	Std. Error	t value
(Intercept)	-0.227084	0.063737	-3.563
connective1	-0.081835	0.026606	-3.076
particle1	-0.009506	0.037757	-0.252
particle2	-0.050665	0.037075	-1.367
connective1:particle1	-0.025902	0.037187	-0.697
connective1:particle2	-0.014382	0.037416	-0.384

3300ms after pronoun onset

model1 = lmer(Logodds2 ~ condition + (1|participant) + (1|item), data = data)

	Estimate	Std. Error	t value
(Intercept)	-0.30434	0.07835	-3.884
Base_Concessive	0.19144	0.09162	2.089
Meme_Causal	0.07517	0.09167	0.820
Meme_Concessive	0.13469	0.09247	1.457
Seul_Causal	0.11067	0.09265	1.194
Seul_Concessive	0.21024	0.09162	2.295

model2 = lmer(Logodds2 ~ connective*particle+(1|participant) + (1|item), data = data)

	Estimate	Std. Error	t value
(Intercept)	-0.18398	0.05140	-3.579
connective1	-0.05842	0.02676	-2.183
particle1	-0.01544	0.03800	-0.406
particle2	-0.02465	0.03740	-0.659
connective1:particle1	0.02866	0.03752	0.764
connective1:particle2	-0.03730	0.03772	-0.989

3700ms after pronoun onset

model1 = lmer(Logodds2 ~ condition + (1|participant) + (1|item), data = data)

	Estimate	Std. Error	t value
(Intercept)	-0.26320	0.07759	-3.392
Base_Concessive	0.19087	0.08853	2.156
Meme_Causal	0.03820	0.08859	0.431
Meme_Concessive	0.05229	0.08934	0.585
Seul_Causal	0.17299	0.08956	1.932
Seul_Concessive	0.23080	0.08853	2.607

model2 = lmer(Logodds2 ~ connective*particle+(1|participant) + (1|item), data = data)

	Estimate	Std. Error	t value
(Intercept)	-0.14901	0.05249	-2.838
connective1	-0.04380	0.02585	-1.694
particle1	-0.06895	0.03672	-1.877
particle2	-0.01876	0.03613	-0.519
connective1:particle1	0.03675	0.03626	1.013
connective1:particle2	-0.05164	0.03646	-1.416

4100ms after pronoun onset

model1 = lmer(Logodds2 ~ condition + (1|participant) + (1|item), data = data)

	Estimate	Std. Error	t value
(Intercept)	-0.18353	0.07395	-2.482
Base_Concessive	0.09578	0.08589	1.115
Meme_Causal	-0.07324	0.08593	-0.852
Meme_Concessive	0.02954	0.08673	0.341
Seul_Causal	0.06134	0.08688	0.706
Seul_Concessive	0.21915	0.08589	2.551

model2 = lmer(Logodds2 ~ connective*particle+(1|participant) + (1|item), data = data)

	Estimate	Std. Error	t value
(Intercept)	-0.128097	0.048932	-2.618
connective1	-0.059395	0.025105	-2.366
particle1	-0.077278	0.035637	-2.168
particle2	-0.007538	0.035058	-0.215
connective1:particle1	0.008007	0.035167	0.228
connective1:particle2	0.011504	0.035362	0.325

4500ms after pronoun onset

model1 = lmer(Logodds2 ~ condition + (1|participant) + (1|item), data = data)

	Estimate	Std. Error	t value
(Intercept)	-0.26353	0.07349	-3.586
Base_Concessive	0.30516	0.08513	3.585
Meme_Causal	-0.04123	0.08516	-0.484
Meme_Concessive	0.21054	0.08593	2.450
Seul_Causal	0.04897	0.08606	0.569
Seul_Concessive	0.22450	0.08513	2.637

model2 = lmer(Logodds2 ~ connective*particle+(1|participant) + (1|item), data = data)

	Estimate	Std. Error	t value
(Intercept)	-0.13888	0.04881	-2.845
connective1	-0.12208	0.02487	-4.908
particle1	-0.04000	0.03529	-1.133
particle2	0.02792	0.03475	0.804
connective1:particle1	-0.00381	0.03484	-0.109
connective1:particle2	-0.03050	0.03503	-0.871

4900ms after pronoun onset

model1 = lmer(Logodds2 ~ condition + (1|participant) + (1|item), data = data)

	Estimate	Std. Error	t value
(Intercept)	-0.22463	0.06659	-3.373
Base_Concessive	0.25035	0.07965	3.143
Meme_Causal	-0.03267	0.07969	-0.410
Meme_Concessive	0.15650	0.08036	1.948
Seul_Causal	0.02750	0.08050	0.342
Seul_Concessive	0.14887	0.07965	1.869

model2 = lmer(Logodds2 ~ connective*particle+(1|participant) + (1|item), data = data)

	Estimate	Std. Error	t value
(Intercept)	-0.132874	0.042325	-3.139
connective1	-0.093482	0.023254	-4.020
particle1	-0.029844	0.033005	-0.904
particle2	0.033416	0.032511	1.028
connective1:particle1	-0.001102	0.032607	-0.034
connective1:particle2	-0.031692	0.032774	-0.967

Fixed effects for offline antecedent choices for **high-span group**

model1 = glmer(Value ~ Condition + (1|Participant) + (1|Item), family=binomial(link="logit"), data = data)

	Estimate	Std. Error	z value	Pr(>|z|)
(Intercept)	0.1355	0.2674	0.507	0.612365
ConditionBase_Conce	1.6866	0.2803	6.017	1.78e-09 ***
ConditionMeme_Cause	-0.1931	0.2394	-0.806	0.420048
ConditionMeme_Conce	1.6599	0.2863	5.799	6.68e-09 ***
ConditionSeul_Cause	0.9700	0.2565	3.782	0.000155 ***
ConditionSeul_Conce	1.3944	0.2677	5.209	1.90e-07 ***

model2 = glmer(Value~ connective*particle+(1|Participant)+(1|Item), family=binomial(link="logit"), data=data)

	Estimate	Std. Error	z value	Pr(>|z|)
(Intercept)	1.05510	0.22226	4.747	2.06e-06 ***
connective1	-0.66065	0.08289	-7.970	1.59e-15 ***
particle1	-0.18621	0.11577	-1.608	0.1077
particle2	-0.07634	0.11283	-0.677	0.4987
connective1:particle1	-0.26583	0.11394	-2.333	0.0196 *
connective1:particle2	-0.18263	0.11432	-1.598	0.1101

Fixed effects for fixation logodds on Experiment 14 for **low-span group**

Pre-critical region (connective)

200ms after connective onset

model1 = lmer(Logodds2 ~ condition + (1|participant) + (1|item), data = data)

	Estimate	Std. Error	t value
(Intercept)	-0.50049	0.07911	-6.327
Base_Concessive	-0.11854	0.09562	-1.240
Meme_Causal	0.10710	0.09562	1.120
Meme_Concessive	0.09895	0.09853	1.004
Seul_Causal	0.12519	0.09474	1.321
Seul_Concessive	0.03668	0.09562	0.384

model2 = lmer(Logodds2 ~ connective*particle+(1|participant) + (1|item), data = data)

	Estimate	Std. Error	t value
(Intercept)	-0.45892	0.04950	-9.271
connective1	0.03587	0.02797	1.282
particle1	0.06146	0.04001	1.536
particle2	-0.10083	0.03905	-2.582
connective1:particle1	-0.03179	0.03953	-0.804
connective1:particle2	0.02340	0.03930	0.595

400ms after connective onset

model1 = lmer(Logodds2 ~ condition + (1|participant) + (1|item), data = data)

	Estimate	Std. Error	t value
(Intercept)	-0.48442	0.07674	-6.313
Base_Concessive	-0.12470	0.09778	-1.275
Meme_Causal	0.21041	0.09780	2.151
Meme_Concessive	0.13075	0.10065	1.299
Seul_Causal	0.07229	0.09685	0.746
Seul_Concessive	0.12287	0.09778	1.257

model2 = lmer(Logodds2 ~ connective*particle+(1|participant) + (1|item), data = data)

	Estimate	Std. Error	t value
(Intercept)	-0.41582	0.04366	-9.523
connective1	0.02563	0.02857	0.897
particle1	0.10198	0.04087	2.495
particle2	-0.13095	0.03994	-3.279
connective1:particle1	0.01420	0.04043	0.351
connective1:particle2	0.03672	0.04018	0.914

Critical region (pronoun + a/ait l'habitude de)

200ms after pronoun onset

model1 = lmer(Logodds2 ~ condition + (1|participant) + (1|item), data = data)

	Estimate	Std. Error	t value
(Intercept)	-0.48670	0.07932	-6.136
Base_Concessive	-0.01352	0.09949	-0.136
Meme_Causal	0.25065	0.09954	2.518
Meme_Concessive	0.12607	0.10209	1.235
Seul_Causal	0.06487	0.09837	0.659
Seul_Concessive	0.18865	0.09949	1.896

model2 = lmer(Logodds2 ~ connective*particle+(1|participant) + (1|item), data = data)

	Estimate	Std. Error	t value
(Intercept)	-0.383915	0.046567	-8.244
connective1	0.002386	0.028957	0.082
particle1	0.085575	0.041416	2.066
particle2	-0.109548	0.040644	-2.695
connective1:particle1	0.059902	0.041135	1.456
connective1:particle2	0.004377	0.040826	0.107

400ms after pronoun onset

model1 = lmer(Logodds2 ~ condition + (1|participant) + (1|item), data = data)

	Estimate	Std. Error	t value
(Intercept)	-0.50476	0.08718	-5.790
Base_Concessive	0.11183	0.09847	1.136
Meme_Causal	0.15412	0.09853	1.564
Meme_Concessive	0.17533	0.10165	1.725
Seul_Causal	0.09901	0.09788	1.012
Seul_Concessive	0.26560	0.09847	2.697

model2 = lmer(Logodds2 ~ connective*particle+(1|participant) + (1|item), data = data)

	Estimate	Std. Error	t value
(Intercept)	-0.370446	0.059671	-6.208
connective1	-0.049938	0.028865	-1.730
particle1	0.030411	0.041339	0.736
particle2	-0.078399	0.040230	-1.949
connective1:particle1	0.039333	0.040781	0.964
connective1:particle2	-0.005976	0.040567	-0.147

600ms after pronoun onset

model1 = lmer(Logodds2 ~ condition + (1|participant) + (1|item), data = data)

	Estimate	Std. Error	t value
(Intercept)	-0.44585	0.08556	-5.211
Base_Concessive	0.19219	0.10193	1.885
Meme_Causal	0.04798	0.10199	0.470
Meme_Concessive	0.21066	0.10518	2.003
Seul_Causal	0.11356	0.10126	1.121
Seul_Concessive	0.25215	0.10193	2.474

model2 = lmer(Logodds2 ~ connective*particle+(1|participant) + (1|item), data = data)

	Estimate	Std. Error	t value
(Intercept)	-0.3097550	0.0546994	-5.663
connective1	-0.0822433	0.0298663	-2.754
particle1	-0.0067693	0.0427641	-0.158
particle2	-0.0399935	0.0416447	-0.960
connective1:particle1	0.0009061	0.0422057	0.021
connective1:particle2	-0.0138537	0.0419770	-0.330

800ms after pronoun onset

model1 = lmer(Logodds2 ~ condition + (1|participant) + (1|item), data = data)

	Estimate	Std. Error	t value
(Intercept)	-0.376702	0.082533	-4.564
Base_Concessive	0.209662	0.103279	2.030
Meme_Causal	0.009456	0.103279	0.092
Meme_Concessive	0.204740	0.106531	1.922
Seul_Causal	0.135474	0.102415	1.323
Seul_Concessive	0.195540	0.103279	1.893

model2 = lmer(Logodds2 ~ connective*particle+(1|participant) + (1|item), data = data)

	Estimate	Std. Error	t value
(Intercept)	-0.25089	0.04867	-5.155
connective1	-0.07750	0.03025	-2.562
particle1	-0.01871	0.04328	-0.432
particle2	-0.02098	0.04218	-0.497
connective1:particle1	-0.02014	0.04271	-0.472
connective1:particle2	-0.02733	0.04247	-0.643

1000ms after pronoun onset

model1 = lmer(Logodds2 ~ condition + (1|participant) + (1|item), data = data)

	Estimate	Std. Error	t value
(Intercept)	-0.35851	0.09388	-3.819
Base_Concessive	0.18851	0.10543	1.788
Meme_Causal	0.01769	0.10549	0.168
Meme_Concessive	0.28410	0.10858	2.617
Seul_Causal	0.13910	0.10458	1.330
Seul_Concessive	0.22392	0.10543	2.124

model2 = lmer(Logodds2 ~ connective*particle+(1|participant) + (1|item), data = data)

	Estimate	Std. Error	t value
(Intercept)	-0.216292	0.064681	-3.344
connective1	-0.089955	0.030819	-2.919
particle1	0.008675	0.044114	0.197
particle2	-0.047964	0.043073	-1.114
connective1:particle1	-0.043248	0.043636	-0.991
connective1:particle2	-0.004300	0.043368	-0.099

1200ms after pronoun onset

model1 = lmer(Logodds2 ~ condition + (1|participant) + (1|item), data = data)

	Estimate	Std. Error	t value
(Intercept)	-0.3281879	0.1009269	-3.252
Base_Concessive	0.2515199	0.1046500	2.403
Meme_Causal	0.0003262	0.1047116	0.003
Meme_Concessive	0.2821815	0.1079731	2.613
Seul_Causal	0.0956599	0.1039572	0.920
Seul_Concessive	0.2125792	0.1046504	2.031

model2 = lmer(Logodds2 ~ connective*particle+(1|participant) + (1|item), data = data)

	Estimate	Std. Error	t value
(Intercept)	-0.1878094	0.0749949	-2.504
connective1	-0.1083824	0.0306585	-3.535
particle1	0.0008761	0.0438982	0.020
particle2	-0.0146178	0.0427543	-0.342
connective1:particle1	-0.0325452	0.0433301	-0.751
connective1:particle2	-0.0173775	0.0430937	-0.403

Post-critical region (continuation)

1500ms after pronoun onset

model1 = lmer(Logodds2 ~ condition + (1|participant) + (1|item), data = data)

	Estimate	Std. Error	t value
(Intercept)	-0.18456	0.09832	-1.877
Base_Concessive	0.12823	0.10303	1.245
Meme_Causal	-0.11654	0.10311	-1.130
Meme_Concessive	0.19651	0.10641	1.847
Seul_Causal	0.02166	0.10250	0.211
Seul_Concessive	0.05883	0.10303	0.571

model2 = lmer(Logodds2 ~ connective*particle+(1|participant) + (1|item), data = data)

	Estimate	Std. Error	t value
(Intercept)	-0.136441	0.072421	-1.884
connective1	-0.079742	0.030220	-2.639
particle1	-0.008132	0.043292	-0.188
particle2	0.016002	0.042096	0.380
connective1:particle1	-0.076782	0.042688	-1.799
connective1:particle2	0.015626	0.042472	0.368

1700ms after pronoun onset

model1 = lmer(Logodds2 ~ condition + (1|participant) + (1|item), data = data)

	Estimate	Std. Error	t value
(Intercept)	-0.20316	0.09693	-2.096
Base_Concessive	0.16064	0.10224	1.571
Meme_Causal	-0.08323	0.10228	-0.814
Meme_Concessive	0.21351	0.10566	2.021
Seul_Causal	0.03154	0.10165	0.310
Seul_Concessive	0.12718	0.10224	1.244

model2 = lmer(Logodds2 ~ connective*particle+(1|participant) + (1|item), data = data)

	Estimate	Std. Error	t value
(Intercept)	-0.128216	0.071002	-1.806
connective1	-0.092170	0.030014	-3.071
particle1	-0.009798	0.042978	-0.228
particle2	0.005379	0.041767	0.129
connective1:particle1	-0.056200	0.042333	-1.328
connective1:particle2	0.011850	0.042129	0.281

1900ms after pronoun onset

model1 = lmer(Logodds2 ~ condition + (1|participant) + (1|item), data = data)

	Estimate	Std. Error	t value
(Intercept)	-0.17561	0.08968	-1.958
Base_Concessive	0.10682	0.10283	1.039
Meme_Causal	-0.04019	0.10286	-0.391
Meme_Concessive	0.25294	0.10624	2.381
Seul_Causal	-0.12387	0.10219	-1.212
Seul_Concessive	0.15929	0.10283	1.549

model2 = lmer(Logodds2 ~ connective*particle+(1|participant) + (1|item), data = data)

	Estimate	Std. Error	t value
(Intercept)	-0.116445	0.060315	-1.931
connective1	-0.113853	0.030178	-3.773
particle1	0.047210	0.043207	1.093
particle2	-0.005755	0.042005	-0.137
connective1:particle1	-0.032711	0.042567	-0.768
connective1:particle2	0.060441	0.042358	1.427

2100ms after pronoun onset

model1 = lmer(Logodds2 ~ condition + (1|participant) + (1|item), data = data)

	Estimate	Std. Error	t value
(Intercept)	-0.29390	0.08597	-3.418
Base_Concessive	0.09751	0.09831	0.992
Meme_Causal	0.11767	0.09835	1.196
Meme_Concessive	0.32340	0.10159	3.184
Seul_Causal	0.01062	0.09774	0.109
Seul_Concessive	0.20688	0.09831	2.104

model2 = lmer(Logodds2 ~ connective*particle+(1|participant) + (1|item), data = data)

	Estimate	Std. Error	t value
(Intercept)	-0.16788	0.05801	-2.894
connective1	-0.08325	0.02885	-2.885
particle1	0.09452	0.04132	2.288
particle2	-0.07726	0.04016	-1.924
connective1:particle1	-0.01962	0.04071	-0.482
connective1:particle2	0.03450	0.04051	0.852

2300ms after pronoun onset

model1 = lmer(Logodds2 ~ condition + (1|participant) + (1|item), data = data)

	Estimate	Std. Error	t value
(Intercept)	-0.27263	0.08707	-3.131
Base_Concessive	0.10364	0.09859	1.051
Meme_Causal	0.04104	0.09862	0.416
Meme_Concessive	0.22146	0.10191	2.173
Seul_Causal	0.05246	0.09803	0.535
Seul_Concessive	0.15668	0.09859	1.589

model2 = lmer(Logodds2 ~ connective*particle+(1|participant) + (1|item), data = data)

	Estimate	Std. Error	t value
(Intercept)	-0.17675	0.05944	-2.974
connective1	-0.06471	0.02895	-2.235
particle1	0.03537	0.04145	0.853
particle2	-0.04406	0.04027	-1.094
connective1:particle1	-0.02550	0.04082	-0.625
connective1:particle2	0.01289	0.04063	0.317

2500ms after pronoun onset

model1 = lmer(Logodds2 ~ condition + (1|participant) + (1|item), data = data)

	Estimate	Std. Error	t value
(Intercept)	-0.253962	0.082231	-3.088
Base_Concessive	0.068723	0.098039	0.701
Meme_Causal	-0.001747	0.098071	-0.018
Meme_Concessive	0.187898	0.101222	1.856
Seul_Causal	0.072661	0.097377	0.746
Seul_Concessive	0.204508	0.098039	2.086

model2 = lmer(Logodds2 ~ connective*particle+(1|participant) + (1|item), data = data)

	Estimate	Std. Error	t value
(Intercept)	-0.165288	0.052519	-3.147
connective1	-0.065036	0.028747	-2.262
particle1	0.004402	0.041153	0.107
particle2	-0.054312	0.040050	-1.356
connective1:particle1	-0.029787	0.040578	-0.734
connective1:particle2	0.030674	0.040368	0.760

2900ms after pronoun onset

model1 = lmer(Logodds2 ~ condition + (1|participant) + (1|item), data = data)

	Estimate	Std. Error	t value
(Intercept)	-0.24368	0.07949	-3.065
Base_Concessive	0.15942	0.09991	1.596
Meme_Causal	-0.01355	0.09993	-0.136
Meme_Concessive	0.08200	0.10297	0.796
Seul_Causal	0.02796	0.09907	0.282
Seul_Concessive	0.11906	0.09991	1.192

model2 = lmer(Logodds2 ~ connective*particle+(1|participant) + (1|item), data = data)

	Estimate	Std. Error	t value
(Intercept)	-0.181199	0.046489	-3.898
connective1	-0.057677	0.029233	-1.973
particle1	-0.028256	0.041829	-0.676
particle2	0.017230	0.040812	0.422
connective1:particle1	0.009904	0.041329	0.240
connective1:particle2	-0.022033	0.041087	-0.536

3300ms after pronoun onset

model1 = lmer(Logodds2 ~ condition + (1|participant) + (1|item), data = data)

	Estimate	Std. Error	t value
(Intercept)	-0.31790	0.07346	-4.327
Base_Concessive	0.17794	0.09590	1.856
Meme_Causal	0.01054	0.09594	0.110
Meme_Concessive	0.29306	0.09855	2.974
Seul_Causal	0.10329	0.09491	1.088
Seul_Concessive	0.26156	0.09590	2.727

model2 = lmer(Logodds2 ~ connective*particle+(1|participant) + (1|item), data = data)

	Estimate	Std. Error	t value
(Intercept)	-0.17683	0.03957	-4.468
connective1	-0.10312	0.02796	-3.688
particle1	0.01074	0.04000	0.268
particle2	-0.05210	0.03918	-1.330
connective1:particle1	-0.03814	0.03966	-0.962
connective1:particle2	0.01415	0.03938	0.359

3700ms after pronoun onset

model1 = lmer(Logodds2 ~ condition + (1|participant) + (1|item), data = data)

	Estimate	Std. Error	t value
(Intercept)	-0.26069	0.06943	-3.755
Base_Concessive	0.11574	0.09662	1.198
Meme_Causal	-0.10708	0.09662	-1.108
Meme_Concessive	0.21231	0.09881	2.149
Seul_Causal	0.04071	0.09516	0.428
Seul_Concessive	0.13193	0.09662	1.365

model2 = lmer(Logodds2 ~ connective*particle+(1|participant) + (1|item), data = data)

	Estimate	Std. Error	t value
(Intercept)	-0.195091	0.030526	-6.391
connective1	-0.087725	0.028013	-3.132
particle1	-0.012987	0.040013	-0.325
particle2	-0.007732	0.039464	-0.196
connective1:particle1	-0.071974	0.039881	-1.805
connective1:particle2	0.029857	0.039531	0.755

4100ms after pronoun onset

model1 = lmer(Logodds2 ~ condition + (1|participant) + (1|item), data = data)

	Estimate	Std. Error	t value
(Intercept)	-0.25260	0.07499	-3.369
Base_Concessive	0.20052	0.09170	2.187
Meme_Causal	-0.11575	0.09170	-1.262
Meme_Concessive	0.23186	0.09409	2.464
Seul_Causal	0.02270	0.09055	0.251
Seul_Concessive	-0.01193	0.09170	-0.130

model2 = lmer(Logodds2 ~ connective*particle+(1|participant) + (1|item), data = data)

	Estimate	Std. Error	t value
(Intercept)	-0.19803	0.04605	-4.300
connective1	-0.08558	0.02669	-3.207
particle1	0.00349	0.03815	0.091
particle2	0.04569	0.03745	1.220
connective1:particle1	-0.08823	0.03788	-2.329
connective1:particle2	-0.01468	0.03759	-0.390

4500ms after pronoun onset

model1 = lmer(Logodds2 ~ condition + (1|participant) + (1|item), data = data)

	Estimate	Std. Error	t value
(Intercept)	-0.12386	0.07810	-1.586
Base_Concessive	0.09100	0.08861	1.027
Meme_Causal	-0.24017	0.08861	-2.711
Meme_Concessive	0.13647	0.09081	1.503
Seul_Causal	-0.05822	0.08741	-0.666
Seul_Concessive	-0.10460	0.08861	-1.181

model2 = lmer(Logodds2 ~ connective*particle+(1|participant) + (1|item), data = data)

	Estimate	Std. Error	t value
(Intercept)	-0.15311	0.05320	-2.878
connective1	-0.07021	0.02575	-2.726
particle1	-0.02260	0.03680	-0.614
particle2	0.07475	0.03619	2.066
connective1:particle1	-0.11811	0.03659	-3.228
connective1:particle2	0.02471	0.03630	0.681

4900ms after pronoun onset

model1 = lmer(Logodds2 ~ condition + (1|participant) + (1|item), data = data)

	Estimate	Std. Error	t value
(Intercept)	-0.11656	0.06974	-1.671
Base_Concessive	0.12183	0.08531	1.428
Meme_Causal	-0.21253	0.08534	-2.490
Meme_Concessive	0.05377	0.08759	0.614
Seul_Causal	-0.09427	0.08434	-1.118
Seul_Concessive	-0.09835	0.08531	-1.153

model2 = lmer(Logodds2 ~ connective*particle+(1|participant) + (1|item), data = data)

	Estimate	Std. Error	t value
(Intercept)	-0.154814	0.042807	-3.617
connective1	-0.064006	0.024850	-2.576
particle1	-0.041123	0.035534	-1.157
particle2	0.099174	0.034849	2.846
connective1:particle1	-0.069141	0.035263	-1.961
connective1:particle2	0.003091	0.035005	0.088

Fixed effects for offline antecedent choices for **low-span group**

model1 = glmer(Value ~ Condition + (1|Participant) + (1|Item), family=binomial(link="logit"), data = data)

	Estimate	Std. Error	z value	Pr(>|z|)
(Intercept)	-0.4160	0.2872	-1.449	0.147
ConditionBase_Conce	1.4017	0.2738	5.119	3.06e-07 ***
ConditionMeme_Cause	-0.1429	0.2606	-0.548	0.584
ConditionMeme_Conce	1.1728	0.2779	4.220	2.44e-05 ***
ConditionSeul_Cause	0.3936	0.2581	1.525	0.127
ConditionSeul_Conce	1.2873	0.2701	4.766	1.88e-06 ***

model2 = glmer(Value~ connective*particle+(1|Participant)+(1|Item), family=binomial(link="logit"), data=data)

	Estimate	Std. Error	z value	Pr(>|z|)
(Intercept)	0.26940	0.23276	1.157	0.247
connective1	-0.60186	0.08022	-7.503	6.25e-14 ***
particle1	-0.17044	0.11356	-1.501	0.133
particle2	0.01542	0.11002	0.140	0.889
connective1:particle1	-0.05599	0.11101	-0.504	0.614
connective1:particle2	-0.09899	0.11137	-0.889	0.374