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**RESEARCH**

# Offline interpretation of subject pronouns by native speakers of Spanish

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Research on anaphora resolution reveals that speakers' interpretation of pronominal subjects is often inconsistent, with results differing in terms of the antecedent preferences of these speakers and the factors that affect these preferences. The present study investigates anaphora resolution by native speakers of Spanish using an offline judgment task where participants are presented with globally ambiguous anaphora to test the predictions of Carminati's (2002) Position of Antecedent Strategy (PAS) with Spanish intra-sentential Main-Subordinate anaphora. The results show that native speakers of Iberian Spanish have a clear preference for the object as the antecedent for the overt pronoun with this structure, while a preference for the subject as the antecedent for the null pronoun was not revealed. These findings appear to be at odds with the PAS and suggest that anaphora resolution is affected by clause order.

**Keywords:** Anaphora resolution; subject pronouns; antecedent preferences; Spanish; offline interpretation

## 1 Introduction

There is a large body of research on anaphora resolution that reveals that speakers' interpretation of pronominal subjects tends to be inconsistent in terms of their antecedent preferences. This has been shown to be the case not only for native speakers of null subject languages, such as Spanish, but also for native speakers of non-null subject languages, such as English, as well as for second language (L2) learners and first language (L1) attriters who speak a null subject language and a non-null subject language. However, it is still not clear from the existing literature how exactly this inconsistency is manifested in anaphora resolution, or which are the factors that affect antecedent preferences with subject pronouns.

The present study aims to contribute to this body of research by investigating anaphora resolution by native speakers of Spanish. Specifically, this study was conducted to test Carminati's (2002) Position of Antecedent Hypothesis (PAS) for Italian intra-sentential anaphora in Spanish and test the interpretative differences that seem to exist between Main-Subordinate and Subordinate-Main anaphora resolution. The PAS postulates that null pronouns are generally assigned to the subject antecedent whereas overt pronouns are generally assigned to the object antecedent (see Section 2.1). Research on anaphora resolution suggests that native speakers of null subject languages consistently assign the subject antecedent to a null pronoun whereas the overt pronoun is not so strictly assigned to the object antecedent (Alonso-Ovalle et al. 2002; Filiaci 2010; Filiaci et al. 2014). Contrary to these results, a recent study by Chamorro et al. (2016) found that Spanish speakers had a clear preference for the object as the antecedent for the overt pronoun, while their preference for the subject as the antecedent for the null pronoun was less consistent.

In order to provide further evidence on anaphora resolution, the present study investigated the interpretation of overt versus null subject pronouns in Spanish using an offline judgment task, where Spanish native speakers were presented with globally ambiguous Main-Subordinate anaphora. The results are interpreted in the light of the predictions of the PAS and the findings from Chamorro et al. (2016) and other relevant studies, with the aim of testing Carminati's proposal further and provide additional evidence about some of the factors which may influence pronoun interpretation in null subject languages.

## 2 Anaphora resolution in null subject languages

Null subject languages, also known as pro-drop languages, are characterized by allowing the subject position of a finite clause to be phonetically empty. Whereas pro-drop languages allow for either a null or an overt subject to appear as the subject of a sentence, as in (1a) for Spanish, in non-null subject languages, the use of a null subject is often ungrammatical, as in (1b) for English, where *pro* represents a null pronoun.

(1) a. Pedro/*pro* salió del restaurante.
Peter/*pro* left of + the restaurant
'(Peter) left the restaurant.'

b. Peter/**pro* left the restaurant.

The proposal of an empty category was first made by Chomsky's (1982) Extended Projection Principle (EPP), according to which the subject position in a sentence must be always filled. Therefore, in those instances in which the subject of a sentence is not phonetically realized, the EPP predicts that the syntactic category is filled with a null subject (i.e. *pro*), which is phonetically empty.

### 2.1 The alternation between null and overt subjects

There are several hypotheses on anaphora resolution which have tried to account for the interpretation of pronouns depending on the context in which they appear. In order to account for the division of labour between null and overt subject pronouns, Carminati (2002) proposed the PAS for Italian intra-sentential anaphora. The PAS postulates that null pronouns are generally assigned to the antecedent in the highest SpecIP (generally the subject), as in (2a), whereas overt pronouns are generally assigned to an antecedent in a syntactic position that is lower than the SpecIP (generally the object), as in (2b).

(2) a. Quando Mario$_i$ ha telefonato a Giovanni$_j$, *pro*$_i$ aveva appena
when Mario has telephoned to Giovanni, *pro* had just
finito di mangiare.
finished to eat
'When Mario has telephoned Giovanni, he had just finished eating.'

b. Quando Mario$_i$ ha telefonato a Giovanni$_j$, lui$_j$ aveva appena
when Mario has telephoned to Giovanni, he had just
finito di mangiare.
finished to eat
'When Mario has telephoned Giovanni, he had just finished eating.'

According to Alonso-Ovalle et al. (2002), the PAS applies to Iberian Spanish, although they found some differences: their results revealed that the null pronoun consistently prefers the subject antecedent, whereas the overt pronoun has more flexible preferences. They carried out their study on Spanish using five questionnaire experiments, with the

first one being directly compared to Carminati's (2002) study. In this experiment, participants were presented with inter-sentential anaphora such as the ones in (3) and asked to choose the referent that the subject pronoun in the second sentence referred to (either the subject *Juan* or the object *Pedro*).

(3) a. Juan pegó a Pedro. *pro* está enfadado.
Juan hit.3SG.PRET to Pedro *pro* is angry
'Juan hit Pedro. He is angry.'

b. Juan pegó a Pedro. Él está enfadado.
Juan hit.3SG.PRET to Pedro He is angry
'Juan hit Pedro. He is angry.'

The results revealed that when *pro* was the subject, as in (3a), participants preferred the subject of the previous sentence as the antecedent in 73.2% of the responses, but when participants were presented with an overt pronoun, as in (3b), they chose the subject of the first sentence as the referent in 50.2% of the responses, a difference that was highly significant ($p < .001$). These results show that the PAS correctly predicts that the null pronoun also prefers to be assigned to the subject antecedent in Spanish, whereas the choice of antecedent for the overt pronoun was not so consistent. Crucially, these findings suggest that there might be other factors affecting pronoun resolution apart from the syntactic distribution between null and overt pronouns, such as the type of anaphora, as Carminati used intra-sentential anaphora and Alonso-Ovalle et al. used inter-sentential anaphora.

The results from Alonso-Ovalle et al. (2002) also suggest that there might be some differences among pro-drop languages in relation to the distribution of subject pronouns. Filiaci (2010) and Filiaci et al. (2014) compared antecedent preferences in intra-sentential anaphora by Spanish and Italian native speakers to explore whether differences exist between pro-drop languages in relation to anaphora resolution. They investigated whether Spanish monolinguals are more willing to accept the subject as the antecedent for an overt subject pronoun than Italian monolinguals, as revealed by Alonso-Ovalle et al. (2002), using sentences in which the pronominal subject could initially refer to either the subject or the object referents, but it was semantically disambiguated at the end of the sentence, as in (4) for Italian and (5) for Spanish.

(4) a. Dopo che Giovanni ha criticato Franco così ingiustamente, lui
after that John has criticised Franco so unjustly he
si è scusato ripetutamente.
REFL has apologized repeatedly
'After John criticised Franco so unjustly, he apologized repeatedly.'

b. Dopo che Giovanni ha criticato Franco così ingiustamente, *pro*
after that John has criticised Franco so unjustly *pro*
si è scusato ripetutamente.
REFL has apologized repeatedly
'After John criticised Franco so unjustly, (he) apologized repeatedly.'

c. Dopo che Giovanni ha criticato Franco così ingiustamente, lui
after that John has criticised Franco so unjustly he
si è sentito offeso.
REFL has felt offended
'After John criticised Franco so unjustly, he felt offended.'

d. Dopo che Giovanni ha criticato Franco così ingiustamente, *pro* si è
after that John has criticised Franco so unjustly *pro* REFL has
sentito offeso.
felt offended
'After John criticised Franco so unjustly, (he) felt offended.'

(5) a. Cuando Ana visitó a María en el hospital, ella le llevó un
when Ana visited to Mary in the hospital she her brought a
ramo de rosas.
bunch of roses
'When Ana visited Mary in the hospital, she brought her a bunch of roses.'

b. Cuando Ana visitó a María en el hospital, *pro* le llevó un
when Ana visited to Mary in the hospital *pro* her brought a
ramo de rosas.
bunch of roses
'When Ana visited Mary in the hospital, (she) brought her a bunch of roses.'

c. Cuando Ana visitó a María en el hospital, ella ya estaba
when Ana visited to Mary in the hospital she already was
fuera de peligro.
out of danger
'When Ana visited Mary in the hospital, she was already out of danger.'

d. Cuando Ana visitó a María en el hospital, *pro* ya estaba
when Ana visited to Mary in the hospital *pro* already was
fuera de peligro.
out of danger
'When Ana visited Mary in the hospital, (she) was already out of danger.'

They found no cross-linguistic differences with the null pronoun between Italian and Spanish speakers, with both groups preferring the subject as the antecedent, whereas differences were found in relation to overt pronouns: Italian speakers consistently preferred the object as the antecedent, whereas Spanish speakers' preferences were equally divided between the subject and the object antecedent.

It is important to indicate that although the aforementioned research on intra-sentential anaphora focused on Subordinate-Main anaphora, both Carminati (2002) and Filiaci (2010) also included a control experiment on Main-Subordinate anaphora. Carminati (2002) conducted a questionnaire task to explore Italian speakers' antecedent preferences in globally ambiguous anaphora using Main-Subordinate sentences with temporal clauses and *if*-clauses. Carminati assumed that *if*-clauses are attached to the IP and temporal clauses are attached to the VP, so in the latter the object becomes more accessible as an antecedent as it is also attached to the VP. Consequently, she predicted a weaker subject preference with null pronouns in Main-Subordinate anaphora with temporal clauses than for other types of anaphora, whereas the overt pronoun bias for the object antecedent should remain the same. Carminati's results revealed that more object antecedents were assigned to null pronouns in Main-Subordinate anaphora with temporal clauses than with *if*-clauses.

Filiaci (2010) also included two control experiments in which she tested Main-Subordinate anaphora, and her results are similar to the ones presented from Carminati (2002), with the overt pronoun revealing a strong bias for the object antecedent and the null pronoun a weak preference for the subject antecedent. That is, both Italian and Spanish speakers revealed faster reading times with anaphora in which the overt pronoun referred to the object antecedent than when it referred to the subject antecedent, and their answers to the comprehension questions that followed the sentences were significantly

more accurate when the overt pronoun referred to the object antecedent than when it referred to the subject antecedent. Moreover, sentences containing a null pronoun did not reveal any significant antecedent preference, especially in Spanish. However, Filiaci's experimental items were semantically disambiguated, so it is not clear whether the same results would apply to Spanish globally ambiguous Main-Subordinate anaphora.

Overall, the results obtained by Carminati (2002) and Filiaci (2010) for Main-Subordinate anaphora are consistent with the ones revealed in Chamorro et al. (2016) for native speakers of Spanish. Chamorro et al. (2016) investigated anaphora resolution in Spanish using an offline naturalness judgment task and an online eye-tracking-while-reading task, where participants were presented with Main-Subordinate anaphora which was disambiguated using number cues. The results of this study also revealed that participants had a clear preference for the object as the antecedent for the overt pronoun, while a subject bias was not shown with the null pronoun. Therefore, the present study was conducted to further test the results from Chamorro et al. (2016) as well as to test Carminati's (2002) PAS and Filiaci's (2010) results for Spanish globally ambiguous Main-Subordinate anaphora, with the aim of providing further evidence of the interpretative differences that seem to exist between Main-Subordinate and Subordinate-Main anaphora and between Italian and Spanish with this structure. Other potential factors that may affect pronoun interpretation are also considered below.

### 2.2 Coherence relations in pronoun resolution

Apart from the differences in the syntactic distribution of null and overt pronouns presented in the previous section, there are other factors which have been shown to influence antecedent preferences in anaphora resolution, such as coherence relations. These coherence relations influence what speakers think to be semantically possible in a sentence (i.e. plausibility) and they affect how speakers interpret pronouns. That is, coherence relations have been shown to influence what speakers predict to be the most likely antecedent of an ambiguous pronoun depending on the semantic cues of a sentence (e.g. verb semantics, connectives between clauses) and speakers' interpretation of the event (Stevenson et al. 1994; 2000; Kehler 2002; Kehler et al. 2008, among others).

An example of this would be implicit causality, which is a property that some verbs have to bias a particular interpretation, assigning the cause of the event described in the sentence to a specific antecedent, either the subject or the object of the main clause (Caramazza et al. 1977). There is a large body of research which investigates the effects of implicit causality in anaphora resolution by manipulating the congruency of the sentence, that is, by manipulating the implicit causality bias of the verb in the main clause as congruent or incongruent with the pronoun in the subordinate clause based on the semantic information given in the subordinate clause (Long & De Ley 2000; Stewart et al. 2000; Koornneef & van Berkum 2006; Featherstone & Sturt 2010, among many others). These studies use gender and verb bias to create incongruent sentences, which present a conflict between the gender of the pronoun and the verb bias, each cue pointing towards a different antecedent, as in (6a), and congruent sentences, in which the cues given by the gender of the pronoun and the verb semantics point towards the same antecedent, as in (6b).

(6) a. John hit Mary because he stole the money.
b. John hit Mary because she stole the money.

The results from these studies show longer reading times for the incongruent sentences than for the congruent sentences, revealing that it is more difficult to process sentences that contain a pronoun which is inconsistent with the verb semantics than sentences in which the pronoun is consistent with the verb semantics.

Based on the aforementioned research, which suggests that coherence relations affect anaphora resolution, the present research includes globally ambiguous temporal anaphora, unlike Chamorro et al. (2016) which included unambiguous anaphora, with the aim of reducing potential bias due to verb semantics or clause connectives (or number disambiguation, as in our previous study) to focus on the effect of clause order (i.e. Main-Subordinate versus Subordinate-Main anaphora) on pronoun interpretation.

### 2.3 Prominence in pronoun resolution

There is also a large body of research which suggests that anaphora resolution is influenced by the prominence of the antecedent. Prominence in pronoun resolution refers to the status of the different antecedents within the discourse. Pronouns usually refer to highly prominent entities in the discourse, but the extent to which those entities are prominent has been shown to depend on several factors, such as the frequency and saliency of the word, topicality, subjecthood and recency. In relation to frequency, van Gompel & Majid (2004) propose that the more infrequent an antecedent, the more attention it attracts (i.e. the more salient it is), and so the more easily speakers will be able to recall it. Topicality predicts that a topic antecedent (i.e. a referent that has been previously introduced in the discourse) is less prominent than a focus antecedent (i.e. when there is a change of referent or a new one is introduced).[1] In terms of subjecthood, the prediction is that a subject antecedent is more prominent than an object antecedent (Arnold 1998). Finally, the recency factor predicts that, given an anaphor in which different antecedents are equally plausible to co-refer with the pronoun, the preferred antecedent will be the most recent one, that is, the one that appears closest to the pronoun in the discourse (Arnold 1998).

When speakers are presented with ambiguous anaphora, their preferred referent will be the most prominent one from all the plausible ones in the discourse. Many studies have found this to be the case, showing that in anaphora resolution co-reference with more prominent antecedents is easier to access and process (i.e. the processing load is lower) than with less prominent antecedents (Givón 1983; Ariel 1990; 1991; Gundel et al. 1993; Gundel 1999; Stewart et al. 2000; Garnham 2001).

## 3 Aims and scope of the study

As mentioned before, the present study was conducted to further test Carminati's (2002) PAS and explore the results obtained in a recent study on anaphora resolution by Chamorro et al. (2016). They investigated the interpretation and processing of overt versus null subject pronouns in Spanish using an offline naturalness judgment task and an online eye-tracking-while-reading task, where participants were presented with anaphora in which the antecedent preferences were predicted using the PAS (i.e. null pronoun: subject preference; overt pronoun: object preference). Participants were presented with semantically neutral Main-Subordinate anaphora in which the grammatical number of the antecedents was manipulated such that the pronoun could refer only to either the subject or the object antecedent, as in (7).

(7) a. La madre saludó a las chicas cuando ella cruzaba una calle
the mother greeted.SG to the girls when she crossed.SG a street
con mucho tráfico.
with much traffic
'The mother greeted the girls when she crossed a street with a lot of traffic.'

[1] See Gundel & Fretheim (2004) for a detailed discussion on the difference between topic and focus.

b. Las madres saludaron a la chica cuando ella cruzaba una calle
the mothers greeted.PL to the girl when she crossed.SG a street
con mucho tráfico.
with much traffic
'The mothers greeted the girl when she crossed a street with a lot of traffic.'

c. La madre saludó a las chicas cuando *pro* cruzaba una calle
the mother greeted.SG to the girls when *pro* crossed.SG a street
con mucho tráfico.
with much traffic
'The mother greeted the girls when (she) crossed a street with a lot of traffic.'

d. Las madres saludaron a la chica cuando *pro* cruzaba una calle
the mothers greeted.PL to the girl when *pro* crossed.SG a street
con mucho tráfico.
with much traffic
'The mothers greeted the girl when (she) crossed a street with a lot of traffic.'

Three different groups of native speakers of Spanish from Spain were tested,[2] and both the offline data and the online data revealed sensitivity to the pronoun mismatch for all three groups (i.e. all groups showed significant *Pronoun* by *Antecedent* interaction effects in their ratings and reading times).[3] The nature of the interaction effects revealed in both offline and online tasks was explored to investigate participants' interpretation of overt and null pronouns. The results from both tasks showed that the interpretation of overt pronouns was more consistent than the interpretation of null pronouns in all groups: participants generally had a clear preference for the object as the antecedent for the overt pronoun, while a subject bias with the null pronoun was not revealed for any of the groups. This was an unexpected result since, as mentioned in Section 2.1, it seems to differ with other studies which suggest that native speakers of null subject languages consistently assign the subject antecedent to a null pronoun, whereas the overt pronoun is more flexible and not so strictly assigned to the object antecedent (Carminati 2002; Filiaci 2010; Filiaci et al. 2014). Therefore, the present study was conducted to explore these results further and test Carminati's PAS for intra-sentential anaphora in Spanish.

One possible explanation for these unexpected results is the type of sentences used in Chamorro et al. (2016), since these experimental items consisted of anaphora which were disambiguated using number cues. Therefore, since number disambiguation has been shown to affect anaphora resolution in Spanish (Carreiras et al. 1993; Garnham et al. 1995; Carreiras 1997), in order to rule out the possibility that having number cues might have influenced Chamorro et al.'s (2016) results, the present study included globally ambiguous anaphora.

In addition, since most of the experiments reported in Carminati (2002), Filiaci (2010) and Filiaci et al. (2014) are on Subordinate-Main anaphora, and the control experiments that Carminati (2002) and Filiaci (2010) conducted for Main-Subordinate anaphora are consistent with the results from Chamorro et al. (2016), this study was carried out to further explore Main-Subordinate anaphora and to be able to draw more reliable

[2] The three groups of Spanish native speakers were: *monolinguals*, *attriters* (near-native speakers of English living in the UK for a minimum of five years) and *exposed* (near-native speakers of English living in the UK for a minimum of five years who had been exposed exclusively to Spanish for a minimum of a week before they were tested). This last group was included to explore whether any potential attrition effects with subject pronouns would disappear after recent exposure to L1 input.

[3] The results from Chamorro et al. (2016) have been simplified here based on their relevance for the present study. However, the group of attriters did not reveal online sensitivity to the pronoun mismatch as they did not show any significant interaction effects in their eye-tracking data.

conclusions about the potential interpretative differences between Main-Subordinate and Subordinate-Main anaphora. Since Filiaci (2010) tested Spanish Main-Subordinate anaphora using semantic disambiguation, the present study includes globally ambiguous Main-Subordinate anaphora to see if the same results are obtained when verb semantics or number features are not available to speakers to select pronoun antecedents. The results of this study are compared with Carminati's (2002) findings on Italian globally ambiguous Main-Subordinate anaphora to see if the same results are obtained for Spanish globally ambiguous Main-Subordinate anaphora or cross-linguistic differences exist between Spanish and Italian anaphora resolution.

The present study addresses the following research question:

(i) Do native speakers of Spanish reveal a clear preference for the object as the antecedent for the overt pronoun and a weaker preference for the subject as the antecedent for the null pronoun with globally ambiguous Main-Subordinate anaphora?

In order to investigate this research question, native speakers of Spanish performed an offline judgment task where they had to select their preferred antecedent in globally ambiguous Main-Subordinate anaphora.

## 4 Method

### 4.1 Participants

Twenty-four Spanish monolinguals (16 females; mean age = 26.542; *SD* = 2.064; range = 22 to 30) were recruited for the study. They were all from Spain and had no knowledge of any other language from birth (Spanish speakers from regions in which another L1 was spoken, such as Catalan, Basque or Galician were excluded from the experiment). Participants had recently arrived in the UK, and had very little knowledge of English, although considering that English language is a mandatory subject in Spanish education, some previous contact with the language is assumed (the mean number of weeks spent in the UK was 12.583, *SD* = 8.366). Participants were asked to complete a questionnaire and rate their use of the L1 and the L2 on a 5-point scale (1 = never; 2 = rarely; 3 = sometimes; 4 = often; 5 = always) in three different settings (at home, in their social circle and in their job or professional/educational setting) and their responses revealed that they used their L1 significantly more often than their L2 ($p < .001$). For the L1, the mean use across all three settings was 4.542, *SD* = .509; for the L2, the mean use was 2.875, *SD* = .824.

### 4.2 Stimuli

The same 32 semantically neutral Main-Subordinate anaphoric sentences designed for Chamorro et al. (2016) were used, although this time number disambiguation was excluded to rule out the possibility that number cues were the cause for participants' antecedent preferences in Chamorro et al.'s study. Similarly, to reduce coherence relation effects, such as verb bias or clause connectives, verbs that did not bias any particular interpretation (such as *saludar* 'to wave', *despedirse* 'to say goodbye', or *sonreir* 'to smile') together with always the same temporal conjunction and the same tenses were used. The aim was to explore antecedent preferences in a globally ambiguous context to be able to focus on the effect that clause order (i.e. Main-Subordinate versus Subordinate-Main anaphora) may have on Spanish anaphora resolution.

Therefore, each sentence consisted of a main clause in the preterite tense, which contained a subject and an object antecedent of the same gender, and a subordinate clause always introduced by *cuando* 'when' and followed by the subject pronoun (either overt or null) and a verb in the imperfect tense conjugated in third-person singular. Since both the

subject and the object antecedents carried singular number, the pronoun could ambiguously refer to either one of them, as (8) below illustrates. All sentences had the same number of words, except for the ones that contained a null pronoun, which had a word less.

(8) a. Condition 1: **Overt pronoun**
La madre saludó a la chica cuando ella cruzaba una calle
the mother greeted.SG to the girl when she crossed.SG a street
con mucho tráfico.
with much traffic
'The mother greeted the girl when she crossed a street with a lot of traffic.'

b. Condition 2: **Null pronoun**
La madre saludó a la chica cuando cruzaba una calle con
the mother greeted.SG to the girl when crossed.SG a street with
mucho tráfico.
much traffic
'The mother greeted the girl when (she) crossed a street with a lot of traffic.'

Each sentence was followed by a question and three possible antecedents (i.e. the subject of the main clause, the object of the main clause or an external antecedent), as in (9).

(9) ¿Quién cruzaba una calle con mucho tráfico?
a. La madre
b. La chica
c. Una tercera persona

'Who was crossing a street with a lot of traffic?
a. The mother
b. The girl
c. A third person'

Each item contained two conditions, one with an overt pronoun and the other with a null pronoun. Half of the 32 items included all female referents and the other half all male referents. In addition, half of the items presented the subject antecedent in answer *a* and the object antecedent in answer *b*, and the other half presented the subject antecedent in answer *b* and the object antecedent in answer *a* (the *a third person* response was always in answer *c*). The 32 items were randomly divided into two lists, each containing one of the two conditions of each item, so both conditions appeared the same number of times in each list. Furthermore, each of the two lists was presented in two different orders, so that order 2 presented the items starting from the last sentence in order 1 and finishing with the first sentence in order 1. In addition to the experimental items, 64 fillers were also randomly included in each list. The fillers had the same format as (8) above, but included inanimate referents, plural referents, common names, other subject pronouns, and other conjunctions such as *mientras* 'while' and *para que* 'so that'.

### 4.3 Procedure

An offline judgment task was used in this study. Both the experimenter and the participants were present during the experiment. Participants were first given the instructions, which were presented in Spanish in written form, and they were instructed to read the sentences in the questionnaire they were given and then answer the question which followed each sentence, choosing as many answers as they wanted from the three they were presented with. No time limit was given to perform the task. The answers from the experiment were then separately coded into Microsoft Excel for each participant, item and condition for the subsequent analysis.

At the end of the experiment, participants were asked to complete a questionnaire that included some personal information as well as their L1 and L2 backgrounds (see Section 4.1). Informed consent to take part in the study was obtained from all the participants and they were paid for their participation in the experiment.

### 4.4 Results

Before presenting the results, it is worth mentioning that whereas some participants selected both the subject and the object as possible antecedents for some items, none of them selected all three answers for any of the items (that is, the subject, the object and a third person as possible antecedents). Those responses that included both the subject and the object as the preferred antecedents are analyzed and referred to below as *either subject or object*.

Table 1 and Figure 1 show the percentage of antecedent preferences for each of the pronouns and they reveal that participants show an overall bias towards the object as the preferred antecedent for both pronouns, although the null pronoun still shows a higher percentage of subject preference in comparison with the overt pronoun. Moreover, the percentages for *a third person* and *either subject or object* are considerably lower than those for *subject* and *object* and they are very similar for both pronouns.

Considering the percentages illustrated in Table 1 and before analyzing the results for the subject and object antecedents, the proportion of *other responses* (i.e. *third person* and *either subject or object*) obtained for the null and the overt pronouns was compared to check whether they differed between the two pronouns. In order to do so, *subject* and *object* responses were coded as 0 and *other responses* (i.e. *third person* and *either subject or object*) were coded as 1, and then the proportion of *other responses* was compared between the null and the overt pronoun. Means showed 6.25% of *other responses* for the null pronoun and 4.17% for the overt pronoun, but in order to see whether this difference was significant, a paired samples t-test was run after converting the regular averages into arcsine values. Results from the t-test showed that although participants selected more *other responses* when the anaphora contained a null pronoun than when it contained an overt pronoun, this difference was not significant ($t_1(23) = 1.678$, $p = .107$; $t_2(31) = 1.234$, $p = .266$).

Next, the proportion of object responses was analyzed to see whether it was different between the null and the overt pronoun. In order to do so, *other responses* were excluded from the data, *subject* responses were coded as 0 and *object* responses as 1. Means showed that participants selected the object referent as the antecedent for both the null and the overt pronoun more often than the subject referent, with 56.53% of *object* responses for the null pronoun and 66.58% for the overt pronoun. As before, a paired samples t-test was conducted to check whether this difference was significant (averages were again converted into arcsine values before running the test). The t-test revealed that the difference between the null and the overt pronouns in relation to participants' preference for the object as their antecedent is significant ($t_1(23) = -2.497$, $p = .020$; $t_2(31) = -2.441$, $p = .021$).

Finally, considering the preference for the object as the antecedent for both pronouns, a one-sample t-test was conducted to explore whether there is actually a preference for the object antecedent when the null and the overt pronouns are tested separately. In order to

**Table 1:** Percentages of antecedent preferences for the null and the overt pronouns.

| | Subject | Object | A third person | Either subject or object |
|---|---|---|---|---|
| **Null pronoun** | 40.62% | 53.12% | 0.52% | 5.72% |
| **Overt pronoun** | 32.03% | 63.80% | 0.78% | 3.38% |

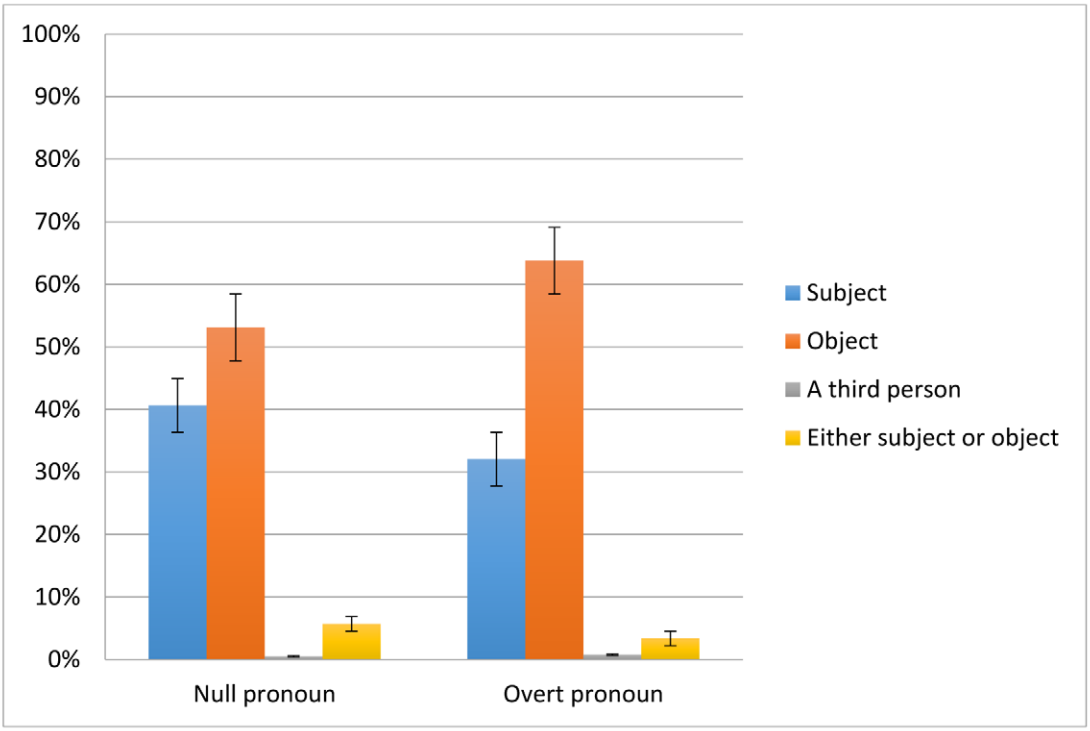


**Figure 1:** Antecedent preferences for the null and the overt pronouns.

do so, the proportion of object responses was checked to see whether it was significantly different from 50% for both the overt and the null pronouns. The coding used was the same as the one in the previous t-test, also excluding *other responses*, and the one-sample t-test was again carried out with arcsine values. The results showed that the object antecedent preference is significant only for the overt pronoun ($t_1(23) = 3.349$, $p = .003$; $t_2(31) = 3.621$, $p < .001$), but not for the null ($t_1(23) = 1.572$, $p = .130$; $t_2(31) = 1.127$, $p = .268$), which reveals that participants clearly prefer the object as the antecedent for the overt pronoun, but with the null pronoun their antecedent preference is not clear. That is, participants showed a preference for the object antecedent with both the null and the overt pronouns, but the extent of this preference differed between the two pronouns, with this object bias being significant only for the overt pronoun.

## 5 Discussion

The results from the present study are consistent with Chamorro et al.'s (2016) findings since participants in this study also assign an object as the antecedent for overt pronouns very consistently, whereas their antecedent preference appears to be unclear when they interpret null pronouns. Interestingly, there seems to be an overall bias towards the object as the preferred antecedent, since participants selected the object more often than the subject as the preferred antecedent for both pronouns. These findings reveal that number disambiguation did not affect Chamorro et al.'s (2016) results, since the anaphora used in the present study were globally ambiguous and the results still reveal a significant preference for the object as the antecedent for the overt pronoun but no significant antecedent preference with the null pronoun. In relation to coherence relations, although there were no coherence-related cues used in the experimental items and globally ambiguous anaphora was used, it could be argued that the temporal conjunction and tenses used in the sentences may have affected pronoun interpretation to some extent. In terms of prominence, even though this was an untimed offline reading task, if we take into consideration that the same results were found for Chamorro et al. (2016), where participants

were involved in an online task, it could be argued that recency may have also affected anaphora resolution to some degree. That is, the fact that the object is the most recent antecedent (i.e. the one that appears closest to the pronoun) may have somewhat favored the bias of the object as the preferred antecedent for both pronouns.

The results obtained seem to differ from similar studies which suggest that native speakers of Spanish consistently assign the subject antecedent to a null pronoun, whereas the overt pronoun is more flexible and not so strictly assigned to the object antecedent (Filiaci 2010; Filiaci et al. 2014). However, some differences exist between the task and the stimuli used in the aforementioned studies and the present study. Filiaci (2010) and Filiaci et al. (2014) used a self-paced reading task with comprehension questions, whereas the present study included an offline judgment task (and an eye-tracking task and an offline judgment task in Chamorro et al. 2016). In addition, Filiaci (2010) and Filiaci et al. (2014) used the preterite tense in both clauses, whereas the present study and Chamorro et al. (2016) used the preterite in the main clause and the imperfect in the subordinate clause. It is possible that these differences may have affected the relative preference for object versus subject antecedents, and that null pronouns may not have revealed a bias towards the object antecedent if participants had been presented with sentences containing the preterite tense in both clauses. It could also be argued that the results may have been affected by the type of task used and the potential limitations that offline judgments may have for the study of pronoun interpretation. However, this is unlikely given that the same results were revealed by Chamorro et al. (2016), who also used an online task to test the same structure.

A more plausible explanation for the results obtained seems to be clause order. While Filiaci (2010) and Filiaci et al. (2014) used anaphora in which the subordinate clause with the antecedents was followed by the main clause with the pronoun (Subordinate-Main), both Chamorro et al. (2016) and the present study contained anaphora in which the main clause with the antecedents was followed by the subordinate clause with the pronoun (Main-Subordinate). In fact, as mentioned in Section 2.1, Filiaci (2010) includes two control experiments in which she tests semantically disambiguated Main-Subordinate anaphora, and her results revealed a strong bias for the object antecedent with the overt pronoun and a weak preference for the subject antecedent with the null pronoun. That is, both Italian and Spanish speakers revealed faster reading times with anaphora in which the overt pronoun referred to the object antecedent than when it referred to the subject antecedent, and their answers to the comprehension questions that followed the sentences were significantly more accurate when the overt pronoun referred to the object antecedent than when it referred to the subject antecedent. Crucially, sentences containing a null pronoun did not reveal any significant antecedent preference, especially in Spanish. Filiaci's (2010) results for Main-Subordinate anaphora are consistent with the ones revealed in the present study and in Chamorro et al. (2016), which suggests that it is clause order rather than semantic or number cues what affects pronoun interpretation with this structure.

In addition, as mentioned in Section 2.1, although Carminati's (2002) PAS was based on Subordinate-Main anaphora, she also conducted a questionnaire task to explore Italian speakers' antecedent preferences in globally ambiguous anaphora using Main-Subordinate anaphora that contained temporal clauses, which is the same type of anaphora used in the present study, and *if*-clauses. Carminati predicted differences in antecedent preferences as she assumed that whereas *if*-clauses are attached to the IP, temporal clauses are attached to the VP, and so is the object, so it becomes more accessible as an antecedent as it is attached to the same phrase as the pronoun. Accordingly, for Main-Subordinate anaphora with temporal clauses, Carminati predicted a weaker subject preference with null pronouns than for other types of anaphora, whereas the overt pronoun bias for the object antecedent should

remain the same. Carminati's results for Italian Main-Subordinate anaphora revealed that more object antecedents were assigned to null pronouns with temporal clauses than with *if*-clauses, which is supported by the results obtained for Spanish in this and Chamorro et al.'s (2016) studies. Crucially, her proposal that in this type of anaphora the object becomes more accessible as an antecedent because the subordinate clause containing the pronoun is attached to the same phrase as the object antecedent (i.e. the VP) can explain the weaker subject preference with the null pronoun and the strong object bias with the overt pronoun revealed in the present study and in Chamorro et al. (2016).

The present results and those from Chamorro et al. (2016) support the hypothesis that clause order affects anaphora resolution. That is, these results on Main-Subordinate anaphora can be interpreted in the light of similar studies on Subordinate-Main anaphora (e.g. Carminati 2002; Filiaci 2010; Filiaci et al. 2014) to support the hypothesis that pronoun resolution is affected by clause order, with Main-Subordinate anaphora revealing different antecedent preferences from Subordinate-Main anaphora. In addition, our findings together with those from Carminati (2002) and Filiaci (2010) also suggest that no cross-linguistic differences exist between Spanish and Italian on pronoun resolution with Main-Subordinate anaphora.

To conclude, the results obtained for Spanish in the present study and in Chamorro et al. (2016) do not support the PAS as it was originally proposed by Carminati for Italian intra-sentential anaphora (i.e. null pronouns are generally assigned to the subject antecedent, whereas overt pronouns are generally assigned to the object antecedent). However, considering that Carminati's PAS was based on Subordinate-Main anaphora and following the results obtained in this study and others (e.g. Carminati 2002; Filiaci 2010; Filiaci et al. 2014; Chamorro et al. 2016), this paper provides further evidence that the PAS is restricted to Italian intra-sentential Subordinate-Main anaphora and that a different parsing strategy is used for Italian and Spanish intra-sentential Main-Subordinate temporal anaphora, since both the subordinate clause containing the pronoun and the object are attached to the VP in this type of anaphora, making the object more accessible as an antecedent (Carminati 2002). The parsing strategy used for Italian and Spanish intra-sentential Main-Subordinate temporal anaphora generally assigns the overt pronoun to the antecedent in the object position, whereas null pronouns can be assigned to the antecedent in either the subject or the object position.

## 6 Conclusions

The results obtained from this study, together with those from Chamorro et al. (2016), suggest that native speakers of Spanish consistently assign the object as the preferred antecedent for the overt pronoun, whereas there is no clear antecedent preference with the null pronoun. This has been shown to be the case for both ambiguous and unambiguous anaphora. In comparison to other related studies (e.g. Carminati 2002; Filiaci 2010), these results appear to be mainly related to clause order (i.e. with Main-Subordinate anaphora) and to be consistent for both Italian and Spanish speakers.

These findings seem to be at odds with Carminati's (2002) PAS, but since this proposal was based on Italian intra-sentential Subordinate-Main anaphora, the present paper provides further evidence that a different parsing strategy is used for Italian and Spanish intra-sentential Main-Subordinate temporal anaphora, by which overt pronouns are generally assigned to the object antecedent and null pronouns can be assigned to the either the subject or the object antecedent.

This paper provides new evidence on anaphora resolution that seems to be at odds with the PAS and previous research on the topic, which calls for a rediscussion of this literature and Carminati's proposal. In addition, this study reveals the importance of the kind of

stimuli and methodology used in different studies on structures such as anaphora, which should be carefully considered in the experimental design and the interpretation of results. With this in mind, more research on Spanish and other null subject languages is needed to further explore the factors that affect anaphora resolution in these languages, such as studies that compare different clause orders (i.e. Main-Subordinate versus Subordinate-Main), different types of anaphora (e.g. temporal versus concessive clauses), and sentences containing different tenses (e.g. preterite versus imperfect).

## Abbreviations

PL = plural, PRET = preterite, REFL = reflexive, SG = singular

## Competing Interests

The author has no competing interests to declare.

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