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Co-referential processing of pronouns and repeated names in Italian

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Abstract

In this study, we investigate whether co-referential processing across sentence boundaries is driven by universal properties of the general architecture of memory systems and whether cross-linguistic differences concerning the number of anaphoric forms available in a language's referential inventory can impact the process of inter-sentential coreference resolution. As a window into these questions, we test whether the repeated-name penalty (RNP) and the overt-pronoun penalty (OPP)—comprehension delays associated with repeated names and overt pronouns, respectively, in comparison to more reduced anaphoric forms in reference to salient antecedents—occur in Italian, examining the extent to which Italian resembles other null-subject languages, with focus on Spanish. Our self-paced reading experiment with factors Antecedent (Subject, Object) and Anaphor (Null Pronoun, Overt Pronoun, Repeated Name) found that Italian exhibits both an OPP and a (weaker) RNP, extending previous research that showed these effects in Spanish and strengthening the claim that coreference resolution might be subject to universal principles.

Keywords

Coreferential processing; repeated names; repeated-name penalty; pronouns; overt-pronoun penalty; Italian

Introduction

Producing and comprehending coherent discourse crucially depends on the successful use and interpretation of anaphoric expressions, whose processing has been shown to be influenced by a number of memory, discourse, and grammatical factors (Garrod & Sanford, 1982; Grosz, Joshi, & Weinstein, 1983, 1995; Halliday & Hasan, 1976; Kintsch & van Dijk,

1978). From the perspective of language comprehension, a general (arguably universal) principle is that specific, informative anaphoric forms (e.g., repeated names) are generally understood as referring back to non-salient antecedents, while less informative anaphors (e.g., pronouns) are more commonly processed as references to salient antecedents (Ariel, 1990; Almor, 1999; Almor & Nair, 2007; Gundel, Hedberg, & Zacharski, 1993; Prince, 1981).

Strong empirical evidence for this inverse relationship between antecedent salience and the specificity/informational load of the anaphoric form has been provided, for instance, by Gordon, Grosz, and Gilliom (1993) and Kennison and Gordon (1997). These studies have revealed that, in English, anaphoric processing is subject to an effect named “repeated-name penalty” (hereafter, RNP): repeated names are harder to process than overt pronouns when their antecedents appear in salient (e.g., subject or first mention), but not in less salient (e.g., object) grammatical positions. A related processing penalty, called the “overt-pronoun penalty” (henceforth OPP), has been reported in the comprehension of overt pronouns in Spanish (Gelormini-Lezama & Almor, 2011, 2013): like repeated names in English, sentences with overt pronouns (e.g., “Él”) in Spanish are read more slowly relative to sentences with null pronouns when they refer back to syntactically salient antecedents (e.g. “Juan” in the examples below, from Gelormini-Lezama and Almor (2011 p. 444)), as opposed to non-salient entities (e.g., “María”).

1.

a.	“Juan	se	encontró	com	María.”
	Juan _i	REFLEXIVE PRONOUN	met	with	María _j
	Juan	met	with		María.
b.	“Él	la	vio	triste.”	
	He _i	her _j	found	sad	
	He	found	her	sad.	
c.	NULL	“La	vio	triste.”	
	NULL _i	her _j	found	sad	
	He	found	her	sad. ¹	

While the RNP has been shown to extend to different languages besides English (e.g., Spanish, Chinese), the generalizability of the OPP has been restricted to Spanish, a null-subject language. Although both penalties reflect an inverse relation between antecedent salience and anaphoric form, this finding raises the possibility that the OPP might be an idiosyncratic property of Spanish that does not occur in other null-subject languages. In order to address this issue, here we report an experiment testing whether both the RNP and the OPP occur in Italian, which, like Spanish, is a null-subject language, but which, compared to Spanish, includes a greater number of anaphoric forms in its referential inventory. Specifically, we address the claim that co-referential processing might be driven by universal properties of the general architecture of memory systems (Ariel, 1990; Almor

¹In (a–c), the first line corresponds to Gelormini-Lezama and Almor’s (2011, p. 444) original example, the second line is an English gloss of the original example,

& Nair, 2007; Gundel, Hedberg, & Zacharski, 1993; Prince, 1981) and investigate the question as to whether differences between Italian and Spanish concerning the number of anaphoric forms available in their referential inventories can impact the process of coreference resolution.

Little empirical research has been carried out in Italian to investigate the theoretical questions above and to examine the RNP and the OPP as empirical effects. Carminati (2002, 2005) carried out a series of self-paced reading experiments to investigate antecedent retrieval during the processing of both null and overt pronouns in Italian. In a set of semantically disambiguated bi-clausal sentences, Carminati (2002, 2005) manipulated whether the pronoun of the main clause was overt or null, and whether it co-referred with the subject or the object of a fronted subordinate clause. Carminati (2002, 2005) found that sentences with null pronouns were read faster than sentences with overt pronouns when the antecedent was more likely the subject of the previous clause rather than the object. In contrast, sentences with overt pronouns were read faster than those with the null counterparts when they were more likely referring to the less salient object antecedents. On the basis of this evidence, Carminati (2002, 2005) proposed that reference processing in Italian follows the “Position of the Antecedent Strategy” (PAS), according to which the antecedent of a null pronoun is assumed to be in subject position, whereas the antecedent of an overt pronoun is assumed to occupy less salient grammatical positions, for instance the object position. Thus, Carminati’s (2002, 2005) results seem to indicate that, similarly to Spanish, Italian exhibits an OPP. Additional empirical evidence also supports Carminati’s PAS predictions for reference resolution biases in monolinguals and bilinguals, adult and young speakers of Italian (e.g., Nitschke, Kidd, & Serratrice, 2010; Sorace & Filiaci, 2006).

Two possible concerns about Carminati’s (2002, 2005) results can, however, be raised. First, Carminati’s stimuli were ambiguous in that, despite a possible semantic bias, the pronouns in the critical sentences could be interpreted as referring to either the subject or the object of the previous clauses. Second and more importantly, Carminati’s stimuli contained intra-sentential anaphora (i.e., anaphors whose antecedents are in the same sentence), unlike previous studies on the RNP and the OPP. Given that converging psycholinguistic evidence from different languages seems to indicate that reference resolution, and in particular pronoun processing, operates differently within and across sentence boundaries (Mitsakaki, 2002; Colonna, Schimke, & Hemforth, 2015), Carminati’s results are not informative about the classic inter-sentential contexts investigated in studies of the RNP and the OPP. Indeed, Carminati (2002) herself was careful to note this point and emphasize that her claims do not extend to inter-sentential anaphora. In addition to these concerns, the similarity between Italian and Spanish suggested by both Carminati’s (2002, 2005) and Gelormini-Lezama and Almor’s (2011, 2013) studies has been challenged by a recent study by Filiaci, Sorace, and Carreiras (2013), who found interesting differences between the two languages in the processing of overt pronouns.

Filiaci, Sorace, and Carreiras (2013) contrasted intra-sentential null and overt pronoun anaphors in both Italian and European Spanish. While null pronouns were processed similarly in both languages (faster when the antecedent was salient), overt pronouns showed different processing patterns. When the antecedent was the subject of the previous clause,

overt pronouns were processed more slowly than null pronouns in Italian, but not in Spanish; when the antecedent was not the subject of the previous clause, overt pronouns were processed faster than null pronouns in both languages. Filiaci, Sorace, and Carreiras's (2013) results could thus be interpreted as evidence for an OPP in Italian but not in European Spanish, in contrast to Gelormini-Lezama and Almor's (2011, 2013) results, which revealed a clear OPP in Argentinian Spanish.

As noted by Filiaci, Sorace, and Carreiras (2013), this inconsistency might be due to differences between the two studies besides the distinct Spanish varieties that were examined. As already mentioned, one of these differences is that Filiaci, Sorace, and Carreiras (2013) examined intra-sentential anaphora, whereas Gelormini-Lezama and Almor (2011, 2013) examined inter-sentential reference resolution. If it is indeed the case that inter- and intra-sentential anaphora can differentially show the OPP, as they do in the case of pronoun resolution in ambiguous sentences (Mitsakaki, 2002) and cleft constructions (Colonna, Schimke, & Hemforth, 2015), for instance, then it is still an open question whether Italian exhibits this penalty for pronominal references across sentence boundaries.

An additional difference between Italian and Spanish noted by Filiaci, Sorace, and Carreiras (2013) is that, although both languages display null and overt pronouns, only Italian includes two distinct forms of overt third-person subject pronouns – the more commonly used forms being strong pronouns (e.g., “*lui/lei*”) and the less frequently used being weak pronouns (e.g., “*egli/ella*”). Filiaci, Sorace, and Carreiras (2013) attribute the reading time differences between Spanish overt pronouns and Italian strong overt pronouns to the existence of weak pronominal forms in the Italian pronoun inventory. Specifically, they argue that the existence of an alternative class of pronouns affects the distance between different referential forms on an accessibility scale (Ariel, 1990), which has been claimed to affect reference processing (Ariel, 2006). If their explanation is correct, it could be that for inter-sentential anaphors, Spanish and Italian will exhibit different processing patterns as well. Specifically, while Spanish, which has only strong overt subject pronouns, shows the OPP for inter-sentential anaphora (Gelormini-Lezama & Almor, 2011, 2013), Italian might not.

Finally, another open question about reference processing in Italian is related to differences between pronouns and repeated names. Since much of the previous research in Italian focused on the difference between null and overt pronouns, it is unclear how both types of pronouns compare with repeated-name anaphors.

The research we report here has thus been undertaken to fill the aforementioned gaps in the literature by examining the processing of different types of anaphors (null pronouns, overt pronouns, and repeated names) and different levels of antecedent salience (subjects and objects) in Italian. More specifically, we set out to investigate whether the RNP would also be elicited in Italian in inter-sentential contexts, in order to test the claim that it might reflect properties of the general architecture of our cognitive system (Ariel, 1990; Almor, 1999; Almor & Nair, 2007; Gundel, Hedberg, & Zacharski, 1993; Prince, 1981). Second, we also aimed to examine whether the OPP is unique to Spanish or whether it occurs in a similar null-subject language like Italian as well. Third, we address the question as to whether differences between the two languages concerning the number of anaphoric forms available

in their referential inventories can impact the process of inter-sentential coreference resolution.

Experiment

Following Gelormini-Lezama and Almor's (2011, 2013) Spanish studies, the experiment we report here aimed to test whether readers of Italian would experience both an RNP and an OPP for inter-sentence references, similarly to readers of Spanish. Based on the notion of a trade-off between referent accessibility and the informational load of anaphoric forms (Almor, 1999; Almor & Nair, 2007; Gelormini-Lezama & Almor, 2011, 2013), we expected to find both an RNP and an OPP in Italian. However, given the differences in pronoun type noted above and the dissimilarities between European Spanish and Italian for intra-sentential pronouns reported by Filiaci, Sorace, and Carreiras (2013), it is possible that Italian readers would show a different processing pattern than the Argentinean readers in the Gelormini-Lezama and Almor's (2011, 2013) studies.

Because anaphors of all forms are generally read faster when referring to the subject rather than the object of the previous sentence, it is important to emphasise that the RNP and the OPP should be expected to take the form of an interaction between anaphoric form and antecedent salience (Gelormini-Lezama, 2012) rather than mere differences between two means. Specifically, these effects should be reflected in sentences with null pronouns being read faster than sentences with repeated name anaphors (RNP) and sentences with overt pronouns (OPP) when the antecedent is in the salient subject position but not in the non-salient object position.

Method

Participants—Forty undergraduate students from the University of Milano-Bicocca (9 males, 31 females) participated in a single self-paced reading session lasting approximately 20 minutes. They were all native speakers of Italian and their age ranged from 18 to 26 years old (mean 20.9 years old).

Materials—The materials were modified Italian translations of the items used in Gelormini-Lezama and Almor (2011). The translation from Spanish into Italian was carried out by a native speaker of Italian and included minor modifications to the items in order to make them read natural. The overall structure of the items was, however, identical to Gelormini-Lezama and Almor's (2011), such that Sentence 1 introduced two referents with proper names, the first of which in the subject position and the second as the grammatical object. Sentence 2 started with a reference to either the subject or the object of the first sentence by means of a repeated name, an overt pronoun, or a null pronoun in subject position. This resulted in six different conditions, as illustrated by the sample item in Table 1.

Importantly, the same verbs were used in all conditions for each item to ensure that individual verb properties would not affect our results. To avoid issues of ambiguity and to replicate the Gelormini-Lezama and Almor's (2011) Spanish experiment as closely as possible, the names of the two characters in the Italian experimental items were of different

genders. It is also noteworthy that, unlike Spanish, Italian verbs (more specifically, the past participle forms of intransitive and reflexive verbs) can be inflected for grammatical gender, agreeing with the gender of the sentence subject. If anything, this should make the Italian critical sentences in which disambiguating information appeared with the verb and with the object even less ambiguous than their Spanish counterparts in which disambiguating information appeared only with the object.

Each two-sentence passage was followed by a yes/no comprehension question in order to encourage participants to engage in the reading task and to serve as an off-line measure of comprehension accuracy. There was a total of 36 experimental items and 36 filler items that were constructed to reduce the predictability of the former and to further mask the purpose of the experiment. These fillers were also two-sentence coherent passages including proper names, but with syntactic and co-reference schemes that were different from those of the experimental items. The filler items were also followed by a comprehension question.

Design—Each participant saw each experimental passage in only one condition, but across participants, each passage was seen in all 6 conditions. The order of the 36 experimental items (6 per condition) and 36 filler items was randomised per participant. The experiment started with a short practice session of 5 trials, which also included yes/no questions.

Procedure—Participants read the experiment instructions on a computer screen and began the practice session to become familiarised with the self-paced reading task. Participants pressed the space bar to begin each practice and experimental trial and to advance to the next sentence in the trial. Sentences were presented in their entirety instead of word-by-word or phrase-by-phrase in conformity with previous RNP and OPP studies (Gelormini-Lezama & Almor, 2011, 2013; Gordon, Grosz, and Gilliom, 1993) and with findings from recent experiments that failed to show the RNP with a word-by-word stimulus presentation (Nair & Almor, 2008). Participants were instructed to press the space bar as soon as they finished reading the initial sentence, after which the entire second sentence would replace the first at the same position on the screen (left adjusted). After reading the second (critical) sentence of the passage, participants would then press the space bar and be presented with a comprehension question. They were required to press the space bar to answer “yes” or the “shift” key to answer “no.” Half of the questions had “yes” answers and half had “no” answers.

The experiment was run on a Windows-based desktop computer running the E-prime 1.0 software (Psychology Software Tools, Pittsburgh, PA). The time lapse from the presentation of the second critical sentence to the participants’ pressing of the space bar to proceed to the comprehension question was recorded and was the dependent measure of the experiment.

Results—The data from one participant were lost due to a technical problem and the data from another participant was discarded because their accuracy in the comprehension questions was below 80%. The mean accuracy of the remaining participants was 92%. Outliers were then identified by an adjusted boxplot rule, based on the upper and lower quartiles, along with a robust skewness estimator, separately for each subject (Hubert & Vandervieren 2008). Any remaining responses longer than 8000 ms were also removed.

Overall, outlier removal affected 2.92% of the data. The mean reading times of the second critical sentence for all six conditions in the remaining data for the remaining participants are shown in Figure 1.

We analyzed log-transformed reaction times in R version 3.2.0 using mixed-effects models with R package lme4 version 1.1–7. We used model comparison to estimate the significance of each term starting with a maximal model containing antecedent salience and anaphoric form and their interaction as fixed effects. We first tried to eliminate the interaction term and if this elimination did not result in a significant loss of model fit, we then attempted to remove each of the individual factors (Baayen, 2008). As recommended by Barr, Levy, Scheepers and Tily (2013), we included the maximal structure of by-participant and by-item random intercepts and slopes that allowed both compared models to converge. We report the coefficients in the final models thus identified, with p values approximated by the normal distribution (Barr et al., 2013).

The analysis with Antecedent (Subject vs. Object) and Anaphor (Null, Overt Pronoun, Repeated Name) as fixed factors and Item and Subject as random factors showed that the interaction of the two fixed factors made a significant contribution to model fit, $\chi^2(2) = 18.472$, $p < .001$. The parameter estimates of the chosen model are shown in Table 2. In order to facilitate the examination of differences between the three reference forms in the subject antecedent conditions, we used treatment coding with the reference levels Subject and Null for the Antecedent and Anaphor factors respectively. The coefficients in Table 2 thus represent differences from this reference level.

As indicated by the first-level effects shown in Table 2, sentences with overt pronouns were read significantly more slowly than sentences null pronouns following sentences with subject antecedents, whereas the comparison between sentences with repeated names and sentences with null pronouns was only marginally significant. The two *interaction* coefficients reflecting the RNP and the OPP, however, were both significant. Finally, in order to directly contrast the two overt forms (i.e., repeated names and overt pronouns), we reran the same analysis described above but using the overt pronoun as the reference level for the Anaphor factor. This analysis found no difference between the Repeated Name and Overt Pronoun conditions for Subject antecedents, nor an interaction for the difference between sentences with the two anaphoric forms and the Antecedent factor.

Discussion—Our experiment found strong evidence for the OPP in Italian. This extends previous research (e.g., Carminati, 2002, 2005; Filiaci, Sorace, & Carreiras, 2013) by showing that the OPP occurs not only within sentences, but also across sentence boundaries in Italian, contrary to our prediction that intra- and inter-sentential anaphora would exhibit different processing patterns. The study further shows that similar effects occur in Spanish and Italian despite differences between the two languages in the distribution of weak and strong pronominal forms, in contrast to Filiaci, Sorace and Carreiras's (2013) suggestion that these differences could affect the relative accessibility of null and overt pronouns.

The interactions between antecedent salience and anaphoric form in Italian showed that the RNP also occurs in Italian—sentences with repeated names were read more slowly than

sentences with null pronouns when the antecedent was the subject of the previous sentence but faster when the antecedent was the object, although this difference was weaker, as indicated by the marginal first level effect of Anaphor in the subject antecedent conditions (name vs. null; $p = .08$). Thus, while both the OPP and RNP can be said to occur in Italian, the RNP is weaker than the OPP.

General Discussion

Similarly to Gerlormini-Lezama and Almor's (2011) Spanish study, our Italian experiment showed a clear OPP. However, unlike Spanish and English, our results showed a weaker RNP in Italian, given that sentences with repeated name anaphors were not read significantly more slowly than sentences with null pronouns. Nevertheless, the presence of an interaction in the form of a slower reading of sentences with repeated names compared to sentences with null pronouns in the subject conditions together with the slower reading of sentences with null pronouns in the object conditions shows that the RNP does occur in Italian, albeit to a lesser degree than the OPP.

The lack of difference between the overt-pronoun and repeated-name conditions in this experiment also resembles the Spanish results of Gelormini-Lezama and Almor (2011). Thus, overall, it appears that the processing of inter-sentential null and overt pronouns is very similar in Italian and Spanish, but it is unclear whether the processing of repeated-name anaphors with subject antecedents is more tolerated in Italian.

The similarity in results between the present Italian data and the previously reported findings in Spanish is particularly revealing because of the identical methodology and almost identical stimuli between the present study and Gelormini-Lezama and Almor's (2011). We can therefore conclude that the processing of null and overt pronouns, and to some degree, of repeated names, is similar in these two Romance languages, despite the fact that while Italian includes both weak and strong subject pronouns, Spanish exhibits only weak and strong object pronouns.

The weaker RNP effect in Italian might reflect an overall reduced discourse function performed by overt pronouns in comparison to repeated names when the antecedent is salient (except when establishing contrast or emphasis). In lieu of a special function, overt pronouns play no vital discourse role and this results in an overall stronger penalty for overt pronouns than for repeated names, which can perform functions such as highlighting, foregrounding, or emphasizing information.

In short, both the OPP and the RNP represent a high processing cost that is not balanced by discourse function (Almor, 1999; Almor & Nair, 2007; Gelormini-Lezama & Almor, 2011, 2013), though this imbalance can have different degrees. In Romance languages such as Spanish and Italian, due to either lower functionality or increased cost, overt pronouns associated with subject antecedents may lead to a stronger imbalance than repeated names.

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Figure 1.
Mean Reading Times. Error bars show the Standard Error of the Mean.

Table 1

Sample Stimuli for Experiment 1

<u>Anaphor Form</u>	<u>Antecedent Saliency</u>	
	Salient (subject)	Non-Salient (object)
Repeated Name	Maria si è incontrata con Giovanni.	Giovanni si è incontrato con Maria.
	Maria l'ha trovato triste.	Maria l'ha trovato triste.
	<i>Maria met with Giovanni.</i>	<i>Giovanni met with Maria.</i>
	<i>Maria found him sad.</i>	<i>Maria found him sad.</i>
Overt Pronoun	Maria si è incontrata con Giovanni.	Giovanni si è incontrato con Maria.
	Lei l'ha trovato triste.	Lei l'ha trovato triste.
	<i>Maria met with Giovanni.</i>	<i>Giovanni met with Maria.</i>
	<i>She found him sad.</i>	<i>She found him sad.</i>
Null Pronoun	Maria si è incontrata con Giovanni.	Giovanni si è incontrato con Maria
	L'ha trovato triste.	L'ha trovato triste.
	<i>Maria met with Giovanni.</i>	<i>Giovanni met with Maria.</i>
	<i>NULL found him sad.</i>	<i>NULL found him sad.</i>

LME model of log transformed RTs. Contrast were coded using dummy coding with Subject and Null used as reference levels

Table 2

	β	SE	df	t	p
Intercept	7.370	0.058	60.881	126.023	0.000 *
Antecedent-Object	0.206	0.039	130.864	5.316	0.000 *
Anaphor-Name	0.074	0.044	69.784	1.714	0.087
Anaphor-Pronoun	0.105	0.041	74.062	2.531	0.014 *
Antecedent-Object:Anaphor-Name	-0.169	0.048	1132.727	-3.492	0.000 *
Antecedent-Object:Anaphor-Pronoun	-0.192	0.049	1128.034	-3.957	0.000 *