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Variation in the use and interpretation of null subjects: A view from Greek and Italian

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We aim to understand whether Greek and Italian, two null subject languages, differ in the use and interpretation of null subjects, based on evidence from both a production and a comprehension experiment. The results of the two experiments show that the two languages differ in the extent to which they comply with the Position of Antecedent Strategy as formulated by Carminati (2002). In order to account for this difference, we introduce a principle which defines prominence of sentence constituents in terms of hierarchical height, elaborating on a recent proposal by Rizzi (2018). Then we show that the prominence of subject and object constituents in Greek and Italian reflects word-order differences between the two languages (Roussou & Tsimpli 2006). In more general terms, this paper argues in favour of a multi-factorial approach to reference interpretation, in that syntactic factors interact with discourse factors, leading to a gradient variety of reference possibilities.

Keywords: null subjects; Position of Antecedent strategy; reference resolution in production and comprehension; word order in Italian and Greek

1 Introduction

In this paper, we investigate if speakers of Greek and Italian, two null subject languages (NSLs, henceforth), differ in the use and interpretation of null subject (NS, henceforth) and overt subject pronouns. Based on a production and a comprehension study, we show that speakers of the two languages exhibit different behavior, as far as both use and interpretation of NSs is concerned. Building on Roussou & Tsimpli (2006), we interpret this result as a consequence of how word-order differences between the two languages are reflected in language-specific patterns of anaphora resolution.

Since the first formulation of the NS-parameter by Rizzi (1982), scholars have noted that the so-called *canonical NSLs* (such as Greek, Italian and Spanish – cf. D'Alessandro 2015) share a cluster of properties, including the obligatory availability of null expletives, the presence of free subject inversion and the lack of *that*-trace effects (Rizzi 1982; see Sheehan 2016 for a review). However, in the following years, much research has shown that there are several aspects in which NSLs behave differently from each other. For example, it is intensively debated whether in NSLs overt subjects occupy a canonical SpecTP position (e.g., Suñer 2002 for Spanish; Alexopoulou et al. 2004 for Greek; Cardinaletti 2004 for Italian) or a left peripheral/dislocated one (Alexiadou & Anagnostopoulou 1998 for Greek; Ordoñez & Treviño 1999 for Spanish; Frascarelli 2007 for Italian). Sheehan (2016) observes that the resolution of this debate has relevant implications for understanding the mechanisms of licensing and interpretation of NSs. More important for the

present discussion, not all NSLs behave the same way in all syntactic tests for deciding between the canonical vs. left-peripheral position of overt subjects.

Here, we focus on how NSLs differ in (at least some) aspects related to the interpretation of NSs, considering their coreference with a previously mentioned antecedent. Since the study by Carminati (2002) on Italian, it has been noted that – in intrasentential contexts like (1) – NSs (indicated in the following examples with *pro*) tend to refer to the antecedent in the canonical subject position SpecIP (i.e., *Marta* in (1)). On the contrary, overt subject pronouns (like *lei* 'she' in Italian) have a strong bias towards an antecedent in a syntactic position lower than SpecIP (i.e., in object position, like *Piera* in (1)).

(1)   Marta scriveva   frequentemente a Piera, quando (pro)
         Marta write.IND.IPFV.3SG. frequently   to Piera, when   pro
         era   negli Stati Uniti.
         be.IND.IPFV.3SG. in the States United.
         'Marta frequently wrote to Piera, when (she) was in the United States.'

The pattern observed for (1) is usually referred to as the Position of Antecedent Strategy (PAS, henceforth), which accounts for the division of labor between NS and overt subject pronouns in Italian and, possibly, other NSLs. For example, related research has shown that Spanish, Catalan and Greek also comply with PAS (Alonso-Ovalle et al. 2002; Mayol & Clark 2010; Papadopoulou et al. 2015, respectively). It is relevant to note that most of the above-mentioned studies (including the one by Carminati 2002) have extended the observation of PAS to intersentential contexts like (2) – taken from Alonso-Ovalle et al. (2002) –, in which the NS refers to Juan, while an overt subject pronoun (*el* 'he') would refer to Pedro.

(2)   Juan pegó   a   Pedro. (pro) Estaba   enfadado.
         Juan hit.IND.PFV.3SG. DOM Pedro   pro is.IND.IPFV.3SG. angry.MASC.SG.
         'Juan hit Pedro. (He) was angry.'

However, a first comparison of the results of these studies reveals that, within the general pattern, there are variations in the extent to which different languages adhere to PAS. For example, Carminati (2002) reports that Italian speakers interpret NSs as referring to object antecedents in 19.28% of cases, which differs from the percentage reported in Papadopoulou et al. (2015), which amounts to 57.42%. Likewise, the percentage of items with Italian overt subject pronouns referring to subject antecedents is 16.67% in Carminati (2002), but 50.2% in the study on Spanish by Alonso-Ovalle et al. (2002). Since these studies are based on different methodologies (e.g., questionnaire studies vs. picture-matching tasks) and different types of items (e.g., intra- vs. intersentential contexts), it cannot be directly concluded that NSLs differ from each other in the use and interpretation of NSs. Two exceptions are the studies by Filiaci et al. (2013) and Torregrossa et al. (2015). The former presents the results of two self-paced reading experiments conducted in Italian and Spanish with comparable stimuli, and shows that overt subject pronouns have a robust object antecedent bias only in Italian. The latter compares the production of NSs in adult Greek and Italian in terms of their relation with their antecedent, on the basis of the same narrative task used across the two languages. The results show that in Greek NSs corefer with object antecedents to a greater extent than in Italian. With this respect, we would like to introduce an interesting set of data that clearly represents the difference between Greek and Italian (we adapted the Italian sentence from Rizzi 2018, ex. (33a)). We constructed the sentences (3) and (4) so that the NS in the main clause refers to the object *Mario* of the

previous clause, due to gender-matching between the past participle *imbarazzato/ntropi-asménos* 'embarrassed' and the object constituent. However, while the sentence in Greek is perfectly acceptable (see also Dimitriadis 1996 for a similar point), its Italian counterpart is perceived as unnatural, due to the robust subject antecedent bias of Italian NSs (see Rizzi 2018 for similar judgments).

(3)   *Greek*
        Epeidí   i Caterina   epékrine   afstirá   to Mario,
        Because C.NOM.FEM.SG. criticize.IND.PFV.3SG. severely M.ACC.MASC.SG.
        (pro) ítan   ntropiasménos.
         pro be.IND.IPFV.3SG. embarrassed.NOM.MASC.SG.
        'Because Caterina has severely criticized Mario, (he) was rather embarrassed.'

(4)   *Italian*
        Poiché Caterina ha   severamente criticato   Mario,
        because C.FEM.SG. AUX.IND.PRS.3SG. severely   criticize.PST.PTCP. M.MASC.SG.
        (pro) era   imbarazzato.
         pro be.IND.IPFV.3SG. embarrassed.MASC.SG.
        'Because Caterina has severely criticized Mario, (he) was rather embarrassed.'

As we will elaborate further below, the contrast between (3) and (4) suggests that Greek and Italian may exhibit a differential sensitivity to different morphosyntactic cues in the process of anaphora resolution (i.e., syntactic position of the antecedent in Italian vs. nominal/adjectival morphology in Greek).

It is important to point out that across all the above-mentioned studies, reference of NS or overt subject pronouns to a subject or object antecedent is never categorical. Even in languages with a clear division of labor between NSs and overt subject pronouns like Italian, there are contexts in which coreference between NSs and object antecedents or overt subject pronouns and subject antecedents is not excluded (cf. the percentage reported above related to Carminati 2002), and may even represent the preferred interpretation. This observation suggests that the interpretation mechanisms of these expressions cannot only be dependent on core grammar. If this were the case, this would be reflected in more categorical judgments (with one interpretation always being excluded) across all speakers and languages (see Papadopoulou et al. 2015 for a similar consideration).

Rather, we propose that grammar is only one among several factors affecting anaphora resolution. Based on Italian data, Carminati (2002: 205) has already observed a possible deviation from PAS, considering cases in which the antecedent clause contains a verb of perception (like *vedere*, 'see'), as in (5). In principle, the NS in (5) is ambiguous. However, it tends to be interpreted as referring to the object of the previous clause *Maria*: After hearing the first clause in (5), the hearer expects to know what the subject *Francesca* has seen, assuming her point of view (cf. Turan 1995). In terms of discourse relations, the second clause represents an *elaboration* of the previous one. This interpretation is reinforced by the use of the imperfective *era* 'was' in the second clause. It encodes unboundedness of the described event of Maria being happy, indicating that the second clause provides a description of the same eventuality as the first one.

(5)   Francesca ha   visto   Maria.   (pro) Era
        F.FEMM.SG. AUX.IND.PRS.3SG. see.PST.PTCP. M.FEM.SG.   pro be.IND.IPFV.3SG.
        molto   contenta.
        very   happy.FEM.SG.
        'Francesca saw Maria. (She) was very happy.'

Crucially, manipulating the aspect of the second sentence in (5) – using the perfective *fu* 'was' instead of the imperfective *era*, as indicated in (6) –, the NS tends to be interpreted as co-referent with the subject of the previous clause *Francesca*, in compliance with PAS. This is due to the fact that perfective aspect marks boundedness of the corresponding event (of being happy) and, accordingly, the second clause is interpreted as a consequence/result of the first sentence, involving (most probably) Francesca.

(6)   Francesca ha   visto   Maria.   (pro) Fu
        F.FEM.SG. AUX.IND.PRS.3SG. see.PST.PTCP. M.FEM.SG. pro be.IND.PFV.3SG.
        molto contenta.
        very   happy.FEM.SG.
        'Francesca saw Maria. (She) was very happy.'

The contrast between (5) and (6) shows that, together with the syntactic position of the antecedent (subject vs. object position), other factors affect anaphora resolution. These include the type of discourse relation that holds between the two sentences (e.g., elaboration vs. result), as triggered in (5) and (6) by verb aspect – see Kehler & Rohde (2013) for a theoretical model of the relationship between pronoun use and discourse coherence.

   To complicate the issue further, an additional factor that may interact with PAS and discourse relations (as marked by verbal aspect) includes discourse topicality. For example, in (7), the sentences in (5) are preceded by a context that establishes *Francesca* as the discourse topic (operationalized here in terms of frequency of mention – see, e.g., Hendriks 2016). Discourse topicality may (but does not need to) counteract the object-bias of verbs of perception as well as the type of discourse relation triggered by a certain aspectual form, favoring the interpretation according to which the NS in the last clause refers to the subject of the previous clause.

(7)   Francesca spera   sempre di incontrare le sue amiche
        F.FEM.SG. hope.IND.PRS.3SG. always to meet.INF. the her friend.FEM.PL.
        quando (pro) esce.   Ieri   (pro) ha
        when   pro go-out.IND.PRS.3SG. Yesterday pro AUX.IND.PRS.3SG.
        visto   Maria.   (pro) Era   molto   contenta.
        see.PST.PTCP. M.FEM.SG. pro be.IND.IPFV.3SG. very   happy.FEM.SG.
        'Francesca always hopes to meet her friends when she goes out. Yesterday (she) has seen Maria. (She) was really happy'.

This set of data suggests that a multi-factorial approach is more suitable to account for pronoun use and interpretation than considering each factor (syntactic position, discourse topicality, type of discourse relation) in isolation. We may think of all these factors as affecting the discourse prominence associated with a certain referent (e.g., Francesca vs. Maria). The use of a pronoun (like a NS) to refer to a discourse referent reflects its relatively high prominence (Arnold 2010). For instance, the fact that speakers tend to interpret the NS in (6) as referring to Francesca (instead of Maria) reflects the relatively high prominence of the constituent *Francesca*, as boosted by the subject position of the antecedent as well as the *result* discourse relation. On the contrary, in (5), the verb of perception – together with the *elaboration* discourse relation – boosts prominence of the object antecedent *Maria*, in comparison to the subject antecedent *Francesca*, so that linking the NS to the object antecedent is the preferred option. Finally, the discourse-topic status of the constituent *Francesca* in (7) may increase the prominence of Francesca, leading to the reverse pattern

of interpretation than in (5). Torregrossa, Bongartz & Tsimpli (2019) have developed a computational analysis of reference production and interpretation, by modelling the relative contribution of different linguistic and discourse factors to the use of pronouns.[1] For instance, the authors show that the use of pronouns (vs. full nouns) is more sensitive to the argument status of a pronoun's antecedent (subject vs. object) than the type of clause in which the antecedent occurs (main vs. subordinate, fn. 1). Based on the weighting of these factors, the authors propose a quantitative model that assigns a *prominence score* to the discourse referents at any point in discourse, which is predictive of which referent will be mentioned by means of a pronoun in later discourse (i.e., ideally, the referent which is associated with the highest prominence score).

Modelling the complexity and multifactoriality of anaphora resolution is beyond the scope of this paper (we refer, however, to Kibrik 2011 and Torregrossa et al. 2019 for a similar approach). Rather, we aim to pin down the role of grammatical and parsing principles in affecting the use and interpretation of NS and overt subject pronouns, in order to account for some of the above-mentioned inconsistencies found in the literature regarding the cross-linguistic validity of PAS. In particular, the comparison between Greek and Italian will allow us to show how anaphora resolution and the extent to which different languages adhere to PAS are strictly connected to other syntactic properties of the languages at stake. In more general terms, we intend to contribute to the understanding of micro-variation in the application of PAS, taking into account data from production and comprehension that are comparable across the two languages, as in the case of Filiaci et al. (2013) and Torregrossa et al. (2015). Before introducing our study, we will account for possible preferences in anaphora resolution by relying on a principle that defines prominence of syntactic constituents (the antecedents of NS and overt subject pronouns) based on structural criteria (in compliance with Carminati 2002 and Rizzi 2018). In this sense, our interest in this paper lies in the definition of syntactic prominence. Then, we will show that both Greek and Italian adhere to the afore-mentioned principle, and any difference in the interpretation and use of NSs across the two languages is due to cross-linguistic variation in other grammatical domains that are connected to the process of anaphora resolution (Roussou & Tsimpli 2006).

2 Syntactic prominence of clausal constituents and its role in anaphora resolution

The bias of NSs towards antecedents in subject position has been observed across several studies (Calabrese 1986; Brennan et al. 1987; Brennan 1995; Carminati 2002; Arnold 2010). Calabrese (1986) formulates two principles (reported here as (8) and (9)), in order to account for this bias (cf. Calabrese 1986: 27, (5) and (6)).

(8)   Use a stressed pronoun only when the occurrence of its referent is not expected.

(9)   A subject pronoun is expected to have the referent of another subject.

In other words, in order to refer to a subject antecedent by means of a subject pronoun (which is the expected pattern), speakers tend to use the unstressed, default form, which corresponds to NSs in the Italian pronominal system.

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[1] The authors take into account factors other than those mentioned in this paper. Besides the argument role of a pronoun's antecedent, they consider the clause type in which the antecedent appears, as well as the distance and the number of intervening characters between the pronoun and its antecedent. However, additional factors can be selected to be included in the model (like discourse topicality, discourse relations, etc.). The computational methodology presented in this paper allows the authors to weight all factors according to their relevance in the process of anaphora resolution and model their interaction.

Rizzi (2018) has recently reconsidered the data presented by Calabrese (1986). On the one hand, he shows that Italian NSs are sensitive to the *aboutness* of the antecedent – rather than its *subjecthood*. He draws this conclusion based on sentences like (10) – adapted from his (32a), in which the NS refers to the object clitic-left-dislocated constituent *Mario*. This interpretation is also triggered by the past participle *imbarazzato* (embarrassed) congruent with Mario in number and gender.[2]

(10)   Poiché   Mario,   Caterina   lo   ha
        because   M.MASC.SG.   C.FEM.SG.   CL.ACC.MASC.SG.   AUX.IND.PRS.3SG.
        severamente criticato,   (pro) era   imbarazzato.
        severely   criticize.PST.PTCP.   pro be.IND.IPFV.3SG. embarrassed.MASC.SG.
        'Because Mario, Caterina has severely criticized him, (he) was embarrassed.'

Rizzi (2018) shows that in Italian, clitic-left-dislocations share the property of marking the aboutness of the corresponding constituents with subjects, with respect to the sentence expressed by the comment or the event expressed by the predicate, respectively (see, however, Rizzi 2005; 2018 on how subjects and clitic-left-dislocations differ from each other). Crucially, (10) differs minimally from (4), since the object constituent is *in-situ* in (4) and left-dislocated (and, hence, marked for aboutness) in (10). In other terms, left-dislocation of the object constituent renders the sentence in (4) – which is perceived by native speakers as unnatural (as noted above) – acceptable. Furthermore, it should be noted that even if formulated considering mainly intrasentential contexts, Rizzi's principle (just like Calabrese's principle in (9)) can be extended to intersentential contexts, too. This is shown by the Spanish example in (2) and by the Italian example (11) below – which illustrates the same point as (10) using two main clauses.

(11)   Mario,   Caterina   lo   ha   severamente
        M.MASC.SG. C.FEM.SG. CL.ACC.MASC.SG.   AUX.IND.PRS.3SG. severely
        criticato.   (pro) Era   imbarazzato.
        criticize.PST.PTCP. pro   be.IND.IPFV.3SG. embarrassed.MASC.SG.
        'Mario, Caterina has severely criticized him. (He) was embarrassed.'

On the other hand, Rizzi (2018) observes that in some cases, the interpretation of NSs is ambiguous between a subject and an object antecedent, as in (12), where the NS in the complement clause is able to refer to both Francesca and Maria (even if Francesca is the subject/topic of the main clause).

(12)   Francesca ha   fatto   notare   a   Maria   che
        F.FEM.SG. AUX.IND.PRS.3SG. make.PST.PTCP. realize.INF. to M.FEM.SG. that
        (pro) era   molto stanca.
         pro be.IND.IPFV.3SG. very   tired.FEM.SG.
        'Francesca made Maria realize that (she) was very tired.'

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[2] Some native speakers of Italian, including one of the anonymous reviewers, consider (10) (and (17) below) as ungrammatical. In principle, a clitic-left dislocation inside a "peripheral" adverbial clause of the *because-type* should be acceptable (see Bianchi & Frascarelli 2010 for this observation and related terminology). The reason why some native speakers do not accept (10) could be that the acceptability of left-dislocated topics within adverbial clauses is subject to interspeaker variation. Furthermore, some speakers may find it difficult to establish an A'-dependency between the left-dislocated constituent and the clitic across the intervening lexical subject *Caterina*. In the latter case, speakers should be able to accept the sentence if the left-dislocated object constituent *Mario* is preceded by the proposition *a* (see Belletti 2018).

To account for coreference between a NS and a previous antecedent (regardless of its subject or object argument status), Rizzi formulates the following structural condition for anaphora resolution (see example (10) in Rizzi 2018):

(13)   A subject pronoun is expected to have the referent of a c-commanding DP.

The principle in (13) introduces a syntactic configuration (i.e., c-command) as determining the interpretation of NSs: NSs are interpreted as coreferent with a c-commanding (subject or object) constituent.

   This second aspect of the proposal is consistent with previous syntactic approaches to the interpretation of NSs, such as the one formulated by Frascarelli (2007). Frascarelli argues that NSs are licensed through agreement by a c-commanding left-dislocated constituent that occupies the Aboutness-shift topic position (*ShiftTopP*) and can be either overt or covert.[3] For example, the NS in the second clause in (14) is licensed by a covert Aboutness-shift topic *Carla* merged in the left-periphery of the sentence (cf. the second part of the representation in (15)). A similar analysis applies to sentences with an overt subject. For example, the first clause in (14) – according to Frascarelli (2007) – contains a NS that sits at the edge of *vP* and is licensed by the constituent *Carla*, which is overtly realized in *ShiftTopP* – as shown in the first part of the representation in (15).

(14)   Carla   mangia   una mela. (pro) Sta   andando   a   scuola.
        C.FEM.SG. eat.IND.PRS.3SG. an   apple. pro is.IND.PRS.3SG. go.GERUND to school.

(15)   [$_{ShiftToPP}$ Carla$_k$ [$_{AgrSP}$ mangia [$_{vP}$ pro$_k$ [$_{VP}$ <mangia> una mela]]]]. [$_{ShiftToPP}$
        <Carla$_k$> [$_{AgrSP}$ sta [$_{vP}$ pro$_k$ [$_{VP}$ andando a scuola]]]].
        'Carla eats an apple. (She) is going to school.'

The analysis of Frascarelli has two main implications. First, overt subjects always occupy an A-bar position in NSLs. Second, sentences containing a preverbal overt subject have the same structure as clitic-left-dislocations – with NSs corresponding to resumptive clitics. Frascarelli's proposal accounts for the interpretations of NSs in sentences like (10) above, which would be analyzed as follows:

(16)   [$_{ShiftToPP}$ <Mario$_k$> [poiché [$_{FamP}$ Mario$_k$ [$_{FamP}$ Caterina$_i$ [$_{AgrP}$ lo$_k$ ha [$_{vP}$ pro$_i$ [$_{VP}$
        severamente criticato]]]]]] [$_{AgrP}$ era[$_{SC}$ pro$_k$ imbarazzato]]].
        'Because Mario, Caterina has severely criticized him, (he) was embarrassed.'

The NS in the main clause in (16) is licensed by the ShiftTopP *Mario*. *Mario* is merged in the sentential left-periphery and starts a topic chain that links the Familiar Topic (i.e., a discourse-given topic) in the adverbial clause and *pro* at the left edge of the small clause (which corresponds to the matrix clause). Frascarelli's (2007) analysis provides an elegant explanation to Rizzi's (2018) observation that NSs are sensitive to the aboutness of a previous constituent. However, we think that her idea of accounting for the interpretation of NSs exclusively by means of formal criteria (c-command by an Aboutness-shift topic) is too extreme (cf. Leonetti under review for a similar view). Let us consider, for instance,

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[3] Since Rizzi (1997), it has been noted that the Italian sentential left-periphery contains recursive topic projections (TopPs). For example, the clitic-left-dislocated object constituent *Mario* in (11) (see text) occupies one of these topic positions (see also Torregrossa 2012 for a review). Building on Rizzi's observation, Frascarelli (2007) has argued that each of these TopPs encodes a specific interpretation (i.e., aboutness-shift, contrastive, familiar). According to Frascarelli's proposal, Aboutness-shift topics are involved in the licensing of NSs.

sentence (17), which is identical to (16), except for the fact that coreference between the NS and the Familiar Topic is not forced by agreement-matching – since both antecedents are masculine singular (cf. *Carlo* in (17) vs. *Caterina* in (16); the sentence corresponds to Rizzi's example (31)). As also discussed by Rizzi, judgements on sentences like (17) are difficult to elicit, given that some speakers do not find these sentences fully grammatical (see fn. 2 above, including our considerations on a-marked topics).

(17)   Poiché Mario,   Carlo   lo   ha   severamente
        because M.MASC.SG. C.MASC.SG.   CL.ACC.MASC.SG. AUX.IND.PRS.3SG. severely
        criticato,   (pro) era   imbarazzato.
        criticize.PST.PTCP. pro be.IND.IPFV.3SG. embarrassed.MASC.SG.
        'Because Mario, Carlo has severely criticized him, (he) was embarrassed.'

Reference of the NS in (17) is ambiguous between the two antecedents *Mario* and *Carlo*, which means that in the structure of (16), one can arbitrarily select *Mario* or *Carlo* as the relevant Aboutness-shift topic. This kind of arbitrariness is not expected if, as argued by Frascarelli, the interpretation is determined only by grammar. Another set of data that cannot be easily analyzed by Frascarelli's proposal concerns, for instance, NSs referring to objects of perception verbs, as considered in sentence (5) in Section 1, repeated here as (18). As argued in Section 1, the NS in the second (main) clause of (18) tends to be inter-preted as coreferent with the object *Maria* and not with the subject *Francesca*, as would be predicted by Frascarelli's proposal (as well as by Calabrese and Rizzi).

(18)   Francesca ha   visto   Maria.   (pro) Era
        F.FEM.SG. AUX.IND.PRS.3SG. see.PST.PTCP. M.FEM.SG.   pro be.IND.IPFV.3SG.
        molto contenta.
        very   happy.FEM.SG.
        'Francesca saw Maria. (She) was very happy.'

In other terms, (18) would involve a topic shift (from *Francesca* to *Maria*) expressed by means of a covert Aboutness-shift topic. The possibility of having covert Aboutness-shift topics leads to an overgeneration of covert topics (cf. also Leonetti under review for a similar criticism). This renders the proposal not predictive of any specific interpretation of NSs, as well as not falsifiable: a relevant (covert) Aboutness-shift topic can always be posited *ad hoc*, depending on the interpretation that one assigns to a NS.

For lack of space, we cannot discuss here several aspects of Frascarelli's proposal – e.g., how it is framed within a syntax-prosody interface analysis of topic constituents. However, examples like (17) and (18) suggest that a purely grammatical approach to the interpretation of NSs may be too restrictive (cf. Leonetti under review for a similar point). Rather, we believe that grammar is only one among several factors contributing to the interpretation of NSs. The multi-factorial analysis of anaphora resolution sketched at the end of Section 1 is more likely to account for the gradient nature of use and the range of possible interpretations of NSs: NSs may be used or interpreted to refer to subject or object antecedents, depending on how the syntactic position of the antecedent interacts with other factors (such as a referent's discourse topicality and coherence relations).

Here, we intend to pin down the specific role of grammar in the process of anaphora reso-lution. Any theory of the interpretation of NSs has to explain the following set of data: i) the bias of NSs towards constituents marked for *aboutness* in both intra- and intersentential contexts (examples (1)–(2) for subjects and (10)–(11) for topics); ii) the possibility to refer to antecedents that are not marked for *aboutness* (e.g., *in-situ* objects) in both intrasentential

(and, specifically, when the object c-commands the antecedent, as in (12)) and intersentential contexts (example (18)); iii) the difference between Greek and Italian in the extent to which they allow for NSs to refer back to non-aboutness antecedents (see (3) and (4)). As previously discussed, Rizzi (2018) accounts for the pattern in (i) and (ii) by distinguishing between two conditions: on the one hand, in intersentential contexts (as in (11)) or in the absence of any c-commanding constituent (as in (10)), the aboutness of the antecedent is the driving factor in anaphora resolution. Note that this idea does not account for the possibility for NSs to refer to object antecedents in intersentential contexts. On the other hand, whenever there is a c-commanding constituent, the c-command determines the interpretation of NSs. This second principle does not predict any bias in the interpretation of NSs (towards subject or object antecedents) if the NS is c-commanded by two (or more) constituents, as observed with (12). We share the intuition that the NS in (12) is ambiguous between the two referents in the previous main clause with Rizzi (2018). However, many sentences of the same type – with the NS c-commanded by both a subject and object antecedent – exhibit the same subject bias as in intersentential contexts (as shown by the Spanish example in (2)). For example, the NS in (19) tends to refer to the subject of the previous clause *Francesca*.

(19)   Francesca ha   detto   a Maria   che (pro)
         F.FEM.SG. AUX.IND.PRS.3SG. say.PST.PTCP. to M.FEM.SG. that pro
         era   molto contenta.
         be.IND.IPFV.3SG. very   happy.FEM.SG.
         'Francesca said to Maria that she was very happy.'

Here, we want to merge Rizzi's two conditions in only one principle, following his intuition that c-command is a relevant factor in anaphora resolution. In particular, we propose (20)–(22):

(20)   A null subject is expected to have the referent of a prominent DP.

(21)   A DP is more prominent than another DP if the former is hierarchically higher than the latter.

(22)   Prominence of a DP depends on other factors beyond syntax (e.g., verb-type, coherence relations, discourse topicality, prosody, etc.).

The principle in (21) accounts for the subject/topic bias in the interpretation of NSs since subjects/topics occupy a relatively high position in the structure. Crucially, the greater the difference between constituents in terms of hierarchical height, the more evident this bias is. This explains, for instance, why the bias is stronger in sentences like (1) – where one DP is in subject position and the other in object position – than in sentences like (17) – where, depending on the preferred syntactic analysis, both DPs sit in CP (cf. Frascarelli 2007 on the idea that Italian subjects are always left-dislocated) or one sits in CP (i.e., the clitic-left-dislocated constituent) and one at the edge of TP (i.e., the subject constituent, according to the analyses of Alexiadou & Anagnostopoulou 1998; Sheehan 2016). The understanding of this mechanism will be crucial to account for the difference between Greek and Italian in the extent to which NSs refer to subject antecedents, as we will show in Section 3. Furthermore, (21) generally applies to both intersentential and intrasentential contexts, without distinguishing between two conditions, as in the case of Rizzi (2018).

We should point out that based on our proposal, structural factors are taken into account in anaphora resolution. Hierarchical height (in our formulation in (21)) can be seen as a proxy to c-command, in line with Rizzi's proposal (see also Franck 2018). Also, we claim that anaphora resolution is sensitive to the difference between constituents in terms of hierarchical height: the greater the difference, the higher the probability for the hierarchically higher constituent to be picked up by a NS. In this sense, the difference in hierarchical height is a continuum and we cannot establish it as a category of grammar. However, we think that this continuum is relevant to the interface of syntax with other cognitive domains. Several studies have shown that cognitive processes operate on a hierarchical structure. For example, Franck (2018) argues that memory retrieval, as crucially involved in agreement attraction effects in language comprehension and production, is sensitive to hierarchical structure. In this sense, anaphora resolution instantiates the same dependency of memory retrieval processes from a hierarchical structure. We propose that the continuum of ways in which constituents differ from each other in terms of hierarchical height is reflected in a continuum of activation of these constituents in memory and, as a consequence, in more or less sharp intuitions on the resolution of NSs in discourse. For instance, as observed in (17), a reduced difference between constituents in hierarchical height increases the likelihood of ambiguity in the interpretation of NSs.

On the one hand, by means of (21) we recognizes the importance of syntax (in terms of hierarchical height) in the process of anaphora resolution: Given two constituents, pronouns tend to refer to the one that is hierarchically higher. On the other hand, (22) explains the possibility of NSs to refer to an object antecedent, which depends on how (21) interacts with the factors listed in Section 1, in compliance with a multi-factorial analysis of pronoun use and interpretation.

3 Cross-linguistic differences in the sensitivity to syntactic prominence: A view from Greek and Italian

The contrast between (3) and (4) in Section 1 may suggest that different languages observe the principles in (20) and (21) to a different extent. Here, we argue that both Greek and Italian comply with (20) and (21). However, the different behavior exhibited by NSs in the two languages is motivated by how (20) and (21) interact with language-specific syntactic features.

Roussou & Tsimpli (2006) show that Greek and Italian exhibit some word-order differences. More specifically, the VSO-order in broad focus thetic sentences is available in Greek, but not in Italian, as shown by the contrast between (23) and (24) – taken from Roussou & Tsimpli (2006: 318). (24) would be acceptable only if the subject constituent *Gianni* has a narrow/contrastive focus interpretation (cf. also Belletti 2004).

(23)   *Greek*
       Episkevase   o   Janis ton   ipolojisti mu.
       repair.IND.PFV.3SG. the.NOM.MASC.SG.   J.   the.ACC.MASC.SG. computer of-mine.

(24)   *Italian*
       ??Ha   riparato   Gianni il   mio   computer.
       AUX.IND.PRS.3SG.   repair.PST.PTCP. G.   the.MASC.SG. my.MASC.SG.   computer.
       'Gianni repaired my computer.'

To account for the contrast between (23) and (24), the authors convincingly argue that in Greek, subject and object constituents can occupy the same domain in the clause (VP, TP or CP), while they cannot in Italian. For example, in (23), the subject *o Janis* and the

object *ton ipolojisti* 'the computer' are merged in the *clitic-shell* above VP (Poletto 2000; Manzini & Savoia 2001; 2004). This is possible because, in Greek, subjects and objects lexicalize different features, as shown by the fact that articles (e.g., the nominative *o* and the accusative *ton* in (23)), as well as nouns, bear case morphology. On the contrary, Italian DPs lexicalize the same features, due to the absence of case distinctions. As a consequence, in Italian, subjects and objects must occupy different clitic-shells: the object is usually merged above VP, while the subject in a higher position, i.e., above TP. In other words, the difference between Greek and Italian in the availability of VSO is interpreted as an effect of the morphological complexity of the nominal paradigm in the two languages.

Crucially, the analysis of Roussou & Tsimpli (2006) – coupled with the principle in (21) – makes interesting predictions related to the different interpretation patterns of NSs in Greek and Italian. The difference between subject and object constituents in terms of hierarchical height (see Section 2) is more pronounced in Italian than in Greek, because in Italian, subjects and objects must be merged in two different domains. Accordingly, it is likely that in Italian, the syntactic position of antecedents (subject or object) functions as a more reliable cue in the interpretation of NSs than in Greek, in which subjects and objects can be merged either in the same or in different domains. It is also plausible that anaphora resolution in Greek relies more on nominal morphology than in Italian, due to the fairly consistent morphological marking in the nominal domain in Greek (with a three-way gender and a four-way case distinction, including vocative marking) as opposed to Italian (with a two-way gender distinction and no case distinctions on DPs. The exception is personal pronouns, which are marked for nominative, accusative and dative). These predictions account for the contrast between (3) and (4) in Section 1. In Italian, the subject bias of NSs reflects the relevant role played by the syntactic position of the antecedent (subject vs. object), which counteracts the effects of morphological marking on the adjective triggering reference to the object. Contrary to this, gender-matching between the adjective and the object constituent is used as a cue in the interpretation of NSs in Greek (which is likely to be more sensitive to noun morphology than Italian), for which the sentence is acceptable.

However, for the moment, the difference between Italian and Greek concerning the subject bias of NSs is based on isolated sentences and sparse evidence. The aim of the next two sections is to provide more systematic evidence that the subject bias in Greek is not as strong as the one in Italian, taking into account data from production (Section 4.1) and comprehension (Section 4.2).

4 Testing the subject bias of null subjects in Greek and Italian: An experiment on the production and interpretation of null subjects

4.1 The production of null subjects in Italian and Greek

4.1.1 Participants

We tested 20 Italian (15 females) and 16 Greek (15 females) adult monolinguals. The Italian speakers ranged in age from 20;3 to 38;2 years (M: 25;4) and the Greek speakers from 20;6 to 40;7 (M: 24;3). In order to control for dialectal differences, we considered – in Italy – only participants born and raised in the province of Macerata (Marche) and – in Greece – only participants born and raised in the city of Thessaloniki. The Italian participants were recruited at the University of Macerata, while the Greek participants were recruited at the Aristotle University of Thessaloniki. We tested only university students because we wanted to keep the participants' level of education as homogeneous as possible since speakers' level of literacy has been shown to have an effect on their use of referring expressions (Arnold et al. 2018). Finally, in order to control for the effect of second language learning on pronoun use, we did not test participants whose self-reported level of proficiency in a second language (English in all cases) was higher than B2 of the European Framework for Language Competence.

4.1.2 Materials and procedure

Null subjects were elicited by means of a narrative elicitation task, using the Edmonton Narrative Norms Instrument (ENNI – Schneider et al. 2005). The ENNI consists of two series of picture-story stimuli (the A-series and the B-series), each comprising three story boards of increasing complexity (Level 1, 2 and 3). Across the two series, the three stories have been designed to be structurally equivalent, with A1 and B1 consisting of 5 pictures, A2 and B2 of 8 pictures and A3 and B3 of 13 pictures. For our task, we used the two most complex stories: Each participant had to tell one story from Level 2 (either of the A- or of the B-series) and one story from Level 3 (either of the A- or the B-series), counterbalancing the order of administration across participants. Each story represents a series of events involving two major characters (a giraffe boy and an elephant girl in the stories of the A-series, and a dog girl and a rabbit boy in the stories of the B-series) and one or two minor characters (in Level 2 and Level 3, respectively). Specifically, A2 and B2 involve one minor character, while A3 and B3 two minor characters of different gender.

We administered the task as a sequence of Power Point slides on a computer screen. First, the participants had to choose one of three envelopes appearing in the first slide. Although all envelopes contained the same story (e.g., A3 or B3), we told the participants that each envelope contained a different story: We pretended not to know the story associated with the envelope (Serratrice 2007). We asked the participants to look at the pictures two by two to understand the plot of the story. Finally, once the 8- or the 13-picture synopsis (for the 2- and 3-series, respectively) had appeared on the screen, they had to tell the story to the interviewer, who did not have visual access to the pictures. After telling the first story (e.g., A2 or B3), we asked the participants to tell the second story after a short break. The stories were audio-recorded and then transcribed by a native speaker of Greek and Italian, respectively. Then, another Greek and Italian native speaker checked the transcriptions. Disagreements were resolved by listening to the audio-recordings again. The final corpus of narratives consisted of 40 Italian narratives and 32 Greek narratives.

4.1.3 Analysis

We divided each narrative into clausal units, defined by the occurrence of a verbal form. Table 1 reports the frequency of NSs, overt pronouns, full DPs and clitics produced in Italian and Greek, respectively, together with the mean number of referring expressions of each type as produced by each participant and its standard deviation.

Table 1: Raw frequencies, means (per participant) and standard deviations of null subjects, full nouns (full DPs), clitics and overt pronouns (PRONs) in Italian and Greek, respectively.

TYPE OF REFERRING EXPRESSION	FREQUENCY	MEAN	STANDARD DEVIATION
Italian			
Null subjects	314	15.70	7.00
Full DPs	278	13.90	8.39
Clitics	79	3.95	2.74
PRONs	14	0.80	1.36
Greek			
Null subjects	534	33.37	14.95
Full DPs	216	13.50	4.30
Clitics	187	11.69	6.19
PRONs	11	.69	.79

In both languages, participants produce mostly NSs and full DPs. Strikingly, the corpus contains very few instances of overt pronouns (PRONs). It should be considered that in some contexts no alternation between NSs and PRONs is possible, such as with PRONs in object position (which alternate with clitics) or following a preposition (such as *s'autón* in Greek or *da lui* in Italian, meaning 'to him', as in example (29) below), or with focus operators like *also* or *even* (*anche lui* 'he also'; *kai autós* in Greek). If these contexts are excluded, participants produced only 9 PRONs in subject position in Italian (5 referring back to a subject and 4 to an object antecedent) and 3 in subject position in Greek (1 picking up a subject and 2 an object antecedent).

Our analysis focuses on NSs, considering only NSs denoting animate characters, in order to control for animacy effects. Since we are interested in understanding to what extent NSs in Italian and Greek refer to subject or non-subject antecedents, we coded each NS for the antecedent's grammatical role, i.e., SUBJ (for subject antecedents) and OBJ (for non-subject antecedents, without distinguishing between direct and indirect objects). We considered only those cases in which the unit immediately preceding the target unit (with the NS) contained both a subject and an object (direct or indirect). For example, we excluded sentences like (25), since they allow only for one possibility (i.e., reference to the subject antecedent).

(25) U1: L'elefantina   corre.
           the elephant girl run.IND.PRS.3SG.

      U2: (pro) scivola   per terra.
            pro   slip.IND.PRS.3SG. on   floor.
           'The elephant girl runs. (She) slips on the floor.'

We also excluded the analysis of NSs whose antecedent did not occur in the immediately preceding clause, in order to control for the effects of distance (i.e., number of clausal units between a referring expression and its antecedent; Kibrik 2011; Torregrossa et al. 2019). For example, the NS in U4 in the excerpt in (26) does not refer to the subject of the previous clause (i.e., the NS in U3), but to the NS in U1, which reflects how the discourse is structured: By means of U4, the speaker repeats the information in U1 and moves the narrative forward, after a hiatus containing information which is *backgrounded* with respect to the main line of the narrative (i.e., that the elephant girl is in pain, because she hurt her knee).

(26) U1: (pro) Presta   aiuto all'   elefantessa.
            pro   offer IND.PRS.3SG. help   to the elephant girl

      U2: che   sembra   molto dolorante.
           that seem.IND.PRS.3SG.   very   sore

      U3: (pro) S'   è   fatta   proprio male
            pro   CL.REFL.DAT.3SG.   AUX.IND.PRS.3SG.   made.PST.PTCP. really   bad
            al   ginocchio.
            to the   knee

      U4: E   (pro) le   presta   i primi soccorsi.
           and pro   CL.DAT.3SG.FEM. offer.IND.PRS.3SG. the first aid.MASC.PL.
           '(He) offers help to the elephant girl, that seems to be very sore. (She) hurt (herself) the knee very badly. (He) gives her first aid.'

After excluding these cases, the analysis concerns 113 occurrences of NSs in Italian (out of a total of 314 occurrences, as reported in Table 1) and 138 in Greek (out of 543). (27) and

(30) report examples of sentences that we included in our analysis. The NS in U2 in (27) refers to the subject of the previous clause (the dog), while the antecedent of the NS in U2 in (28) is the object clitic in U1 (referring to the person being treated), as is clear from the verb semantics. Note that U2 in (28) is not completely acceptable (even if it was actually produced) and improves if the NS is substituted by the overt pronoun *lui* 'he'.

(27) NS with a subject antecedent (Italian)
    U1: Il   cane vede   passare   per   il   sentiero un coniglio
         the dog see.IND.PRS.3SG. pass-by.INF. through the path   a rabbit

    U2: e   quindi, diciamo,   (pro) chiede   aiuto.
         and then   say.IND.PRS.1PL. pro ask.IND.PRS.3SG. help
         'The dog sees a rabbit, a doctor, passing by through the path and then, let us say, (he) asks for help.'

(28) NS with an object antecedent (Italian)
    U1: e   lo   cura
         and CL.ACC.MASC.SG. treat.IND.PRS.3SG.

    U2: (pro) si   riprende.
         pro CL.REF. recover.IND.PRS.3SG.
         '(He) treats him. (He) recovers.'

(29) and (30) show the reference possibilities for NSs in Greek, with the NS in U2 in (29) referring back to the subject of the previous clause (the rabbit) and the one in U2 in (30) to the object clitic *ton* in U1. Notice that the sentence is perfectly acceptable in Greek, contrary to the Italian sentence (28).

(29) NS with a subject antecedent (Greek)
    U1: Pigéni   o   lagós   s'autón
         go.IND.PRS.3SG. the.NOM.MASC.SG. rabbit.NOM.MASC.SG. to him.ACC.MASC.SG.

    U2: (pro) Zitái   éna.
         pro ask.IND.PRS.3SG. one.ACC.NEUTR.SG.
         'The rabbit goes to him. (He) asks for one.'

(30) NS with an object antecedent (Greek)
   U1: (pro) Ton   exetázi.
         pro CL.ACC.MASC.SG. examine.IND.PRS.3SG.

    U2: (pro) óntos íxe   fái   polí
         pro indeed AUX.IND.PFV.3SG. eaten.PST.PTCP. a lot.
         '(He) examines him. (He) had eaten a lot, indeed.'

4.1.4 Results

Figure 1 compares the distribution, in percentage, of NSs referring to a subject or an object antecedent in both languages. In Italian, out of 113 NSs, 101 refer to subject antecedents and 12 to object antecedents (corresponding to 89.4% and 10.6% of cases, respectively). In Greek, out of 138 occurrences of NSs, 100 refer to subject antecedents and 38 to object antecedents (corresponding to 72.5% and 27.5% of cases, respectively).

The distribution of NSs referring back to a subject (vs. object) antecedent differs significantly between the two languages ($\chi^2(1) = 11.15, p = .001$). In both languages, NSs tend to refer mostly to subject antecedents. However, there is a greater number of NSs referring to an object antecedent in Greek than in Italian.
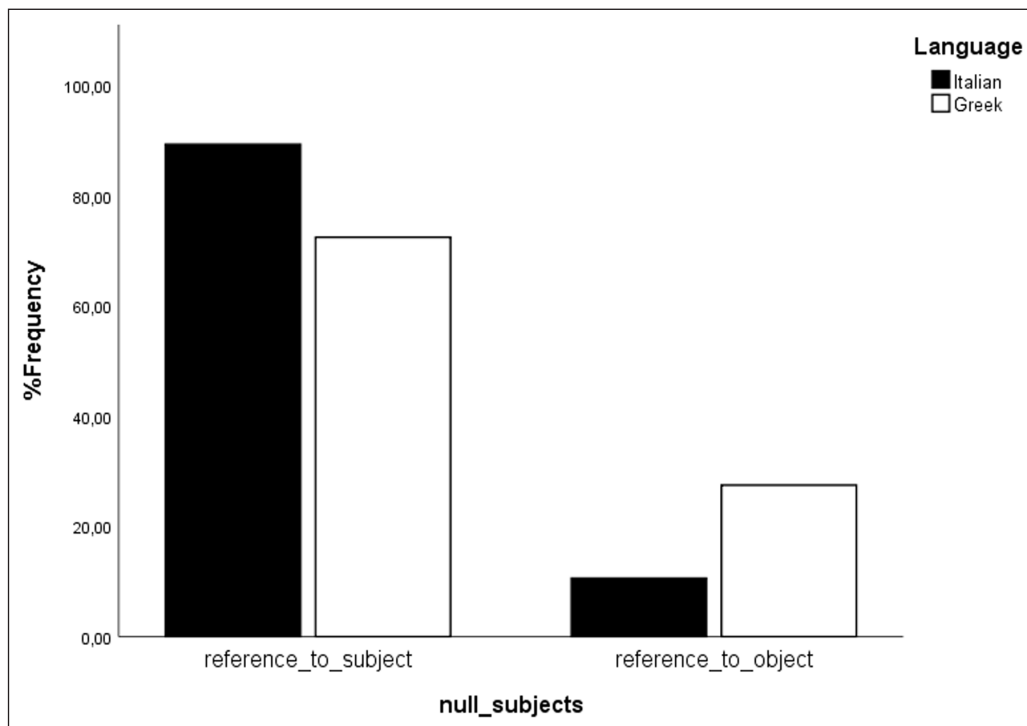
Figure 1: Reference possibilities of null subjects in Italian and Greek, in production. The percentage of null subjects referring back to a subject or an object antecedent occurring in the immediately preceding clausal unit, in Italian and Greek, respectively.

4.2 The interpretation of null subjects in Italian and Greek

4.2.1 Participants

One hundred twenty-four monolingual Italian- and Greek-speaking adults took part in the study. We divided the participants into two groups: 62 Italian-speaking adults (Mean age: 30;7, Range: 22–54; SD:7.96) and 62 Greek-speaking adults (Mean: 21;6; Range: 18–48; SD: 5.83). Before conducting the study, each participant had to complete a short questionnaire, related to background information (age, level of education, region of origin in Greek or Italian), knowledge of a second or a third language (when applied/if applicable) and level of proficiency in this language. Most of the Greek participants (62.9%) were born and raised in Northern Greece (e.g., areas around Thessaloniki), but participants from Central Greece (19.35%) and Southern Greece (17.75%) also took part in the study. As for the Italian participants, we had participants from both Northern Italy (Lombardy and Emilia Romagna, 51%) and Central Italy (Marche, Tuscany, Umbria, 49%). Differently from our study on production (Section 4.1.1), we did not include only university students. However, to control for any effect of literacy, we asked for the participants' educational level, calculating it on a 5-point Likert-type scale, with 5 representing the highest educational level attained, from compulsory primary education to post-graduate education. A two-sample t-test reveals that the educational level does not differ across the two groups ($t(124) = -1.10$, $p = .28$; for Italian M = 3.75, SD = 1.01; for Greek: M = 3.91; SD = .55). We excluded all participants who declared to be bilingual (in two national languages) or to have a self-reported level of proficiency in a second language (English in all cases) higher than C1 of the European Framework for Language Competence from the analysis. We did not account for the participants' competence in a particular dialect, even though among the Italian participants, 50% declared to have an active competence in both Italian and a local dialect, while this was the case for only 11.3% of Greek participants. The criteria for participation in this second study were not as strict as in the first

study (Section 4.1.1). By so doing, we could rely on a greater number of participants, in order to achieve greater statistical power.

4.2.2 Materials and procedure

We administered an offline interpretation task in Italian and in Greek, respectively. By taking part in an online survey, participants had to indicate the extent to which they interpreted a NS vs. overt subject pronoun (PRON) as referring to a subject vs. object antecedent, based on a 5-point Likert-scale. We manipulated two factors: Pronoun Type (NS vs. PRON) and Pronoun Interpretation (reference to the subject vs. reference to the object), resulting in four different conditions. We used identical sentences across the two languages. Each sentence consisted of an SVO-main clause introducing two same-gender (masculine in all cases) referents, one in subject and one in object position. This SVO-sentence was followed by a subordinate clause containing either a null or an overt pronoun in subject position (as in (31)–(32) in Italian and (33)–(34) in Greek, respectively). Reference of these pronouns is potentially ambiguous between the subject and the object antecedent.[4] As is clear from the examples, when designing the stimuli, we tried to keep the sentences as ambiguous as possible, in order to avoid that the action described in the subordinate clause (e.g., closing the folder in (31)–(34)) would be prototypically associated with one of the two referents. This way, we controlled for possible effects of world knowledge on anaphora interpretation.

(31)   *Italian*
       Il   dottore   pagò   l'architetto   mentre (pro)
       the doctor.MASC.SG. pay.IND.PFV.3SG. the architect.MASC.SG. while   pro
       chiudeva   la   cartella.
       close.IND.IPFV.3SG. the folder.FEM.SG.
       'The doctor paid the architect, while (pro) was closing the folder.'

(32)   *Italian*
       Il   dottore   pagò   l'architetto   mentre
       the doctor.MASC.SG. pay.IND.PFV.3SG. the architect.MASC.SG. while
       lui   chiudeva   la   cartella
       he.NOM.MASC.SG. close.IND.IPFV.3SG. the folder.FEM.SG.
       'The doctor paid the architect, while he was closing the folder.'

---

[4] For this task, we decided to use only post-matrix temporal adverbial clauses introduced by the conjunction *while*. As for the position of the subordinate clause (pre- vs. post-matrix), we considered only anaphoric contexts, in compliance with our study on production (Section 4.1). However, we are aware that pronoun interpretation may differ if analyzed in association with intra-sentential anaphora or cataphora, respectively (e.g., Fedele & Kaiser 2014). As for their semantics, *while*-clauses tend to provide background temporal information (with respect to the event described in the previous clause), which is usually not associated with any subject- or object-bias in terms of the interpretation of the corresponding pronoun with respect to a previous antecedent. In this respect, *while*-clauses differ from other clauses such as *because*-clauses or *so-that*-clauses (expressing causality and consequence, respectively), which are more biased towards coreference with an object or a subject antecedent, respectively. For example, after hearing a sentence like *The doctor paid the architect because he (…)* – modified from (32) –, one is expected to know something about the architect, i.e., what he did to be paid. On the contrary, sentences like *The doctor paid the architect, so that (…)* usually trigger coreference with the subject antecedent (i.e., the doctor), as the one having a certain purpose. One of the reviewers suggests that pronoun interpretation may vary depending on the type of adverbial clause that is at issue (i.e., central vs. peripheral, cf. Haegeman 2004 on this distinction). As far as we know, no existing study addresses this interesting issue, which is worth investigating. Crucially, while central adverbials are integrated into the matrix clause (modifying the corresponding event), peripheral adverbial clauses are "less tightly connected" (Bianchi & Frascarelli 2010: 52) and "contribute to discourse structuring" (Haegeman 2004: 62). This difference at the syntax/semantics interface may affect the interpretation of the corresponding pronouns. For example, while pronoun interpretation in association with central clauses may be more sensitive to syntactic (intra-sentential) constraints (because of clausal integration), pronoun interpretation with peripheral clauses may be more affected by discourse factors.

(33)   *Greek*
         O   giatros   plirose   ton
         the.NOM.MASC.SG.   doctor.NOM.MASC.SG.   paid.IND.PFV.3SG.   the.ACC.MASC.SG.
         architektona,   eno   (pro) ekleine   to
         architect.ACC.MASC.SG.   while   pro   close.IND.IPFV.3SG.   the.ACC.MASC.SG.
         fakelo.
         envelope.ACC.MASC.SG.
         'The doctor paid the architect, while (pro) was closing the folder.'

(34)   *Greek*
         O   giatros   plirose   ton
         the.NOM.MASC.SG.   doctor.NOM.MASC.SG.   paid.IND.PFV.3SG.   the.ACC.MASC.SG.
         architektona,   eno   aftos   ekleine
         architect.ACC.MASC.SG.   while   he.NOM.MASC.SG.   close.IND.IPFV.3SG.
         to   fakelo.
         the.ACC.MASC.SG.   folder.ACC.MASC.SG.
         'The doctor paid the architect, while he was closing the folder.'

To manipulate Pronoun Interpretation (reference to the subject vs. object), each sentence was followed by a question asking how likely it was that the action expressed by the verb in the subordinate clause was being performed by the subject or the object of the main clause (as shown in (35) and (36), corresponding to (31)–(32) and (33)–(34), respectively).

(35)   *Italian*
         Quanto probabile pensi che fosse il dottore/l'architetto a chiudere la cartella?

(36)   *Greek*
         Poso pithano einai oti o giatros/o architektonas ekleine to fakelo;
         'How likely do you think that it was the doctor/the architect that closed the folder?'

After reading the target sentence (31)–(34), participants had to answer the question in (35)–(36) based on a 5-point Likert scale, where 1 indicates that it was not likely at all (that the subject or the object antecedent performed the action expressed by the subordinate clause), and 5 indicates that it was very likely. The design of the study is inspired by the methodology developed by Papadopoulou et al. (2015) in that the possible interpretations of NSs and overt pronouns are made part of the experimental conditions. However, while Papadopoulou et al. (2015) test interpretation preferences by means of a picture-matching task (i.e., the participants had to indicate whether a given picture matches – or does not match – the sentence), in our study, the question (cf. (35) and (36)) provides one of the two possible interpretations of NSs and overt pronouns (reference to the subject vs. reference to the object). We decided to rely on a Likert-scale task since it is more sensitive than a traditional yes-no task (such as asking *Was it the doctor/the architect that closed the folder?*) at identifying qualitative and quantitative differences between conditions (Schütze & Sprouse 2013).

   Sentence materials consisted of 30 experimental items appearing in four different versions that differed with respect to the type of pronoun (null vs. overt) and target question (referring to the subject or the object antecedent). Following a Latin Square Design (with the two factors being manipulated within participants and items), we created four lists, each containing 30 critical sentences and 15 fillers. Fillers were created by manipulating the referring expression (a full DP instead of a NS or an overt pronoun in the subordinate clause),

the gender of PRON in the subordinate clause together with the gender of one of the two antecedents (e.g., a female character used as an object, followed by a gender-matched overt pronoun), the type of subordinate clause (e.g., a temporal clause indicating precedence in time instead of simultaneity) and the linear order between the main and the subordinate clause. Two examples of fillers are given in (37) and (38):

(37) Prima che il capostazione   fermasse   la ladra,
      Before that the station master.MASC.SG. stop.SBJV.IPFV.3SG. the thief.FEM.SG.
      lei   gettò   il portafoglio che (pro)
      she.NOM.FEM.SG. throw.IND.PFV.3SG. the wallet   that pro
      aveva   rubato.
      AUX.IND.IPFV.3SG. stolen.PST.PTCP.
      'Before the station master stopped the (female) thief, she threw the wallet that she had stolen'.
      [Following question: How likely do you think it was the female thief who threw the wallet?]

(38) Dopoché il contabile   parlò   con
      After that the accountant.MASC.SG. speak.IND.PFV.3SG. with
      l'imprenditore,   l'imprenditore   preparò
      entrepreneur.MASC.SG. the entrepreneur.MASC.SG. prepare.IND.PFV.3SG.
      il contratto definitivo.
      the contract final
      'After the accountant talked to the entrepreneur, the entrepreneur prepared the final contract'.
      [Following question: How likely do you think it was the accountant who prepared the final contract?]

Since in all fillers the reference to the subject vs. object antecedent was unambiguous, the fillers were also used to make sure that the participants were attentive to the presented stimuli. For example, attentive readers should answer with the highest score (i.e., 5) to the question in (37) and with the lowest score (i.e., 1) to the question in (38). Specifically, 9 out of 15 fillers required 5 as an answer and 6 out of 15 required 1.

Each participant undertook only one experimental list and no item was presented more than once to the same participant. Before the experiment, participants had to read the following instructions in Greek or in Italian: "The following questionnaire consists in reading and interpreting some sentences. Specifically, you will read a sentence that mentions two characters, A and B (for example, "A greets B […]") and a sentence that acts as a continuation and describes an action performed only by one of the two characters (for example, "[…] while A/B runs"). After reading the two sentences, you will be asked how likely you think it was that A or B performed the action described in the continuation. Remember that 1 indicates a low likelihood and 5 indicates a high likelihood." For each language, 15 participants completed List 1, 18 List 2, 15 List 3 and 14 List 4.

4.2.3 Analysis
We analysed participants' Likert-scores independently for NSs and PRONs. In each case, we ran a 2×2 ANOVA with the Likert-scores as dependent variable and Language (Italian vs. Greek) and Pronoun Interpretation (subject vs. object) as independent variables, using the SPSS for Windows software, version 24.0. The statistical significance level was set at $p \leq .05$.

4.2.4 Results

Before presenting the results, it should be pointed out that the participants were attentive to the task, as revealed by the analysis of the fillers: Fillers that were expected to be associated with low scores (6 items) received an average score of 1.19 (SD: .76), and fillers that were expected to be associated with high scores (9 items) received an average score of 4.78 (SD: .72). As expected, judgements related to fillers are more categorical than those related to target sentences (see Section 5 for discussion).

Figure 2 compares the Likert-scores associated with NSs as referring to the subject (reference_to_subject) or to the object (reference_to_object) antecedent across the two languages (Italian vs. Greek). The 2×2 ANOVA reveals a significant effect of Pronoun Interpretation (subject vs. object; $F(1, 1826) = 395.147, p < .001, \eta^2 = .178$), indicating that in general, participants prefer to refer NSs to subject antecedents (vs. object antecedents). However, the two languages exhibit this tendency to a different extent, as shown by a significant Language*Pronoun Interpretation interaction ($F(1,1826) = 23.581, p < .001, \eta^2 = .013$). In particular, Greek participants accept reference of a NS to an object antecedent to a greater extent than Italian participants (see also the results reported in Table 2).

Figure 3 compares the Likert-scores associated with PRONs as referring to the subject (reference_to_subject) or object (reference_to_object) antecedent across the two languages (Italian vs. Greek). The 2×2 ANOVA reveals a significant effect of Pronoun Interpretation (subject vs. object; $F(1, 1885) = 936.375, p < .001, \eta^2 = .344$), indicating that in general, participants prefer to refer PRONs to object antecedents (vs. subject antecedents). However,
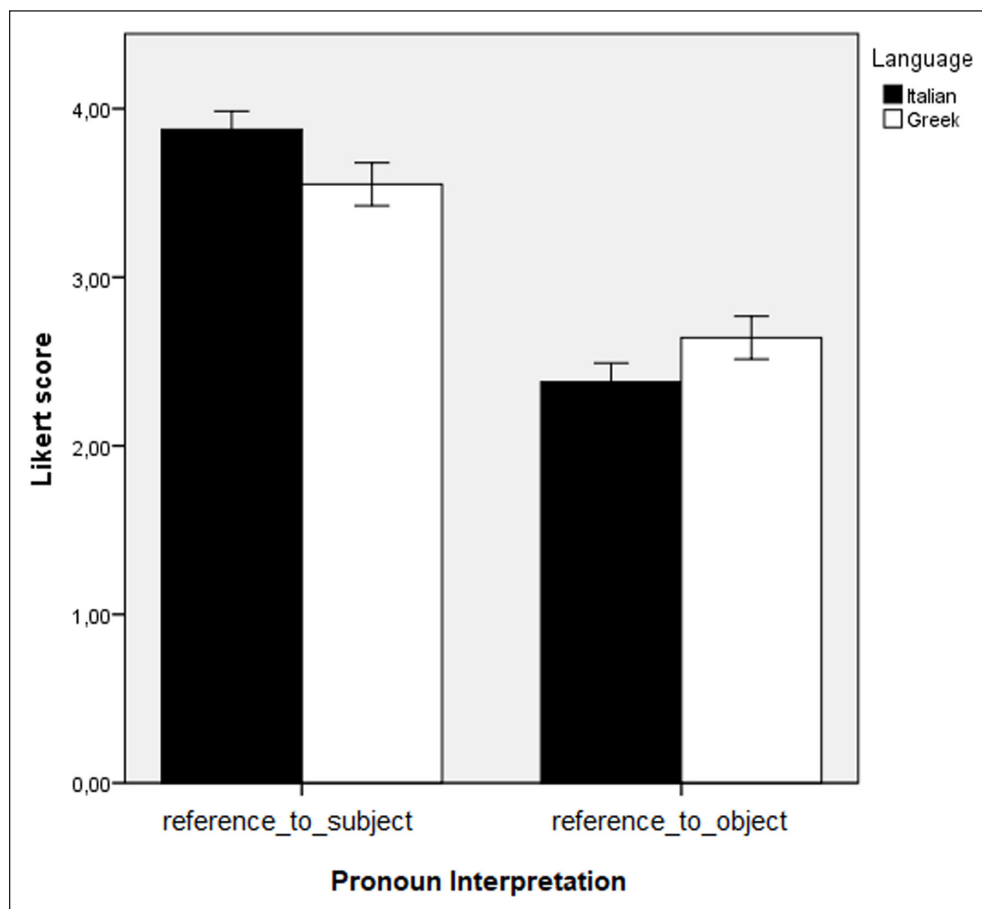
Figure 2: The interpretation of null subjects. Likert scores associated with NSs as referring back to a subject (reference_to_subject, on the left) or an object (reference_to_object, on the right) antecedent across the two languages (Italian in black and Greek in white).

Table 2: Mean Likert-scores on a 5-point-scale and standard deviations for null subjects (NSs) referring to a subject or object antecedent across the two languages.

	Subject_antecedent	Object_antecedent
Italian adults (N = 62)	3.87 (1.16)	2.37 (1.23)
Greek adults (N = 62)	3.55 (1.36)	2.64 (1.39)
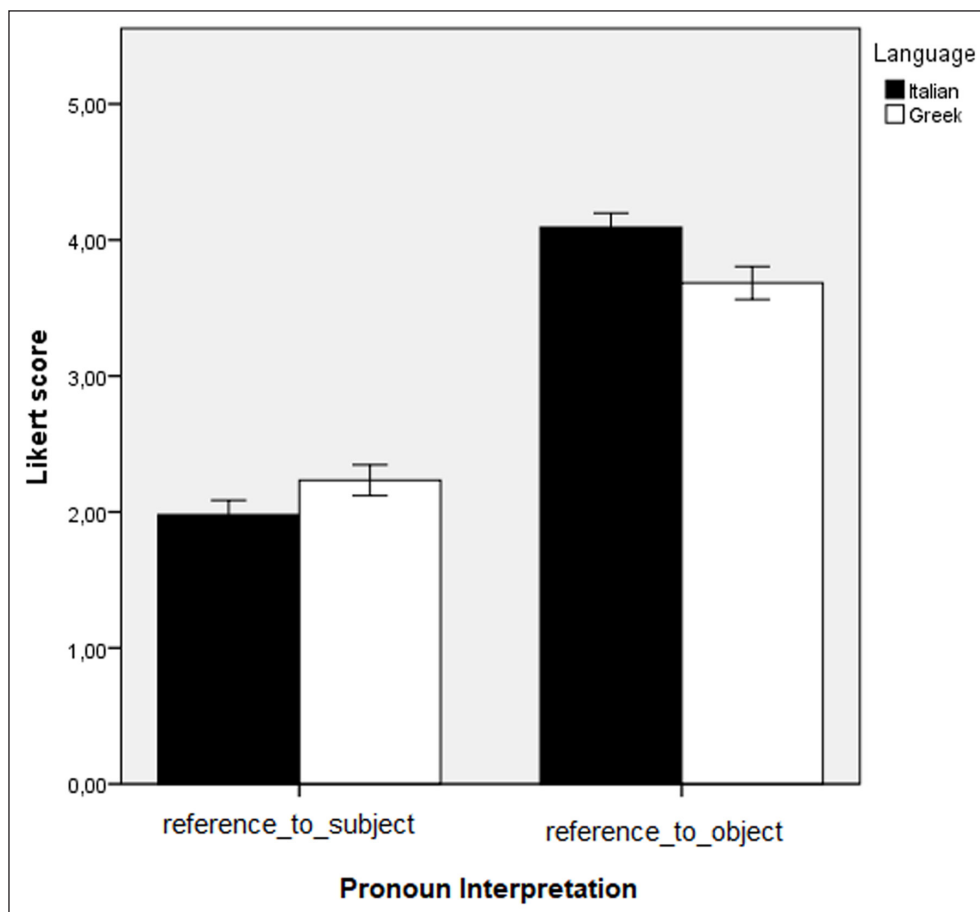
Figure 3: The interpretation of overt pronouns. Likert scores associated with overt subject pronouns as referring back to a subject (reference_to_subject, on the left) or an object (reference_to_object, on the right) antecedent across the two languages (Italian in black and Greek in white).

as in the case of NSs, the two languages exhibit this tendency to a different extent, as shown by a significant Language*Pronoun Interpretation interaction (F (1,1885) = 34.008, $p < .001$, $\eta^2 = . 018$). In particular, Greek participants accept reference of a PRON to a subject antecedent to a greater extent than Italian participants (see also the results reported in Table 3).

5 Discussion and conclusions

The Experiments presented in Section 4 revealed that Greek and Italian NSs differ from each other in their use and interpretation. In particular, Greek NSs are freer in their reference possibilities than Italian ones, being able to refer to object antecedents to a greater extent. To our knowledge, this is the first study to show that NSLs differ from each other in some

Table 3: Mean Likert-scores on a 5-point-scale and standard deviations for overt subject pronouns (PRONs) referring to a subject or object antecedent across the two languages.

	Subject_antecedent	Object_antecedent
Italian adults (N = 62)	1.97 (1.18)	4.09 (1.15)
Greek adults (N = 62)	2.23 (1.26)	3.68 (1.32)

aspects related to the use and interpretation of NSs, based on a set of data from production and comprehension that is comparable across the two languages. This way, it sheds some new light on some differences between NSLs in the extent to which they comply with PAS, as has been already noticed in the literature, but rarely discussed (see reference quoted in Section 1). On the one hand, the two experiments presented in this paper confirm that Italian and Greek adhere to PAS since in both languages, NSs tend to refer to an antecedent in the canonical subject position SpecIP. On the other hand, we found some variation in the extent to which NSs are able to refer to an antecedent occupying a low position in the syntactic structure (i.e., an object *in-situ*). In Section 2, we reformulated PAS in terms of a principle that defines prominence of a constituent (with respect to another constituent) in terms of hierarchical height (see (21) in Section 2): The structurally higher is the constituent, the more prominent it is and, hence, the more likely it is that it is picked up by a NS (see (20) in Section 2). As pointed out in Section 2, defining differences in the degree of prominence in terms of differences in hierarchical height accounts for the gradient nature of speakers' intuitions on anaphora interpretation. In particular, we noticed that NSs are more likely to refer to object constituents when object constituents are left-dislocated as compared to when they occur in-*situ*: In the former case, the difference between the object and the subject constituent (in SpecIP) in terms of hierarchical height is reduced.

Crucially, (21) provides a principled explanation for the different behavior of NSs in Italian and Greek, as shown in our two Experiments (Section 4). In Section 3, we showed that, contrary to Italian, Greek allows for VSO word order. In VSO-sentences like (39) the subject and object constituent do not differ from each other in terms of hierarchical height to the same extent as the subject and object constituent in (40). While the former occupy the same clausal domain, the latter are in different domains (higher for the subject and lower for the object) – Roussou & Tsimpli (2006). Therefore, according to (21), NSs are more likely to refer to the object constituent 'the architect' in (39) than in (40).

(39)   Plirose   o   giatros ton
        pay.IND.PFV.3SG. the.NOM.MASC.SG. doctor the.ACC.MASC.SG.
        architektona,   eno   (pro) ekleine   to
        architect.ACC.MASC.SG. while   pro   close.IND.IPFV.3SG. the.ACC.MASC.SG.
        fakelo.
        envelope.ACC.MASC.SG.

(40)   O   giatros   plirose   ton
        the.NOM.MASC.SG.   doctor.NOM.MASC.SG. pay.IND.PFV.3SG. the.ACC.MASC.SG.
        architektona,   eno   (pro) ekleine
        architect.ACC.MASC.SG. while   pro   close.IND.IPFV.3SG.
        to   fakelo.
        the.ACC.MASC.SG.   envelope.ACC.MASC.SG.
        'The doctor paid the architect, while pro/he was closing the folder.'

In response to this proposal, it might be objected that in the present study, we did not consider if variations in word order actually affect the interpretation of NSs, since, for instance, the comprehension experiment only focused on the SVO-order. Therefore, we propose for the moment that the observed difference between Italian and Greek is due to the fact that the two languages are differently sensitive to word-order information as a cue to anaphora resolution. As proposed in Section 1, it is likely that in a language like Greek, where subject and object can appear both in the same and different clausal domains, sensitivity to word-order information is (as a cue to anaphora resolution) not as strong as it is in Italian. In Italian, there is always a pronounced asymmetric relation in terms of hierarchical height between the subject and the object constituent (at least in broad focus sentences). In further studies, we plan to test this hypothesis by investigating how variation in word-order (SVO vs. VSO in Greek and SVO vs. OSV in Italian) affects the interpretation of NSs.

The hypothesis sketched in this paper leaves the question open concerning to which cues (if not word-order) Greek is most sensitive in the process of anaphora resolution. While discussing the contrast between (3) – repeated here as (41) – and (4) in Section 1, we proposed that Greek seems to be more sensitive than Italian to morphological information encoded in referring expressions or constituents related to them, such as the masculine singular adjective *ntropiasménos* 'embarrassed' in (41) matching the noun *ton Mario* (Mario) in number and gender.

(41)   Epeidí   i Caterina   epékrine   afstirá   to Mario,   (pro)
        because C.NOM.FEM.SG. criticize.IND.PFV.3SG. severely M.ACC.MASC.SG. pro
        ítan   ntropiasménos.
        be.IND.IPFV.3SG. embarrassed.NOM.MASC.SG.
        'Because Caterina severly criticized Mario, (he) was really embarassed.'

This greater sensitivity to morphological information may be an effect of the greater morphological complexity of the nominal inflectional paradigms of Greek as compared to Italian (Section 3).

Furthermore, we should mention that, although the observed difference in the use and interpretation of NSs in Greek and Italian appears to be relatively stable and consistent across experiments, this difference is not substantial. Also, the judgements given to the target sentences in Experiment 2 are not as categorical as they are with sentences violating grammatical constraints, as shown, for example, by the comparison between judgements associated with fillers and target sentences respectively, as reported in Section 4.2.4. Our idea that anaphora resolution is sensitive to the hierarchical height of a constituent as compared to other constituents should account for this gradience. This gradient effect is the prerequisite for the possibility for NSs in both languages to refer to both subject and object antecedents – as we showed in Sections 1 and 2 (with perception verbs, for instance). This depends on how our principle (21) – which defines syntactic prominence in terms of hierarchical height – interacts with other factors affecting the use and interpretation of pronouns, including verb-type, coherence relations, discourse topicality, etc. Principle (22) accounts for the complexity of this interaction. As noted by an anonymous reviewer, the aim of this paper has been to identify the specific contribution of syntactic prominence to anaphora resolution. In this sense, the empirical evidence that has been provided in Section 4 does not contribute to a full understanding of (22) and all possible factors that affect anaphora resolution. However, we decided to assign (22) a key role in our theory to underline that the complexity of the definition of a referent's prominence cannot be captured by a univocal account (based, for instance, only on syntax). As we

proposed in Section 2, discourse referents are associated with a certain degree of prominence, which varies depending on how all the above-mentioned factors (and, possibly, additional ones) interact with each other, boosting or decreasing prominence. Modelling this interaction requires identifying the most relevant factors involved in the use and interpretation of pronouns in discourse and weighing their relative contribution, possibly along the lines of Kibrik (2011) and Torregrossa et al. (2019) and much related work. The definition of syntactic prominence, as elaborated in this paper, may be seen as a first step in this direction.

To conclude, we would like to suggest that the results of our study have several implications for understanding the principles governing the distribution of referring expressions across languages, in both a synchronic and diachronic perspective. In particular, we conclude our discussion with some speculative remarks on how our findings may contribute to the theoretical debate related to the Accessibility Hierarchy Theory, as formulated by Ariel (1990), as well as diachronic changes concerning the use of NSs.

According to Ariel (1990), the form of referring expressions encodes the degree of accessibility of their antecedent: referring expressions are ordered on a scale, ranging from low to high accessibility markers. For instance, if compared to pronouns (e.g., he), full nouns (e.g., the man) are more informative, more rigid (i.e., able to refer to a unique referent) and phonologically heavier, and express a lower degree of accessibility of their antecedents. (42) and (43) show how referring expressions are ordered in the accessibility marking scale in Italian and Greek, respectively (the hierarchy focuses on those referring expressions that can appear in subject position; see also Torregrossa et al. 2015).

(42)   Italian: *l'uomo anziano < l'uomo < quell'uomo < quest'uomo < lui < pro*

(43)   Greek: *o γéros ánthropos < o ánthropos < ekínos o ánthropos < aftós o ánthropos < aftós < pro*
         [English translation: *the old man < the man < that man < this man < he < pro*]

Italian and Greek split the accessibility hierarchy along the same categories, both exhibiting the opposition between overt pronouns and NSs. The present study elaborates on Ariel's proposal showing that, *ceteris paribus*, the same category does not necessarily encode the same function across languages: NSs in Greek are associated with a greater range of reference possibilities than Italian NSs. Likewise, the results of our comprehension experiment concerning PRONs (Section 4.2.4) show that PRONs behave differently across the two languages, too: Greek PRONs referring to subject antecedents are accepted to a greater extent than Italian PRONs in the same condition (Figure 3). In other terms, the results of the comprehension study suggest that within the accessibility hierarchy, the function associated with different referring expressions may overlap to different degrees across languages. For instance, NSs and PRONs in Greek may both refer to an object antecedent. However, the extent to which their function overlaps differs from what happens in Italian, where the division of labour between NSs and PRONs is more pronounced. It should be mentioned that the data reported in Section 4.2.1 does not allow us to show if the same pattern of division of labour between NSs and PRONs holds true for production. As has been mentioned in Section 4.1.4, PRONs are very rare in our corpus, and NSs seem to be in complementary distribution with full DPs rather than PRONs.

From a diachronic perspective, our definition of prominence in terms of hierarchical height seems to shed some new light on the use of NSs in Old Italian. Poletto (2014) reports data from Old Italian, which very closely resemble the Greek pattern of use of NSs. In (44) – (29), in Poletto (2014: 21) – two NSs occur: the first one refers to *la gente*

d'oltremare 'the people of overseas', which is the subject of the previous clause (in line with PAS). On the contrary, the second NS picks up the referent of the by-phrase *da loro* (by them, alias the Romans), which is not in subject position (contrary to PAS, in this case).

(44)   E   [la   gente   d'oltremare]$_i$ vuol   gran   male   [a' Romani]$_j$
        and   the   people   of overseas   want.IND.PRS.3SG.   great   evil   to.the Romans
        perché   (pro)$_i$ fur   già   segnoreggiati   da   loro$_j$,   e   (pro)$_j$
        since   pro   be.IND.PFV.3PL.   already   dominated   by   them   and   pro
        fecero   loro   dura   e   aspra   segnoria.
        do.IND.PFV.3PL.   them   hard   and   harsh   rule.
        'The people from overseas hate the Romans because they were ruled by them, in a hard and harsh way.'

Crucially, Old Italian allows for VSO-word order, which suggests that subject and object constituents occur in the same domain, as in the case of Greek. If our hypothesis is correct, this would mean that in Old Italian, word order (alias, the syntactic position of subjects and objects in the clause) is not, as cue in the process of anaphora resolution, as strong as it is in Modern Italian.[5]

The consideration of diachronic data may suggest another interpretation of the evidence presented in this paper. As mentioned in Section 2, Frascarelli (2007) proposes that Italian NSs have the syntactic structure of clitics. One may assume that on the contrary, Greek NSs are weak pronouns (Cardinaletti & Starke 1999). The different reference possibilities exhibited by NSs in Italian vs. Greek might reflect the difference in their underlying syntactic structure. At a diachronic level, NSs in Modern Italian may have evolved from weak pronouns in Old Italian. In other terms, NSs in Greek and Old Italian, on the one hand, and in Modern Italian, on the other hand, would instantiate different stages in a null subject cycle (cf. Fuß & Wratil 2013 for a similar idea). Although interesting, this proposal would raise a learnability problem: It is difficult to explain how learners know that a NS is a clitic in one language and a weak pronoun in another language. Crucially, our account of the difference between Italian and Greek does not run into this problem, since we made clear that the different patterns of interpretation of NSs reflect other properties of the grammar of the two languages, such as the possibility of allowing for VSO-order and morphological richness of the nominal paradigm. Furthermore, the proposal that NSs in Greek represent a different syntactic category than NSs in Italian would allocate the difference between the two languages in the use and interpretation of NSs within the domain of grammar. However, this would, again, contradict the evidence shown in this paper, that grammar is only one among several factors affecting anaphora resolution (see (22) in Section 2). A multi-factorial approach to anaphora resolution that considers different variables and their relative weight (as presented in this paper) provides a better account for the complexity of the phenomenon of anaphora resolution.

Abbreviations

1 = first person, 3 = third person, ACC = accusative, AGR = agreement, DAT = dative, FEM = feminine, IND = indicative, INF = infinitive, IPFV = imperfective, MASC = masculine, NOM = nominative, PL = plural, PST.PTCP = past participle, PRS = present, REFL

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[5] Here, we leave the issue open concerning the mechanisms allowing for the VSO-order in Old Italian: Contrary to what happens in Greek – the presence of VSO in Old Italian does not correlate with the possibility for subjects and objects to lexicalize different features since case-marking on DPs is not available in Old Italian.

= reflexive, SG = singular, SBJV = subjunctive, AUX = auxiliary, CL = clitic, CP = complementizer phrase, DOM = differential object marking, DP = determiner phrase, ENNI = Edmonton Narrative Norms Instrument, M = mean, NS = null subject, NSL = null subject languages, OBJ = object, OSV = object-subject-verb, PAS = Position of Antecedent Strategy, PRON = pronoun, SD = standard deviation, SUBJ = subject, SVO = subject-verb-object, TOP = topic, U = utterance, VP = verb phrase, VSO = verb-subject-object

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The authors have no competing interests to declare.

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