

Split Antecedents, Noncoreference, and DRT

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This article is concerned with the theory of anaphoric relations involving nonreflexive pronouns.* Our main contention is that this amounts solely to a theory of the conditions under which pronouns and their antecedents can or cannot be identified. With referential antecedents, these are conditions enforcing coreference or noncoreference (with non-referential—e.g. quantified—antecedents, the relevant notion is identity under an assignment of values to variables; cf. section 4.1). This conclusion runs counter to the widely held position within the syntactic literature that the notions of disjoint reference and (partially) overlapping reference play essential roles in the theory.¹ This position—a version of which appears at least as early as Postal (1966)—has been most forcefully defended by Howard Lasnik in a series of works (Lasnik 1976, 1981, 1986; Lasnik & Uriagereka 1988; Chomsky & Lasnik 1993).

In section 1 we review Lasnik's arguments and evidence. In section 2 we discuss empirical problems for this approach involving plural pronouns and so-called split antecedents, brought to light by Seely (1993). We then show that Seely's solution is inadequate, in light of anaphoric relations that obtain beyond the sentential domain. In section 3 we develop an alternative analysis within a framework capable of handling

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¹ An exception is Fiengo & May (1994); we comment briefly on their theory in section 5.

phenomena at this more inclusive level. We extend our analysis in section 4 to the effect of Principle B of the Binding Theory, developing a formal account motivated by the various possibilities of anaphora resolution at the supersentential level of representation. We conclude in section 5 with a discussion of the empirical status of binding theory effects involving split antecedents, briefly contrasting our approach with that of Fiengo & May (1994), and point to some consequences of our analysis.

The syntactic perspective of this article is that of the Principles and Parameters framework (GB; see e.g. Chomsky & Lasnik 1993) and the semantic perspective that of Discourse Representation Theory (DRT; see Kamp & Reyle 1993). Our analysis can be viewed as one way of working out the hypothesis stated by Chomsky (1993:43 [1995:211]) that "binding conditions hold only at the LF interface," taking DRT to be the theory of this interface.

1 Lasnik's theory of referential relations

The starting point for Lasnik's theory of anaphoric relations is the behavior of referential NPs and the kinds of relations they enter into. He addresses two questions: (i) what referential relations can, must, and cannot obtain between two or more NPs in a single sentence; and (ii) what theoretical vocabulary is necessary to account for the answer to question (i). Lasnik observes that there are four types of referential relations two NPs (and correspondingly, their denotata) may have with respect to each other: coreference, noncoreference, disjoint reference, and (partially) overlapping reference. Let A and B be NP denotata; for concreteness, we take these to be sets of individuals.² Then these relations are defined as follows:

- (1) a Coref(A, B): $A = B$
 b Noncoref(A, B): $A \neq B$
 c Disjoint(A, B): $A \cap B = \emptyset$
 d Partial-Overlap(A, B): $(A \cap B \neq \emptyset) \wedge (A \neq B)$

² In the case of singular NPs, their denotata will thus be singletons; cf. also footnote 14. Since we are not concerned here with presenting a compositional translation from syntactic representation to semantic interpretation, treating referential NPs as denoting sets of individuals is most convenient for our purposes.

The following examples illustrate each of these relations in turn, obtaining in each case between the italicized NPs:

- (2) a *Mary* believes John is proud of *her*.
 b *The students* believe John is proud of *them*.
 (3) a *Mary* is proud of *her*.
 b *The students* are proud of *them*.
 (4) a *Mary* is proud of *them*.
 b *The students* are proud of *her*.
 (5) a *Mary* believes John is proud of *them*.
 b *The students* believe John is proud of *them*.

Concerning question (i), according to Lasnik noncoreference must—and hence coreference cannot—obtain in (3), while disjoint reference must—and hence partially overlapping reference cannot—obtain in (4). In (2) and (5) the pronouns have what Lasnik calls *free reference*, that is, any of the referential relations is possible (modulo number agreement) but not obligatory.³ This difference between (3)/(4) and (2)/(5) shows that referential relations hold obligatorily only in a certain local domain, known as the pronoun's *binding domain*: in these examples, the minimal sentential clause containing both pronoun and antecedent (see e.g. Chomsky 1981, 1986 for detailed discussion). In addition, the obligatoriness holds only if the antecedent c-commands the pronoun; thus in the following examples, noncoreference and disjoint reference are not required, although the antecedents occur in the pronouns' binding domain ((6b) is from Lasnik (1976:(36a)):

- (6) a The man who smiled at *Mary* likes *her*.
 b The man who forced *Tom* to hit *Harry* hates *them*.

As for question (ii), Lasnik claimed (1976 [1989:102]) that the syntactic configurations of obligatory noncoreference and obligatory disjoint reference coincide. Given this, and since it is a consequence of the definitions in (1) that disjoint reference asymmetrically entails noncoreference, it follows that the latter relation is theoretically

³ If in (3b) *the students* and *them* denote nonidentical sets of individuals, then this sentence exemplifies disjoint reference. Since plurality only entails a cardinality of two or more, the same sentence can be used to illustrate coreference or partially overlapping reference between a plural pronoun and a plural antecedent, as seen by (2b) = (5b).

derivative. This leads to the following regulative principle for nonreflexive pronouns, to account for data such as (2)-(6) (Chomsky & Lasnik 1993:551(211b) [1995:100]):

(7) *Disjoint Reference Condition*

A nonreflexive pronoun must be disjoint in reference from every *c*-commanding NP in its binding domain.

The regulative principle for nonreflexive pronouns constitutes Principle B in the Binding Theory of Chomsky (1981) and later work; henceforth we refer to it (in whatever formulation is relevant to the point at hand) as *BT(B)* and to the semantic constraints it is designed to enforce as *BT(B) effects*.⁴

Just as disjoint reference entails noncoreference, so does coreference entail overlapping reference, if the requirement of partiality (the nonidentity conjunct in (1d)) is removed. However, while coreference is required with reflexives, Lasnik contended (1981:fn.8) that there are no cases of obligatory partially overlapping reference.⁵ Therefore, he concluded (1981 [1989:131]) that the relations of coreference, disjoint reference, and partially overlapping reference are independent primitives of the theory of referential relations.

⁴ *BT(A)* regulates the anaphoric relations of reflexive pronouns, which we refrain from treating here. These are complicated by the phenomenon of nonlocally bound reflexives, as in so-called picture noun phrases and logophoric contexts; see e.g. Hestvik (1992) and Reinhart & Reuland (1993). We also omit discussion of anaphoric relations between nonpronominal NPs (regulated by *BT(C)*). The anaphoric possibilities here are complicated by bridging phenomena, though whether these are grammatically regulated is controversial; see van Deemter (1992, 1994) for an analysis within the DRT framework.

⁵ This appears not to be the case at least with non-locally bound reflexives, however; consider the following contrast:

- (i) Mary wanted to surprise her sisters. She hung a picture of them on the wall.
 (ii) Mary wanted to surprise her sisters. She hung a picture of themselves on the wall.

In (i) Mary need not (but may) be included in the reference of *them*, but in (ii) Mary must be included in the reference of *themselves*. Note, too, that reflexives do not exhibit free reference: unlike the difference between (2) and (3), the following is a contrast in grammaticality, not interpretation:

- (iii) Mary is proud of herself.
 (iv) * Mary believes that John is proud of herself.

As we are not treating reflexive pronouns in this paper, we refrain from drawing any conclusions from these observations.

2 Counterexamples to disjoint reference

2.1 Sentence internal split antecedents

It is significant that Lasnik's theory of anaphoric relations is based only on examples in which the *c*-commanding potential antecedents of the pronoun are either all within the pronoun's binding domain or else all outside of it. Seely (1993) has, however, drawn attention to the fact that a third possibility exists in the case of so-called split (i.e. nonconjoined) antecedents: namely, that (at least) one of the antecedents is within the pronoun's binding domain, and (at least) one is outside of it. He observed that in such a configuration, a relation of coreference with the antecedents taken jointly, and thus of partially overlapping reference with each, is possible; this is illustrated by the following examples, patterned on Seely's (7a), (9a)-(15a), where again italicization indicates anaphora:

- (8) a *John* wants [*CP Mary* to represent *them*].
 b *John* asked *Mary_i* [*CP PRO_i* to represent *them*].
 c *John* said that [*CP Mary* represented *them*].
 d *John* was happy because [*Mary* had protected *them*].
 e *John_i* pleased *Mary* only by [*PRO_i* standing up for *them*].
 f *John* really resented [*Mary's* description of *them*].

As Seely points out, this counterexamples Lasnik's empirical claim, and hence his formulation of *BT(B)* as a disjoint reference condition.⁶

To account for such cases, Seely introduces the notion of *exhaustive binding*, defined in terms of a system of indexation in which an index consists of a set of integers (following Lasnik 1989):

- (9) a *X* is *exhaustively bound* iff every syntactically dependent member of the index of *X* is *c*-commanded by its antecedent; *X* is free otherwise.

⁶ Fiengo & May (1994:40) also cite the following example as exhibiting acceptable overlapping reference (we return to their view of split antecedents in section 5):

- (i) *Watson* said *Crick* expected *them* to win the Nobel Prize.

- b A member M of the index of X is *syntactically dependent* if M is identical with a member of the index of an intrasentential NP; we refer to that NP as the antecedent of M.⁷
- c BT(B): A pronoun must be free (i.e. not exhaustively bound) in its binding domain.

Stated in referential terms, Seely's version of BT(B) requires the pronoun's reference not to be exhausted by the joint references of c-commanding antecedents within its binding domain. To illustrate, consider (8a), here annotated with set indices:

- (10) John_{1} wants [CP Mary_{2} to represent them_{1,2}].

Although by (9a) the pronoun here is exhaustively bound, it is nevertheless free in its binding domain (the embedded CP), satisfying BT(B) (9c). Thus, the pronoun is free in reference; in particular, coreference with the two antecedent NPs taken together is permitted. In contrast, in (11) (= Seely's (6)), the pronoun is exhaustively bound inside its binding domain, which precludes the indicated anaphoric relation:

- (11) *Bill_{1} told Mary_{2} about them_{1,2}.

Examples such as the following, not discussed by Seely, are also consistent with his analysis:

- (12) a [John_{1}'s mother]_{2} protected them_{1,2} from the robbers.
b [The woman who loves John_{1}]_{2} represented them_{1,2} at the trial.

Although in each of these examples the antecedent NPs, which exhaust the pronoun's reference, are both within the pronoun's binding domain (the matrix CP), one of them (namely *John*), does not c-command the pronoun. Thus it is not exhaustively bound and hence referentially free.

⁷ We have corrected Seely's actual definition, which reads: "A member M of the index of X is syntactically dependent if M is identical with the index of an intrasentential NP." This cannot be right, given the definition of an index as a set of integers.

2.2 Intersentential split antecedents

The requirement of syntactic dependence in (9a) restricts overlapping reference within the binding domain to cases where the antecedents that are outside of the binding domain are still within the maximal syntactic clause containing the pronoun. This is because Seely regards cases like the following, where one or more of the antecedents are outside of the sentence containing the pronoun altogether, as ungrammatical:

- (13) John_{1} said [CP Mary_{2} represented them_{2,3}].

By (9a), the pronoun in (13) is exhaustively bound by *Mary*, since the latter is the only NP on which the pronoun is syntactically dependent. Since *Mary* also c-commands the pronoun in its binding domain, BT(B) as stated in (9c) is violated and the sentence is ruled ungrammatical on the intended anaphoric relation.

However, while it is true that if (13) were uttered out of the blue, with no previous context, the only way to understand the pronoun would be as referring jointly to the references of *John* and *Mary*, additional context removes this restriction:

- (14) a *Bill* and *Mary* were asked to appear before the committee. But *Bill* fell ill and had to be excused. John said that *Mary* represented *them*.
b *Bill* and *Mary* were charged with a crime. *Mary*, being a lawyer, decided to handle the defense. John said that *Mary* represented *them*.

In these examples, there is no intuitive difficulty establishing an anaphoric relation between *them* and *Bill* and *Mary* taken together, in contrast to the prediction of Seely's version of BT(B). That is, it is possible for the reference of a pronoun to be determined by split antecedents, at least one of which c-commands the pronoun within its binding domain and at least one of which does not occur in the sentence containing the pronoun at all.

2.3 Inclusive reference

Seely's theory could easily be repaired by removing the requirement that only sentence internal antecedents may suspend the disjoint reference condition. However, there is more telling evidence against Seely's version of BT(B). If the pronoun's reference is a proper subset of that of a single NP that c-commands it, then we have a special case of

partial overlap, sometimes called *inclusive reference*. Lasnik judged inclusive reference to be impossible within the binding domain of the pronoun, and Seely explicitly agreed with his judgment. However, just as with split antecedents, we find that cases of inclusive reference are acceptable in a suitable context. Consider the following examples (the relevant binding domain is bracketed):

- (15) a John_{1} and Mary_{2} often connive behind their colleagues' backs to advance the position of one or the other. This time, they_{1,2} managed [PRO_{1,2} to get her_{2} a position in the front office].
- b John_{1} and Mary_{2} were experiencing marital strife, so they_{1,2} called up Bill_{3} to discuss the situation. [They_{1,2,3} talked about them_{1,2} for the rest of the evening].
- c John_{1} and Mary_{2} were charged with a crime. Since Mary_{2} is a lawyer, [they_{1,2} wanted her_{2} to represent them_{1,2}].
- d John_{1} and Mary_{2} discussed their_{1,2} participation in the upcoming contest with Bill_{3}. [They_{1,2,3} expect them_{1,2} to win].

These discourses constitute additional direct counterexamples to Lasnik's disjoint reference condition, but also to Seely's analysis, since although the c-commanded pronoun is exhaustively bound in its binding domain, nevertheless, its reference can overlap with the reference of the binding NP.

2.4 Preliminary conclusions

The data we have discussed in this section go beyond those brought to bear by Seely against Lasnik's analysis. One might try to continue amending the analysis along the same lines, by further altering the domain of application of disjoint reference. But we draw a different conclusion: that BT(B) does not, contra Lasnik, directly enforce disjoint reference within its domain of application.

The data also point to a conclusion that is a commonplace of discourse-based approaches to anaphoric relations, but one often ignored in syntactically oriented approaches: that a pronoun whose reference cannot be resolved within an utterance context is at the very least pragmatically misused, and the discourse as a whole becomes infelicitous; the effect is essentially that of presupposition failure. This is well-illustrated by examples such as the following:

- (16) a The men said Mary likes them.
b The men said Mary likes him.

According to Lasnik's theory, the reference of the pronoun in these cases is free with respect to the reference of the matrix subject NP. But this is not what we find. Out of the blue, *them* in (16a) can only be understood as coreferential (and crucially not partially overlapping in reference) with *the men*, while the reference of *him* in (16b) cannot be resolved, making the sentence infelicitous in this minimal context (i.e., there is no way of knowing whether the person denoted by *him* is one of the men or not). In other words, although these sentences do not *per se* involve BT(B) violations, still the first is constrained in the way it can be interpreted and the second has no felicitous interpretation.

This observation indicates that part of the task of interpreting a (referentially used) pronoun is to resolve its reference, and if this cannot be done within the sentence, then it must be done within the wider context, if discourse felicity is to be maintained. Moreover, as data such as the examples in (14)-(15) show, this can result in overlapping reference with the pronoun within its binding domain, which demonstrates that it is misguided to prohibit this possibility, as both Lasnik's and Seely's versions of BT(B) do. For this reason, we also take such data to constitute convincing evidence against any sentence-bound approach to anaphora (at least as far as nonreflexive pronouns are concerned). The most appropriate way of analyzing this, we contend, is as a discourse-level requirement of coreference. This approach enables the underlying theory of anaphoric relations to be simplified to a binary distinction between coreference and noncoreference, or more generally, between identity and nonidentity, in a sense we will make precise in the next two sections.

3 Anaphoric relations at the discourse level

To formally implement this approach, we need a framework in which extrasentential, or discourse-level, relations can be treated in the same way that intrasentential relations can. Such a framework is available in Discourse Representation Theory (DRT; see Kamp & Reyle 1993 for a detailed exposition of the theory). In this section, we briefly review how anaphoric relations are dealt with in DRT, paying particular attention to plural pronouns and split antecedents. We then show how the counterexamples to disjoint reference are predicted to be acceptable by this theory under a noncoreference version of BT(B).

3.1 Pronominal reference in DRT

In DRT, certain kinds of semantic representations, called *Discourse Representation Structures* (DRSs), are algorithmically and incrementally constructed from syntactic representations.⁸ A DRS K consists of a pair of sets $\langle U_K, Con_K \rangle$, called its universe and its condition set. (DRSs are customarily represented by means of boxlike drawings, with the members of the universe displayed at the top and the conditions arrayed below.) U_K is made up of *discourse referents*, which play a role similar to variables in predicate logic, and Con_K consists of predicates over those discourse referents (these predicates, which are derived from the syntactic representation, may be complex and contain other DRSs as components; thus the notion of a DRS is recursive). In the initial stages of DRS construction, the elements of Con_K are syntactic structures, which are gradually decomposed by the DRS construction algorithm into structures resembling formulae of predicate logic. Like such formulae, DRSs have a well-defined modeltheoretic semantics. To be precise, a DRS K is true in a given model M iff there is a way of embedding the universe of K into that of M , i.e. of associating individuals of M with the discourse referents in U_K , such that these individuals satisfy, in M , the DRS conditions of K over the corresponding discourse referents.

The discourse referents that initially concern us are those introduced by noun phrases. In DRT, every occurrence of an NP in a sentence is represented by a unique discourse referent in the DRS being constructed from the sentence. In the case of nonpronominal NPs, the construction algorithm also introduces into the DRS specific conditions over the discourse referent, providing the descriptive content of the NP, or with names, anchoring the discourse referent to the individual so named; we will call these *content conditions*. A pronoun is not directly associated with content conditions;⁹ rather, the discourse referent that represents it must be linked to some discourse referent that is associated with content conditions. We will refer to this procedure as *pronominal resolution*. Formally, this is done by adding to the DRS an identity condition over the discourse referents introduced by the pronoun and its antecedent (in the modeltheoretic embedding, these discourse referents are associated with the same individual(s)). This treatment of pronouns is encapsulated in the DRT construction rule for pronouns, a

⁸ A single DRS may contain the semantic representation of multiple sentences, as many as comprise the text or discourse in question; in such cases, DRS construction proceeds sequentially from one sentence to the next.

⁹ However, it may be associated with grammatical information about person, gender, and number. We ignore the first two, to simplify the exposition; but number will play a central role in our analysis.

simplified version of which is the following:

(17) *CR.PRO* (first version)

If α is a pronoun in a syntactic structure S , carry out the following operations on the immediate DRS K in which α occurs:

- (a) Introduce a new discourse referent β into U_K and in Con_K substitute β for the syntactic structure consisting of α and its categorial projections.
- (b) Add to Con_K the condition $\beta = \gamma$, where γ is a suitable accessible discourse referent.¹⁰

The restriction to the immediate DRS in which the pronoun occurs is intended to allow for the pronoun's occurring bound in the scope of a quantifier or an attitude expression, though we ignore the latter and only briefly touch on the former in this paper.¹¹ Clause (a) of *CR.PRO* reduces the syntactic structure by removing all the nodes of the pronoun's syntactic projection. The suitability requirement in clause (b) is meant to insure that the pronoun and its antecedent share relevant grammatical features such as person, gender and number. (Note, incidentally, that there is no requirement that the antecedent discourse referent be introduced by a linguistic entity; this allows for deictic resolution of the pronoun.)

We illustrate pronominal resolution first with a simple example. Consider the following discourse:

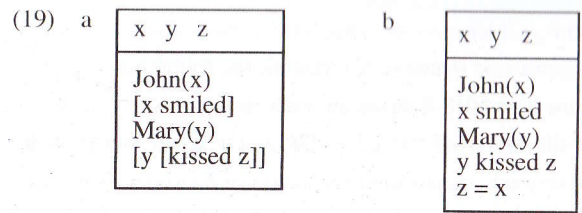
(18) John smiled. Mary kissed him.

The two DRSs in (19) give the processing of the text in (18), prior (in (19a)) and

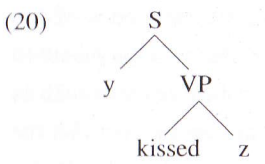
¹⁰ Accessibility is a relation between discourse referents and DRS conditions; informally, a discourse referent α is accessible from a condition β in a DRS K provided that the condition set containing β is at least as embedded within K as is the DRS universe containing α (accessibility is formally defined in terms of the subordination relation mentioned in footnote 11). For most examples we are concerned with, the accessibility relation is trivial, since the relevant universe and condition set are both immediate constituents of the same DRS; only for pronouns dependent on quantificational expressions does the accessibility requirement make an essential difference (see (28) in section 4.1). We will follow Kamp & Reyle in occasionally speaking of a discourse referent as being accessible from a given DRS K , meaning it is accessible from any condition in Con_K .

¹¹ The phrase 'immediate DRS' is an informal term of convenience; the notion can be formally spelled out in terms of the DRT notion of subordination defined by Kamp & Reyle.

subsequent (in (19b)) to pronominal resolution;¹²



The conditions John(x) and Mary(y) are the content conditions associated with the discourse referents introduced by the NPs *John* and *Mary*, respectively. The conditions [x smiled] and [y [kissed z]] represent the reduced syntactic structures of the sentences in (19); i.e. [y [kissed z]] is an abbreviation of the tree structure:



Following Kamp & Reyle (1993), we frequently omit the bracketing on reduced syntactic representations, as in (19b).

The fact that syntactic structures are themselves DRS conditions means that we can speak of discourse referents as entering into c-command relations. To be precise, let α and β be distinct NPs in a syntactic structure S , such that α c-commands β , and let γ and δ be the discourse referents introduced by α and β , respectively; then we say that γ c-commands δ . We will make use of this later in our analysis.

The condition $z = x$ in (19b) renders the effect of coindexation in GB theory, and can be viewed as corresponding to what is described in the GB-literature as ‘assignment of coreference’ between the pronoun and its antecedent (in addition, the identity condition is used for pronominal resolution to a nonreferential antecedent, as we will show later).

With plural pronouns, the situation becomes more complex. First, we must introduce discourse referents that map to entities denoted by plural NPs (i.e. sets of

¹² For simplicity, we omit the conditions anchoring the discourse referents for *John* and *Mary* to the respective individuals denoted by these NPs, and also the discourse referents and associated conditions of verbal event arguments.

individuals). The informal DRT-notation for these discourse referents is capital letters; we will also informally refer to these as plural discourse referents.¹³ Next, the plural pronoun has to be resolved. When a single plural NP is the antecedent of a plural pronoun, the DRS processing is analogous to the case of singular anaphora. For example, the final DRS for the text “*The men* are happy. *The women* like *them*.” would look like (19b) except for the obvious lexical differences and having plural discourse referents. But as the phenomenon of split antecedents shows, a plural pronoun can also be resolved to the totality of several distinct NPs in the discourse. To handle this, DRT employs a special procedure, called *Summation*. The following definition (slightly simplified from Kamp & Reyle 1993:308) introduces a single plural discourse referent and identifies it with the ‘sum’ of any number of distinct discourse referents.

(21) *Summation*
 If β_1, \dots, β_n ($n \geq 2$) are discourse referents accessible from a DRS K , then the following operation may be carried out: Introduce a new plural discourse referent Γ into U_K and the condition $\Gamma = \beta_1 \oplus \dots \oplus \beta_n$ into Con_K .

In the modeltheoretic embedding of a DRS containing a Summation condition, the plural discourse referent Γ is mapped, in set-theoretic terms, to the set that comprises the union of the images under the embedding of β_1, \dots, β_n (recall from footnote 3 that we are taking singular NPs to denote singletons).¹⁴

Here is an example of Summation, as it applies in the following discourse, where the intended reference of *they* is *Mary* and *John*:

(21) *Mary* invited *John* to dinner. *They* had Chinese food.

¹³ In official DRT terminology, singular and plural discourse referents are called *atomic* and *nonatomic*, respectively. Formally, they are distinguished by being associated with conditions of the form $at(x)$ and $non-at(x)$, respectively, which are not what we are calling content conditions but rather conditions that fix logical type; cf. footnote 14.

¹⁴ In the actual DRT model theory of Kamp & Reyle (1993), plural NPs denote nonatomic elements of a complete atomic join semilattice, and Summation is modelled by the join operation on the lattice; however, there is no truthconditionally relevant difference between the lattice-theoretic and set-theoretic exposition. Because of this, we will say that the discourse referents for two NPs whose denotation spaces in the NP algebra coincide, are of the same atomicity (i.e., atomic or nonatomic).

The DRS construction contains three stages: first, the construction of the universe and condition set based on the syntactic input; second, the Summation induced by the two individual discourse referents introduced by *Mary* and *John* (this operation can already apply before the second sentence of (21) is processed); third, the pronominal resolution. The following DRSs (which again omit irrelevant details) give these stages, with (22c) being the final DRS:

(22) a	b	c						
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Mary(x) John(y) x invited y to dinner X had Chinese food Y = x⊕y X = Y								

The effect of Summation is to make available in the DRS a plural discourse referent, which can then serve as the antecedent of a plural pronoun. Without Summation, and in the absence of some other accessible plural discourse referent, pronominal resolution could not be carried out: the discourse referent of a plural NP and the discourse referent of a singular NP are of distinct atomicity (cf. footnote 14), so the latter is not suitable for the former, in the sense of CR.PRO. As a result, the plural discourse referent would not be associated with any content conditions, so that if the DRS were embedded into a model, it would be sufficient for truth, given the interpretation rules of DRT, that some set of individuals satisfy the predicates over the plural discourse referent. For example, (21) would be true as long as at least two arbitrary individuals had Chinese food; clearly these are incorrect truth conditions. This deviance can be seen as a formal expression of the infelicity that arises when a pronoun fails to get resolved to a suitable antecedent within the discourse that it occurs in; cf. the discussion of (16) in section 2.4. But because of Summation, the plural discourse referent X in (22) does have a suitable antecedent and is consequently associated with content conditions by being identified with the ‘sum’ denoted by Y, each of whose ‘summands’ is associated with a content condition.¹⁵

¹⁵ The ‘summands’ need not be singular, in view of texts like *Mary_{1} and Bill_{2} invited John_{3} to dinner. They_{1,2,3} had Chinese food.* Summation could apply iteratively to the DRS for this text, giving $X = x \oplus y$ for the conjoined NP *Mary and Bill*, and $Y = z \oplus X$ as the resolving condition for the pronoun. Cf. the discussion of the DRS in (31) in section 4.2.

3.2 Split antecedents and overlapping reference

A direct consequence of the availability of Summation is an account of the possibility of partially overlapping reference with a pronoun within its binding domain. In particular, Seely’s counterexamples to disjoint reference fall out straightforwardly. For example (8a), repeated here as (23a), receives the DRS in (23b) (abstracting away from the DRT treatment of propositional attitudes):

(23) a *John* wants *Mary* to represent *them*.

b	<table style="width: 100%; border-collapse: collapse;"> <tr><td style="border-bottom: 1px solid black; padding: 2px;">x y X Y</td></tr> <tr><td style="padding: 2px;">John(x) Mary(y) [x wants [y to represent X]] Y = x⊕y X = Y</td></tr> </table>	x y X Y	John(x) Mary(y) [x wants [y to represent X]] Y = x⊕y X = Y
x y X Y			
John(x) Mary(y) [x wants [y to represent X]] Y = x⊕y X = Y			

Examples like (12), in which both split antecedents are within the pronoun’s binding domain but one of them fails to c-command the pronoun, would receive a similar DRS. Moreover, since Summation is not a sentence-bound operation, examples like (14), where the pronoun is exhaustively bound according to Seely’s analysis, because one of its split antecedent does not occur in the sentence at all, are also straightforwardly accounted for on our approach.

Also predicted is the existence of inclusive reference, as in the sentences in (15); consider for example (15c), repeated here as (24a), which exhibits in the same sentence both properly overlapping and inclusive reference within the two lower pronouns’ respective binding domains:

(24) a *John_{1} and Mary_{2} were charged with a crime. Since Mary_{2} is a lawyer, [CP they_{1,2} wanted [CP her_{2} to represent them_{1,2}]].*

b

x	y	z	X	w	Y	Z
John(x)						
Mary(y)						
crime(z)						
[x and y were charged with z]						
lawyer(y)						
[X wanted [w to defend Y]]						
Z = x⊕y						
w = y						
X = Z						
Y = Z						

CR.PRO correctly permits overlapping reference between a singular pronoun and a plural NP in its binding domain, although the pronoun's reference is included in the reference of the NP.

It is worth emphasizing that in all these cases the overlapping reference is a by-product of anaphoric relations independently established by means of identity conditions, which may be mediated by Summation; this is clearly seen in (24b). In other words, in our theory, in contrast to Lasnik's, overlapping reference is a derivative notion; only coreference and its dual, noncoreference (or more generally identity and non-identity) play a significant role. It is also clear that the term 'split antecedents' is a syntactic description, since semantically an anaphoric element only has a single antecedent, though this may be (and in the case of split antecedents is) only representable at the discourse level.

One may wonder why DRT has Summation but not the converse operation, which would take a plural discourse referent and make arbitrary 'subsums' (down to single discourse referents) available, thus allowing inclusive reference to be directly established. The reason is empirical: whereas forming the sum of arbitrary NPs is always possible (up to processing constraints), it is in general not possible to resolve a singular pronoun to an unexplicit part of plural antecedent, as (16b) illustrates.¹⁶ (cf. also Partee's well-known example: **Nine of the ten marbles are in the bag; it is under the couch*)

¹⁶ There is, however, one type of exception to this generalization, namely, where the antecedent denotes a male/female pair: *That couple_{1,2} is interesting; he_{1} is a gardener and she_{2} is a physicist.* (Similar examples with plural pronouns do not exist in English due to the absence of gender marking here.) For simplicity, we disregard such cases in the present account. See van Deemter (1992) for an analysis on which the licensing of such anaphora by pronouns is semantically on a par with standard identity anaphora (e.g. coreference).

4 Incorporating noncoreference restrictions into DRT

4.1 Basic noncoreference

The resolution clause (b) of CR.PRO as formulated in (17) restricts the relation between the pronoun and its antecedent only in terms of suitability and accessibility. Obviously, the basic effect of BT(B), illustrated in (25), must be added to the DRT treatment of pronouns, since anaphora between the pronouns and the nonpronominal NPs is impossible in these cases:

- (25) a **John* likes *him*.
 b **The men* like *them*.

Unlike the examples in section 2, where apparent disjoint reference disappears in a suitable context, there is no ordinary discourse in which these sentences are acceptable if the two NPs are intended to corefer.¹⁷

In terms of our analysis, we have two alternatives for ruling out coreference in sentences like (25a-b). One is simply to adopt a suitable version of BT(B) as an independent grammatical principle, following the usual course taken in GB theory. But Kamp & Reyle (1993:238) proposed incorporating the effect of BT(B) into the DRT construction rule for pronouns, CR.PRO, as an additional constraint on the resolution clause, rather than stating it elsewhere in the grammar. This is appealing on the grounds of conceptual simplicity and theoretical economy: since BT(B) regulates the anaphoric aspect of the interpretation of pronouns, it is natural that its effect should be part of the operation that yields the semantic representation of pronouns.¹⁸

¹⁷ There are, however, certain 'out-of-the-ordinary' contexts in which coreference even in these cases is intuitively acceptable; see e.g. Evans (1980), Reinhart (1983), and Heim (1993). These involve circumstances where the use of a nonreflexive pronoun sanctions a reading not available with a reflexive pronoun. Most of these are felt to be contrived and unnatural, in contrast to the cases of apparent disjoint reference we have been discussing. It therefore seems plausible to treat them, as Heim does, as cases where BT(B) can be set aside in specific contexts, rather than as being configurations where BT(B) does not apply in principle. See also Chomsky (1981:314 (fn. 3)).

¹⁸ Obviously, building BT(B) into CR.PRO means that this construction rule can handle only nonreflexive pronouns. A separate rule will be needed for reflexive pronouns (possibly two, for locally and nonlocally bound reflexives), with a different resolution clause. (See Asher & Wada (1988) for an earlier analysis using DRT principles to account for restrictions on pronominal anaphora, but one

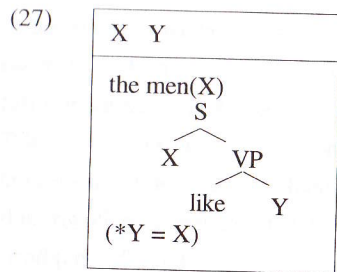
Kamp & Reyle's formulation of CR.PRO incorporates a simplified BT(B), confined to singular pronouns; our version applies to both singular and plural pronouns:¹⁹

(26) CR.PRO (second version)

If α is a nonreflexive pronoun in a syntactic structure S , carry out the following operations on the immediate DRS K in which α occurs:

- (a) Introduce a new discourse referent β , of the appropriate atomicity for α , into U_K and in Con_K substitute β for the syntactic structure consisting of α and its categorial projections.
- (b) Add to Con_K the condition $\beta = \gamma$, where
 - (i) γ is a suitable accessible discourse referent;
 - (ii) γ does not c-command β within β 's binding domain.

To illustrate, here is the DRS for (25b):



The discourse referent Y (instantiating β in (26)) is c-commanded by X within its binding domain (here, the whole sentence), which by (26bii) thus cannot be its antecedent, i.e., the identity condition $Y = X$ is not an admissible resolving condition for the pronoun. This captures the noncoreference effect of BT(B), since the establishment of the pronoun's reference depends on its being equated with an antecedent by means of the identity condition; thus nonidentity amounts to

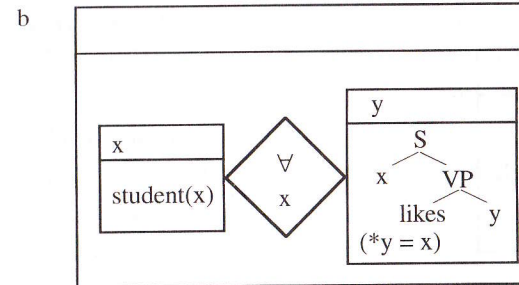
based, like Lasnik's theory, on disjoint reference.)

¹⁹ Kamp & Reyle formulate separate rules for singular and plural nonreflexive pronouns, chiefly, it seems, in order to account for the distributive reading of plural pronouns with quantifying antecedents, which requires the use of individual (i.e. atomic) discourse referents. Since this is independent of matters related to BT(B), we have not incorporated it into our account.

noncoreference.

Moreover, since the effect of BT(B) is not a constraint on reference per se, but rather on the admissibility of identity conditions, CR.PRO also covers cases of nonreferential (e.g. quantified) potential antecedents, where the pronoun is semantically a bound variable. We illustrate this with an analysis of (28a), which is ungrammatical under the intended reading that every student likes himself:

(28) a *Every student likes him.



The treatment of quantification in DRT derives from generalized quantifier theory (see Kamp & Reyle 1993:314ff. for details). The construction rule for quantifying NPs introduces a tripartite condition (called a *duplex condition*, since it contains two DRSs as constituents). The diamond contains a specification of the quantificational force and the quantified discourse referent (which thus functions semantically like a variable), the lefthand DRS constitutes the first argument, or restrictive term, of the quantifier, and the righthand DRS the scope of the quantifier. As seen in (28b), the scope DRS contains a representation of the entire reduced sentence structure, while the content condition for the quantified subject occurs in the restriction DRS. Clearly, attempting to identify the quantified subject as the antecedent of the pronoun (by means of the condition $y = x$) would violate the resolution clause (bii) of CR.PRO, since the discourse referent x in subject position c-commands the discourse referent y in the position of the pronoun within its binding domain.²⁰

²⁰ The universe of the restriction DRS is by definition accessible (cf. footnote 10) from the scope DRS. The reason that the discourse referents for the quantified NP and the pronoun are introduced into the subDRSs, not the main DRS, is to account for the unavailability of anaphora to quantified antecedents outside of the quantificational scope, as in *Every man left early. He took the bus.

4.2 Are split antecedents subject to noncoreference restrictions?

Additional empirical motivation for analysing BT(B) effects at the level of DRSs comes from restrictions on anaphora to split antecedents. Recall from section 2.1 that there is a BT(B) effect with split antecedents, when each of the NPs constituting the split antecedent c-commands the pronoun within its binding domain. This is exemplified by (11), repeated here as (29a), which receives the DRS in (29b):

(29) a *Bill_{1} told Mary_{2} about them_{1,2}.

b

x	y	X	Y
Bill(x)			
Mary(y)			
x told y about X			
Y = x⊕y			
X = Y			

The formulation of CR.PRO in (26) permits the resolution condition $X = Y$, since Y, being introduced by Summation, does not even occur in the syntactic structure of the sentence, let alone c-command the pronoun within its binding domain. Thus, it is wrongly predicted that the group consisting of Bill and Mary should be an admissible antecedent for the pronoun. To avoid this consequence, the resolution clause of CR.PRO must be augmented with a condition prohibiting identification with a discourse referent introduced by the rule of Summation, just in case all of the NPs making up the 'sum' are both within the binding domain of the pronoun and c-command it.

However, it is not only the discourse referents introduced by the NPs occurring within the pronoun's binding domain that must be excluded from the resolution clause. Consider the following sentence (modelled on one suggested by Hans Kamp, p.c.), in which the embedded clause is structurally the same as (29a):

(30) *Bill_{1} and Mary_{2} said they_{1,2} told Fred_{3} about them_{1,2,3}.

The following composite DRS represents three attempted resolutions of the pronoun *them* in this sentence, given by the pairs of conditions in (i)-(iii), respectively (again abstracting away from the DRT treatment of propositional attitudes):

(31)

x	y	X	Y	z	Z	W	V	U
Bill(x)								
Mary(y)								
X = x⊕y								
Fred(z)								
x and y said [Y told z about Z]								
Y = X								
(i) W = Y⊕z								
Z = W								
(ii) V = X⊕z								
Z = V								
(iii) U = x⊕y⊕z								
Z = U								

On the analysis in (i), the identity condition $Z = W$ has the same effect as the condition $X = Y$ in (29b), and would be excluded by the restriction needed to account for (29a). However, on the analysis in (ii), since X by definition fails to c-command Z at all (*a fortiori* within its binding domain), that restriction would not prevent V from being the resolving discourse referent for Z. Likewise, on the analysis in (iii), while all three discourse referents x, y and z c-command the pronoun, only z does so within its binding domain (the bracketed constituent), so that the restriction would wrongly permit the condition $Z = U$.

The problem for (26) with the analyses of (30) in (31ii) and (31iii) is that the resolution clause of CR.PRO—also with the restriction mentioned above—fails to take into account the transitivity of identity. Although only Y and z c-command Z within the latter's binding domain, it is the identification of the sum of x and y with X, and of the latter with Y, that gives rise to the observed BT(B) effects. To account for this it is necessary to further restrict the resolution clause so as to exclude any discourse referent that is identified with a sum whose summands are collectively identified (in a sense to be made precise) with any (sum of) discourse referents c-commanding the pronoun within its binding domain.

The problem concerning the transitivity of identity is a general one in DRT, deriving from the association of each NP with a distinct discourse referent and the establishment of anaphoric relations between NPs through identity conditions over the corresponding discourse referents. Kamp & Reyle (1993:235-236) address this matter for simple cases involving singular pronouns, as in *John said he likes him, where the discourse referents introduced by the pronouns are independently identified with the discourse referent introduced by the nonpronominal NP. They define equivalence classes of discourse referents occurring in identity conditions, and restrict CR.PRO by requiring in effect that a potential resolving discourse referent for a pronoun not be a member of the equivalence class of any discourse referent that c-commands the pronoun's

discourse referent within its binding domain.

However, their definition does not take into account the identification of a plural discourse referent with a sum of discourse referents under the Summation condition (though it does serve to construct equivalence classes of plural discourse referents under the identity condition). Since expressions of the form $\alpha_1 \oplus \dots \oplus \alpha_n$ are not themselves discourse referents, it would be both ad hoc and unintuitive to include them in the equivalence class. We propose instead to define equivalence classes of sets of discourse referents, among whose members will be the singletons of single discourse referents occurring on either side of an identity condition, as well as the set of 'summands' occurring on the righthand side of a Summation condition. In addition, to capture the transitivity of identity here, the latter must be constructed recursively from members of the equivalence classes of the individual 'summands'. Finally, in order to account for cases like (31iii), members of the equivalence class must include singletons of those discourse referents identified with a sum, which is itself part of a larger sum, whose summands are a member of the equivalence class. The following is a precise definition of this equivalence class:²¹

- (32) Given a discourse referent α occurring in a DRS K , the class of its *DRS-equivalents*, $[\alpha]_K$, is the smallest class Γ such that:
- (i) $\{\alpha\} \in \Gamma$;
 - (ii) for any discourse referents β and γ , if $\{\beta\} \in \Gamma$ and $\text{Con}K$ contains either $\beta = \gamma$ or $\gamma = \beta$, then $\{\gamma\} \in \Gamma$;
 - (iii) for any discourse referents $\beta, \gamma_1, \dots, \gamma_n$, if $\{\beta\} \in \Gamma$ and $\text{Con}K$ contains $\beta = \gamma_1 \oplus \dots \oplus \gamma_n$, then $\{\gamma_1, \dots, \gamma_n\} \in \Gamma$;
 - (iv) for any discourse referents $\beta_1, \dots, \beta_n, \gamma_1, \dots, \gamma_m$, if $\{\beta_1, \dots, \beta_n\} \in \Gamma$ and $\gamma_1 \in [\beta_1]_K, \dots, \gamma_m \in [\beta_n]_K$, then $\{\gamma_1, \dots, \gamma_m\} \in \Gamma$; and
 - (v) for any discourse referents $\beta_1, \dots, \beta_n, \gamma_1, \dots, \gamma_m$, and δ , if $\{\beta_1, \dots, \beta_n\} \in \Gamma$, $\{\gamma_1, \dots, \gamma_m\} \subseteq \{\beta_1, \dots, \beta_n\}$ and $\text{Con}K$ contains $\delta = \gamma_1 \oplus \dots \oplus \gamma_m$, then $\{\delta\} \cup (\{\beta_1, \dots, \beta_n\} - \{\gamma_1, \dots, \gamma_m\}) \in \Gamma$.

In terms of this definition, the restriction on CR.PRO is simply that no DRS-equivalent of a potential resolving discourse referent for a pronoun may be identical to the set of discourse referents that c-command the pronoun within its binding domain.

²¹ As shown in Berman & Hestvik (1994), it is necessary to extend the class of identified discourse referents to those used in defining the restrictive term of a quantifier; for reasons of space, we omit this case here.

To facilitate a concise formulation of this restriction, we introduce the following abbreviation:

- (33) $\text{BC}(\alpha) =_{\text{df}} \{\beta \mid \beta \text{ occurs within } \alpha\text{'s binding domain and } \beta \text{ c-commands } \alpha\}$

The final version of CR.PRO is now formalized in (34), where again clause (bii) contains the effect of BT(B):²²

- (34) *CR.PRO* (final version)
- If α is a nonreflexive pronoun in a syntactic structure S , carry out the following operations on the immediate DRS K in which α occurs:
- (a) Introduce a new discourse referent β , of the appropriate atomicity for α , into U_K and in $\text{Con}K$ substitute β for the syntactic structure consisting of α and its categorial projections.
 - (b) Add to $\text{Con}K$ the condition $\beta = \gamma$, where
 - (i) γ is a suitable accessible discourse referent; and
 - (ii) $\text{BC}(\beta) \notin [\gamma]_K$.

Let us see how this formulation of CR.PRO accounts for the BT(B) effects observed with split antecedents. Consider first the simple summation example in (29a). In its DRS (29b), $\text{BC}(X) = \{x, y\}$ and $[Y]_K = \{\{Y\}, \{X\}, \{x, y\}\}$ by (32i-iii); thus $\text{BC}(X) \in [Y]_K$, so $X = Y$ does not satisfy the resolution clause (37bii) and Y is not an admissible resolving discourse referent for X . Turning to (30), with the three analyses represented by the DRS in (31), we have $\text{BC}(Z) = \{Y, z\}$. This set turns out to be a member of each of the equivalence classes $[W]_K, [V]_K$, and $[U]_K$, of the respective candidate resolving discourse referents. For $[W]_K$, this follows directly from clause (iii) of (32), given the condition $W = Y \oplus z$. For $[V]_K$, it follows crucially from clause (iv) of (32), given the conditions $V = X \oplus z$ (making $\{X, z\} \in [V]_K$ by (32iii)) and $Y = X$. Finally, for $[U]_K$, the crucial clause is (32v), which, given the conditions $U = x \oplus y \oplus z$ and $X = x \oplus y$, makes $\{X, z\} \in [U]_K$, from which it follows by (32iv), given $Y = X$, that $\{Y, z\} \in [U]_K$. Consequently, each of the proposed resolving conditions in (31i-iii) is, correctly, inadmissible. We leave it as a straightforward exercise for the

²² The present formulation of the resolution clause differs slightly but significantly from that given in Berman & Hestvik (1994). Our earlier analysis, which employed equivalence classes of sets of discourse referents defined on the basis of Kamp & Reyle's definition of equivalence classes of discourse referents, failed to account for cases such as (31iii).

reader to verify that standard noncoreference cases like (25), as well as transitive cases like **John said he likes him*, also fall out as desired from (34).

This formulation of CR.PRO still correctly permits properly overlapping and inclusive reference between a pronoun and a c-commanding NP within the pronoun's binding domain. Consider for example (24). For the lowest pronoun, with discourse referent Y , $BC(Y) = \{w\} \notin [Z]K = \{\{Z\}, \{Y\}, \{X\}, \{x, y\}\}$; therefore $Y = Z$ is admissible and overlap between the references of Y and w is sanctioned. For the pronoun corresponding to w , $BC(w) = \{X\} \notin [y]K = \{\{y\}, \{w\}\}$, so $w = y$ is admissible and overlap between the references of w and X is sanctioned. We again leave it as an exercise for the reader to verify that analogous results hold for inclusive reference with plural pronouns, as in (15b,d).

5 The empirical status of local split antecedents

In contrast to Seely's judgment of (11) (= (29a)), Fiengo & May (1994:40) judge the following similar example (= their (116)) grammatical:

(35) John_{1} talked to Mary_{2} about them_{1,2}.

On the basis of this judgment, they conclude that there are no binding-theoretic restrictions on split antecedents and their analysis embodies this conclusion. In this regard their theory is equivalent to ours as stated in the preliminary version of CR.PRO in (26) but is less restrictive than our final version of CR.PRO in (34).

We in fact share both Seely's intuition about (11) and Fiengo & May's about (35). One explanation for the difference between these examples that immediately springs to mind is that the latter would not in fact be an instance of locally c-commanding split antecedents, if the NP *Mary* failed to c-command out of the PP; thus no BT(B) effect would be expected in (35). However, evidence that c-command does obtain here comes from the possibility of coreference between the prepositional object and a reflexive pronoun (i.e., there is no BT(A) effect), as in the following example (cf. Pollard & Sag 1992:(70b)):

(36) John talked to *Mary* about *herself*.

Thus, it seems reasonable to conclude that (35) is indeed a case of c-commanding split

antecedents, like (11). Significantly, we find that the difference between (11) and (35) with respect to BT(B) also obtains with singular pronouns (cf. Reinhart & Reuland 1993:(122)):

- (37) a John talked to *Mary* about *her*.
b *John told *Mary* about *her*.

Finally, we note an apparent subject/object asymmetry with *talk to* but not with *tell*, as indicated by comparing the contrast in (37) with the uniform unacceptability of the following:²³

- (38) a **John* talked to *Mary* about *him*.
b **John* told *Mary* about *him*.

Although we currently have no explanation for these observations, the nonuniform behavior of *talk to* suggests that the acceptability of (35) cannot by itself be taken as providing reliable evidence against the existence of BT(B) effects with local split antecedents. In contrast, the uniform behavior of *tell* provides consistent evidence in support of this. To further test this it is necessary to find other suitable predicates that behave uniformly. These must be (at least) three-place predicates, all of whose arguments have the same conceptual status (e.g. [+human]). Although a detailed empirical investigation is beyond the scope of this paper, initial consideration of (appropriately contextualized) sentences with verbs fulfilling these criteria tends to support, in our judgment, Seely's generalization that c-commanding local split antecedents induce a BT(B) effect. Consider the following example:²⁴

- (39) At their wedding reception, John and Mary were speaking to Bill and Sue.
a John_{*i*} said that he_{*i*} wanted [PRO_{*i*} to photograph Mary for them].
b John_{*i*} said that he_{*i*} wanted [Bill to photograph Mary for them].

²³ The same asymmetry obtains in cases involving Summation:

- (i) *John_{1} and Mary_{2} talked to Fred_{3} about them_{1,2}
(ii) John_{1} talked to Mary_{2} and Fred_{3} about them_{2,3}

The corresponding examples with *tell* are, as expected, uniformly unacceptable.

²⁴ Although the *for*-PP is not an obligatory argument phrase here, it behaves as an argument with respect to binding theory, cf. *John* photographed *Mary* for *himself*/**him*.

In (39a) the most plausible resolution for the pronoun is Bill and Sue; John and Mary are not an acceptable resolution, as predicted by (34). In contrast, in (39b), John and Mary can be the antecedent of the pronoun. We find the same type of contrast with the following verbs: *assign to*, *deny to*, *cede to*, *compare to*, *consign to*, *entrust to*, *explain to*, *leave to*, *offer to*, *point out to*, *promise to*, *reveal to*. On the basis of such evidence we tentatively conclude, contra Fiengo & May, that split antecedents can induce BT(B) effects. This means that a uniform treatment of pronominal resolution must be sensitive to the way the potential antecedent arises. Therefore, the incorporation of BT(B) into the construction rule for pronouns should be as we have formulated it in (34).

Let us briefly reflect on this conclusion. If it stands up to further empirical scrutiny, it would constitute a convincing argument that the effect of BT(B) really belongs at the interface between syntax and semantics. On one hand, the locality constraint and the c-command requirement are clearly syntactic properties. On the other hand, that split antecedents should be subject to this constraint strongly supports a nonsyntactic aspect, since these do not constitute a single syntactic constituent, which would be required for establishing either a coreference or a noncoreference relation at a syntactic level. But at the discourse level, a single entity is available through Summation.

Even if further investigation should lead to the conclusion that local split antecedents do not induce a semantically hard BT(B) effect, we believe that our analysis (which should then be based on a version of CR.PRO similar to (26) but making reference to equivalence classes of discourse referents, to account for the transitivity of identity) provides the conceptually most appealing approach to pronominal anaphora. Consider a purely syntactic alternative, such as that offered by Fiengo & May (1994:39ff.). They employ a standard version of binding theory, mediated by syntactic indices. But in order to account for split antecedents, they must resort to complex indices. Rather than using set indices such as Lasnik (1986) advocated, they introduce the notion of a *fusion index*, using the notation $j\oplus\dots\oplus n$.²⁵ This is the index associated with a plural pronoun whose antecedent consists of the collection of NPs bearing the single indices j, \dots, n . Fiengo & May extend the definition of coindexation to accommodate fusion indices: i is coindexed with j, \dots, n iff $i = j\oplus\dots\oplus n$. That is, when one member of a coindexed pair bears a fusion index, the other member is a set of distinct syntactic constituents. It seems to us that this analysis is simply a way of forcing into strictly syntactic terms what is essentially a syntax-independent process—

namely, Summation. (Cf. also Chomsky's (1993:fn.53) comments on the theoretical dispensability of indices.) Since Summation is independently needed and motivated within DRT, we believe that replicating it in the syntax sheds no further light on anaphora resolution.²⁶

If our interpretation of BT(B) effects (which is essentially that of Seely 1993) is right, it also has consequences for certain theoretical claims about pronominal anaphoric relations. In particular, the impossibility of local split antecedents both of reflexive pronouns (on which there is consensus in the literature) and of nonreflexive pronouns (as we argue, following Seely), constitutes a direct argument against Burzio's (1989) theory of anaphora, which entails that nonreflexive pronouns can occur in any environment where reflexive pronouns are excluded. It also constitutes a somewhat more indirect argument against the approach of Reinhart (1983), according to which anaphora between a reflexive pronoun and a local antecedent involves syntactic binding. Hence, the impossibility of local split antecedents of reflexives indicates that there is no syntactic binding in this configuration. Therefore, anaphora between a nonreflexive pronoun and local split antecedents is also not a case of binding. But then Reinhart's theory predicts that coreference between a nonreflexive plural pronoun and c-commanding local split antecedents should be possible, which again we have argued to be incorrect.

26 Possible indirect support for our approach might be seen in Reinhart & Reuland's (1993) argument that BT(B) should apply at a semantic level of representation that distinguishes the distributive and collective readings of certain predicates. As we show in Berman and Hestvik (1994), if Reinhart & Reuland's observations are correct, we can take them into account by augmenting our theory with a treatment of distributivity, proposals for which already exist within DRT (cf. Roberts 1987 and Kamp & Reyle 1993). However, we also provide data that call Reinhart & Reuland's conclusions into question. We suggest that the differential effects of distributivity on pronominal resolution are due to lexical semantic properties of the verbs involved, and thus should not be accounted for by the theory of pronominal resolution itself.

25 The identical notation for fusion indices and Summation is a coincidence, as far as we are aware.

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