

A-definites and the discourse status of implicit arguments

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Abstract

This paper focuses on the semantics of implicit arguments and compares it with that of explicit indefinites with which they can be truth-conditionally paraphrased. It is shown that once the discourse-potential of expressions is taken into account, the semantics of implicit arguments differs from their indefinite explicit counterparts. They are shown to be semantically identical to a particular kind of non-quantificational NPs (a-definites) which are characterized by their inability to serve as antecedents for future reference. A model of this behavior of implicit arguments, it is argued, follows naturally from the underlying assumption of Discourse Representation Theory that semantic representations must include two kinds of information, a set of available discourse markers and a set of predicative conditions. Because implicit arguments satisfy a predicate's argument positions without introducing discourse markers into the Discourse Representation Structure of a sentence, they cannot serve as the antecedent of definite pronouns. When they *do* enter into anaphoric relations it is not through discourse markers equality clauses, but instead is the result of either lexical identification of variables (via semantic detransitivization or meaning postulates) or of an accomodation process which involves bridging and/or factoring inferences.

Understanding discourse requires determining which eventualities are described, keeping track of the entities which participate in those eventualities, and determining the roles they play. In many cases, our understanding can rely on the morphosyntactic mention of participants. But in others, some of the participants involved are not explicitly mentioned. This paper is concerned with the effect this difference in morphosyntactic expression has on the semantic representation of participants. More specifically, the central issue on which we focus is whether the semantic interpretation of arguments which are not morphosyntactically expressed differs from that of explicit indefinite arguments with which they can be paraphrased *salva veritate*. Our claim is that once the discourse potential of expressions is taken into account, the semantics of implicit arguments and their indefinite explicit paraphrases *do* differ. We show that this difference supports the fundamental hypothesis of Discourse Representation Theory (hereafter DRT, see Kamp 1981, Heim 1982, and Kamp

and Reyle 1993, among others) that the semantic information which sentences encode is two-pronged. It consists of both predicative conditions *and* sets of discourse markers.¹

1 Implicit arguments

Linguists typically assume that the verb *sunk* in the short passive sentence in (1a) includes an implicit actor argument (see Roeper 1987, Williams 1987 among others). The representational nature of this implicit argument varies somewhat from framework to framework, but this variation is orthogonal to the issues addressed in this paper. We assume as our starting point that implicit arguments are included in the argument structures of verbs which introduce them, however one represents them, as theta-grids (Chomsky 1981), argument-structure lists of various sorts (the ARG-ST list in HPSG) (Davis and Koenig 2000, Manning and Sag 1998), or as a set of positions within a logical structure (Van Valin and Lapolla 1997). For our purposes, what is crucial is that implicit arguments are part of the representation of lexical items which would license their explicit morphosyntactic expression, even though no explicit material in either the surface string or its structural analysis might clue readers in to their presence.

- (1) a. A ship was sunk
- b. A ship sank
- c. A ship was sunk by someone
- d. ...to collect settlement money from the insurance company.

Psycholinguistic work supports this common linguistic hypothesis. The data presented in Mauner, Tanenhaus, and Carlson (1995) suggest that the verb *sunk* in the short passive sentence in example (1a), but not the verb *sank* in the intransitive sentence in example (1b), includes an agent in the representation of its argument structure. Mauner et al. show that subjects find less sensible — and take longer to process— rationale clauses like (1d) when they follow intransitive sentences like (1b) than when they follow short or agentive passive sentences like (1a) and (1c) respectively. They reason that this behavioral difference between surface similar intransitive and short passive sentences stems from the fact that only the short passive verb *sunk* in (1a) includes an agent in its argument structure that can serve as the antecedent of the unexpressed PRO subject of the rationale clause. Since readers must anchor the anaphoric PRO subject of *collect*, the absence of a possible anchor

¹We are not the first to notice that short passives and agentive passives whose agent adjunct is *by someone* are not semantically equivalent. McCawley (1988) argues that the two structures have different semantic interpretations and proposes that the logical subject of short passives is an unspecific pronoun which never surfaces (UNSPEC in his terminology). By contrast to McCawley's model-theoretic distinction, we focus in this paper on the discourse-potential differences between implicit arguments and their explicit indefinite truth-conditional paraphrases.

when the rationale clause follows a non-agentive intransitive verb like *sank* leads to more anomaly judgments and increased processing time.

Maurer and Koenig (1999) and Maurer and Koenig (to appear) provide evidence for the lexical source of implicit agents in the argument structures of (short) passive, but not intransitive and middle verbs. They show that (short) passives and middle verbs differ in the availability of an implicit agent, even when verbs are equated for whether or not they describe events whose occurrences entail an agentive participant. Consider examples (2a) and (2b). Both forms of *sold* describe events in which an agentive participant sold the vase. Vases do not *literally* sell themselves. This intuition is confirmed by the semantic anomaly of both (3a) and (3b) where an agent entailment is explicitly contradicted.

- (2) a. The vase was sold immediately
b. The vase sold immediately
c. The vase was sold by someone
d. . . . to raise some money for charity.
- (3) a. #The vase was sold immediately, but nobody sold it.
b. #The vase sold immediately, but nobody sold it.

Despite their conceptually equivalent agent entailments, the short passive and middle forms of *sell* differ in the availability of an agent for the interpretation of the unexpressed PRO subject of rationale clauses, just like the short passive and intransitive *sunk* and *sank* did. Only the former can felicitously combine with the rationale clause in (2d). This intuitive contrast was confirmed experimentally. Main verbs of rationale clauses took longer to process when they followed middle sentences than when they followed short passive sentences. Furthermore, when rationale clauses were preposed, the same processing differences showed up as soon as the main clause verb was recognized. (See Maurer and Koenig, to appear.) A plausible interpretation of these results is that the middle and short passive forms of *sold* differ in their argument structure, even though they both describe events which include an agentive seller participant. Linguistic and psycholinguistic evidence thus converge to suggest that whether an agent is encoded in the argument structure of a short passive (intransitive/middle) verb is lexically encoded in the verb's entry and immediately affects sentence processing.

The common presence of an agent in the lexical representation of *sunk* in the short and agentive passive sentences in (1a) and (1c) raises the question of the semantic relation between these two sentences. Both entries for *sunk* include an agent argument and the two sentences are truth-conditionally equivalent; they are true in the same set of models.²

²As a reviewer pointed out, this is only true if the sortal gender restriction included in the pronoun *someone* is disregarded. Of course, this *caveat* does not apply to the formula in (4). See footnote 1 for additional qualifications.

Should we conclude from these two facts that the semantic contribution of implicit agents (and implicit arguments more generally) is identical to that of *by*-phrases whose complement NP is an indefinite pronoun? Indeed, (1a) and (1c) are often assumed to be semantically equivalent. Their common semantic interpretation can be roughly paraphrased by the first-order formula in (4). (See Fodor and Fodor 1980 and Dowty 1981, among others.) This putative semantic identity between implicit arguments and their explicit indefinite counterparts seems necessary within traditional model-theoretic approaches in which meaning is directly tied to truth-conditions. If the meaning of a sentence equals the conditions under which it is true, then the fact that (1a) and (1c) are true in the same sets of models entails that they are semantically equivalent. If, furthermore, the meaning of a (subsential) expression equals its contribution to the truth-conditions of the sentence in which it is included, the identity of the non-agent related subparts of (1a) and (1c) suggests that the semantic contribution of implicit and explicit indefinite agents must be identical too. This traditional position seems confirmed by the rationale clause data we just discussed: implicit and explicit indefinite agents can equally easily control the unexpressed subject PRO of a rationale clause. But, as work in Discourse Representation Theory and File Change semantics has shown (see Kamp 1981 and Heim 1982), traditional truth-conditions do not exhaust the semantic contributions of sentences and subsential expressions.

$$(4) (\exists x)(\exists y) (\textit{ship}'(y) \wedge \textit{sink}'(x, y))$$

Two classically truth-conditionally equivalent sentences can differentially contribute to the on-going representation of the discourse. The truth-conditional equivalence of (1a) and (1c) is therefore no guarantee that their “meaning” — i.e., their conventional contribution to the interpretation of their utterances — are equivalent. As we show in this paper, this distinction between meaning-as-truth-conditions and meaning *simpliciter* is emphatically confirmed by the behavioral differences of short and agentive passives in discourse. More specifically, our claim is that once the discourse-potential of expressions is included in the definition of the meaning of expressions, the semantics of (1a) and (1c) *do* differ; the (discourse-related) semantic contribution of implicit agents is distinct from that of their explicit paraphrases. We thus argue for the following two hypotheses.

Hypothesis 1 *Implicit arguments are not semantically equivalent to existentially quantified variables.*

Hypothesis 2 *Implicit arguments satisfy the argument position of predicates without introducing a discourse marker into the Discourse Representation Structure for sentences in which they occur.*

2 The three functions of NPs and pronominals

Our main Hypothesis 2 assimilates the semantic contribution of implicit arguments to a subclass of non-quantificational NPs and pronominals discussed in Koenig (1999). We sum-

marize first this work’s analysis of non-quantificational NPs. As Koenig suggests, non-quantificational NPs or pronominals have (at least) three main distinct functions within DRT:

1. They can introduce new discourse markers to which subsequent NPs can refer back;
2. They satisfy one of a main predicate’s arguments;
3. They introduce a restriction on the referent of the discourse marker that they introduce.

These functions coalesce for typical (indefinite) NPs. Consider the simple discourse in example (5).

(5) A man smiled. He was happy.

The indefinite NP *a man* fulfills all three functions. It satisfies the sole actor argument role of the predicate denoted by *smiled*. It also introduces a discourse marker to which the pronoun *he* in the following sentence can refer. Finally, it restricts the referent of this discourse marker to be a man. These three functions are perspicuously represented in the linear format for representing Discourse Representation Theory of Zeevat (1989), as shown in the semantic translation for sentence (6a) given in (6b).³

(6) a. A man smiled.

b. $x \ \& \ man'(x) \ \& \ smiled'(x)$

c. ‘a’ translates as ‘ $\lambda P \lambda Q(x \ \& \ P(x) \ \& \ Q(x))$ ’

‘man’ translates as ‘ $\lambda v(man'(v))$ ’

‘smiled’ translates as ‘ $\lambda u(smiled'(u))$ ’

As one can easily see, (6b) derives from the semantic translations of *a*, *man*, and *smiled* represented in (6c) through β -reduction. Furthermore, the semantic translation of *a* consists of three clauses, each encoding one of the three functions of non-quantificational NPs. The first clause explicitly marks the introduction of a new discourse marker. This discourse marker will serve as an anchor for subsequent discourse markers which are coreferential with it. The second clause restricts the model-theoretic interpretation of this newly introduced discourse marker to entities which are included in the interpretation of the predicate *man'*

³To simplify, ‘&’ represents a dynamic version of traditional truth-conditional conjunction. See van Eijck and Kamp (1997) for details on the various possible semantic interpretations of such “merge” operators. The distinction between the introduction of discourse markers and satisfying the argument positions of predicates parallels the distinction between Discourse Entities and Discourse Roles in the psychological model of reading proposed in Garrod and Sanford (1990). We leave an explicit discussion of the similarities between Discourse Representation Theory and Garrod and Sanford’s psychological model to a more appropriate forum. (See Bosch (1988) for a critical discussion of Garrod and Sanford’s model that echoes the issues we discuss in this paper.)

(i.e. to men). The final clause restricts it further to those men who smiled, thereby making the referent of the discourse marker x satisfy the sole argument position of the predicate *smiled*'. The relevance of the new discourse marker x manifests itself in sentence (7a). The pronoun *he* in it again bears three functions. It introduces a new discourse marker z , it constrains its referent to be identical to that of a previously introduced discourse marker x , and forces it to be in the interpretation of the predicate *happy*'.

- (7) a. He was happy.
 b. z & $z = x$ & *happy*'(z)

The use of discourse markers as a representational device separate from predicative conditions and quantificational structure thus serves to explicitly encode the varying contributions to the on-going representation of the discourse of distinct kinds of NPs, in particular the distinction between quantificational, indefinite, and definite NPs.

What has not been traditionally recognized is that not all NPs fulfill all three functions or alternatively that not all non-quantificational lexical NPs or pronouns divide up into either indefinite or definite NPs. In particular, the French subject clitic *on* (Koenig 1999) and Hungarian Predicate Modifier NPs (Farkas 1997) do not fulfill the first function.⁴

Consider the minimal pair in (9)-(10).

- (9) #On_i a assassiné la présidente.
 INDEF have.PR kill.PPT the president
 Il_i était du Berry, paraît-il.
 he be.PST from.the Berry, seem.PR-it
 'Someone_i murdered the (woman) president. He_i comes from the Berry, it seems'
- (10) Quelqu'un_i a assassiné la présidente.
 INDEF have.PR kill.PPT the president
 Il_i était du Berry, paraît-il.
 he be.PST from.the Berry, seem.PR-it
 'Someone_i murdered the president. He_i comes from the Berry, it seems'

⁴German *man* seems to parallel French *on*, as example (8) illustrates (W. Wolck, p.c.). We leave a detailed comparison of these to another occasion.

- (8) #Man_i hat die Präsidentin erschossen
 INDEF have.PR the president shoot.PPT
 Er_i kam aus Bayern
 He come.PST from Bavaria
 'Someone_i shot the (woman) president. He_i comes from Bavaria.'

Quelqu'un and *on* are both felicitously translated by the English indefinite pronoun *someone*. But whereas *quelqu'un* can be the antecedent of a definite pronoun in a subsequent sentence, *on* cannot. For all intents and purposes *on* is inert in discourse: it cannot serve as the anchor of an anaphoric element (see section 4 for qualifications). We call words or phrases such as *on* ‘a-definites’, indicating by that term pronominals or lexical NPs that are neither definite nor indefinite: the status of the discourse marker they introduce is irrelevant, since they do not introduce one.⁵ We reserve the term ‘indefinite’ for NPs such as *quelqu'un*, i.e. to lexical NPs or pronouns which introduce a discourse marker that is not anchored to a previously introduced entity. Representing the difference between a-definites and indefinites is easy in the linear representation of Discourse Representation Structures proposed in Zeevat (1989) since it explicitly encodes the difference between the various functions of non-quantificational NPs. (11a) and (11b) are the two translations, into this semantic metalanguage, of sentences (9) and (10) respectively.

(11) a. $y \ \& \ \textit{president} \ (y) \ \& \ y = p \ \& \ \textit{murdered} \ (x, y) \ \& \ z \ \& \ z = t \ \& \ \textit{from} \ (z, b)$

b. $x \ \& \ y \ \& \ \textit{president} \ (y) \ \& \ y = p \ \& \ \textit{murdered} \ (x, y) \ \& \ z \ \& \ z = x \ \& \ \textit{from} \ (z, b)$

Of paramount importance for the anaphoric behavior of *on* is the absence of the discourse marker x in (11a), which *quelqu'un* introduces in (11b). This lexical semantic difference reflects the fact that *on* satisfies the agent argument position of *tuer* without introducing a new element into the discourse representation. As a consequence, whereas the discourse marker introduced by *il* ‘he’ in the second sentence can be interpreted as coreferential with the one which *quelqu'un* introduces through the discourse markers equality clause $z = x$ in (11b), the referent of z must be identified with that of another discourse marker (arbitrarily named t) in (11a). Thus, the lexical properties of *on* make the intended interpretation of (9) impossible.

It is worth noting that this variation in the lexically specified discourse properties of pronouns is expected given DRT’s hypothesis that sentence meaning in natural language includes information about “active/inactive” discourse markers as well as information about the “world”. If non-quantificational NPs and pronominals have the three aforementioned functions, we expect some NPs or pronominals to fulfill some, but not all, of these functions. The contrast between *on* and *quelqu'un* provides evidence for the possible dissociation of the role and reference functions of nominals and thus confirms the claim that non-quantificational NPs and pronominals are functionally diverse. Moreover, the discourse inertness of a-definites like *on* is not as easily modeled in all approaches to the dynamic aspects of meaning. In fact, the behavior of *on* favors a traditional DRT-style approach over some other approaches that make use of dynamic predicate logic à la Chierchia (1995a). In

⁵French subject clitic *on* has several uses which can be roughly translated as English *we*, *people*, or *someone*. This paper is only concerned with the last use. This a-definite use is typically described as the indefinite use of *on* in traditional grammars. See Koenig (1999) for a review of the evidence that these uses instantiate different grammatical constructions. Note, finally, that Koenig (1999) calls *on* an ‘ultra-indefinite’. We now think the term ‘a-definite’ more appropriately reflects the fact that the discourse behavior of *on* lies outside of the opposition between indefinite and definite pronouns.

this latter class of approaches, the protracted availability of discourse markers for coreference reduces to a dynamic interpretation of existential quantifiers. (6a) and (7a), for example, would be translated as (12a) and (12b) respectively, in Chierchia’s logic, and their discursive sequence as (12c) (simplifying for expository purposes):

- (12) a. $\lambda p \exists x (man'(x) \wedge smiled'(x) \wedge \sim p)$
 b. $\lambda q (happy'(x) \wedge \sim q)$
 c. $\lambda q \exists x (man'(x) \wedge smiled'(x) \wedge happy'(x) \wedge \sim q)$

In Chierchia’s approach, the intersentential coreference possibilities of indefinites follows from the fact that each sentence includes in its semantic translation a variable which functions as a place-holder for subsequent sentences (p in (12a)). The semantic translation of (7a), namely (12b), then replaces the “subsequent discourse” variable p (via ordinary β -reduction, \sim cancellation, and a dynamic definition of conjunction which is not relevant to our purposes), yielding (12c). The variable x in the second sentence now falls under the scope of the initial existential quantifier. Thus, the “dynamism” of indefinite reference is handled through assigning widest scope to existential quantifiers at their point of introduction into the discourse. No special representational status is assigned to the semantic translation of non-quantificational NPs. By contrast to the analysis of a-definites we outlined above, no distinction is made between the existential *interpretation* of a free variable and the fact that these variables correspond to active discourse markers. The distinctive behavior of indefinites and a-definites like French *on* therefore cannot be modeled: if both receive an interpretation logically equivalent to traditional existential quantification, they must both be interpreted as variables bound by an existential quantifier.⁶ By contrast, the two-pronged semantics of DRT affords us the representational means of distinguishing between a-definites and indefinites. Responsibility for the existential interpretation of free variables falls upon the embedding function which maps Discourse Representation Structures onto their model-theoretic interpretations. Availability of a free variable for subsequent anaphoric reference, on the other hand, depends on the presence of an accessible discourse marker corresponding to the argument position the variable satisfies.⁷ Because the two semantic consequences of the presence of non-quantificational NPs or pronominals are dissociated, the fact that only

⁶Interestingly, not all forms of Dynamic Predicate Logic lack the representational means to distinguish between indefinites and a-definites. The original formulation of Dynamic Predicate Logic in Groenendijk and Stokhof (1991) is not subject to this limitation because of its attribution of a dynamic interpretation to both open and (existentially) closed formulas. Conversely, not all formulations of Discourse Representation Theory preserve the representational distinction between existentially interpreted variables and the introduction of new discourse markers for these variables. As discussed below, the recasting of DRT within Constructive Type Theory proposed in Piwek and Krahmer (to appear) is one such example. More important than the particular tradition on which a proposal draws is its preservation of the two-pronged nature of semantic interpretation which traditional DRT stresses. As long as it does, it can model the distinction between indefinites and a-definites.

⁷See section 4 for qualifications and discussions of examples which involve accommodation in the sense of Lewis (1979).

the first consequence is relevant for a-definites (but not (in)definites) is easily accounted for. It reduces to whether or not the NP or pronominal introduces a discourse marker, as the contrast between the semantic translations of a-definite *on* and indefinite *quelqu'un* in (13) illustrates. Only *quelqu'un* lexically specifies that the variable x also constitutes a new discourse marker.

- (13) a. 'on' translates as ' $\lambda Q (\textit{human}(v) \ \& \ Q(v))$ '
 b. 'quelqu'un' translates as ' $\lambda Q(x \ \& \ \textit{human} \ (x) \ \& \ Q(x))$ '

3 The semantics of implicit arguments

Now that we have introduced the crucial semantic distinction between indefinites and a-definites, let us return to the semantic interpretation of implicit arguments, and in particular, the implicit agents of short passives. Our claim is simple: implicit arguments are a-definites. They satisfy one of a predicate's argument positions, but do not introduce a discourse marker for that position. As a result, the referent of an implicit argument cannot serve as the antecedent of a pronoun in a subsequent clause. Sentences (14a) and (15) illustrate.⁸

- (14) a. #The first female president_{*i*} was murdered e_j . He_{*j*} was from the Berry, it seems.
 b. $y \ \& \ \textit{president} \ (y) \ \& \ y = p \ \& \ \textit{murdered} \ (x, y) \ \& \ z \ \& \ z = t \ \& \ \textit{from} \ (z, b)$
- (15) #The Russian space agency_{*i*} issued pressurized suits e_j . He_{*j*} was still unhappy.

Semantically, sentence (14a) is identical to the French sentence in (9), as its semantic translation in (14b) (to be compared to (11a)) demonstrates. No discourse marker corresponding to the verb's implicit agent is introduced in the Discourse Representation Structure. The same holds true for the implicit recipient argument of *issued* in (15). Since no discourse marker is introduced for this argument, *he* in the following clause cannot be anchored to it. By contrast, agentive passives do introduce a discourse marker for the argument position of their governing verbs' agents. Thus, the agentive passive counterpart to sentence (14a) in (16a) receives a translation which crucially includes a discourse marker introducing clause, namely x , for the variable which satisfies the agent argument position, as indicated in (16b).

- (16) a. The president_{*i*} was murdered by someone_{*j*}. He_{*j*} was from the Berry, it seems.
 b. $y \ \& \ \textit{president}(y) \ \& \ y = p \ \& \ \textit{murdered}(x, y) \ \& \ x \ \& \ z \ \& \ z = x \ \& \ \textit{from}(z, b)$

⁸Givon's (1995) claim that agents in short passive clauses have low topic persistence is very similar to what we call discourse inertness of a-definites except that we claim that the topic persistence of a-definites is not low, but zero!

The discourse marker for the next sentence subject pronoun *he*, namely *z*, can now be equated with this previously occurring and accessible discourse marker. Hence the felicity of (16a). In brief, the two hypotheses we set forth at the beginning of this paper regarding the semantic contribution of implicit arguments appropriately model the contrast between implicit and explicit agents in short passive sentences. If a-definites, be they explicit or implicit, do not introduce discourse markers, subsequent NPs cannot refer back to them through discourse marker equality clauses. We similarly correctly predict that (17c) can follow (17b), but not (17a), since (17b) alone introduces a discourse marker, say *x*, with which the referent of *he* can be identified (see (17d)).

- (17) a. A ship was sunk.
 b. A ship was sunk by someone.
 c. He was French.
 d. *z* & French (*z*) & *z* = *x*

Despite its apparent success, our account of the discourse inertness of implicit agents seems to run afoul of the linguistic data presented in Manzini (1983), Roeper (1987), and Williams (1987) and the psychological evidence reported in Mauner, Tanenhaus, and Carlson (1995) and Mauner and Koenig (to appear), all of which suggest, as noted above, that the implicit agents of short passives can antecede the unexpressed PRO subject of rationale clauses. Sentence (18), repeated from (1), illustrates.

- (18) a. A ship was sunk to collect a settlement from the insurance company.
 b.*A ship sank to collect a settlement from the insurance company.

As these scholars argue, the unexpressed PRO subject of *collect* is controlled by the implicit agent of *sunk*, which contrasts with what happens in the case of intransitive verbs, as illustrated in (18b). The implicit argument of *sunk* does not seem, contrary to our claim, to be inert in discourse since it can antecede what is generally regarded as an anaphor of some sort, namely the unexpressed PRO subject of *to* VP infinitives.

A similar issue arises in the case of our explicit a-definite argument, French subject clitic *on*. *On* does not exclude all instances of anaphoric reference. The referent of *on* can, in particular, be the target of intrasentential reflexive binding. As (19) illustrates, the agent argument position which *on* satisfies can be bound to the patient argument position of *lavé* ‘to wash’ via the reflexive clitic marker *se*.

- (19) On s’ est encore lavé
 INDEF REFL be.PPT again wash.PPT
 dans ma salle de bain.
 in my room of bath
 ‘Somebody washed himself/herself in my bathroom again.’

We claim, in accord with the assumptions of most syntacticians, that cross-sentential pronominal coreference differs from both subject PRO anaphoric identification and intrasentential reflexive binding. In particular, the latter two do not involve discourse marker equality clauses and are thus compatible with our hypothesis that implicit and explicit a-definites do not introduce discourse markers. Informally speaking, the anaphoric interpretation of the PRO subject of rationale clauses, as well as intrasentential reflexive binding, follows from lexical processes or meaning postulates as we will show in detail. To stress the lexical source of the co-referentiality of the referents of the a-definite and anaphor, we will talk of *lexical identification* of argument positions for both cases.

To account for the data involving *on*, we can adapt the analysis of similar data for the Italian arbitrary *si* discussed in Chierchia (1995b). Chierchia notices that the external argument of Italian arbitrary *si* cannot be the antecedent of a cross-sentential pronoun, but can be the antecedent of an intrasentential reflexive or reciprocal anaphor.⁹ He suggests an analysis of reflexive binding in terms of semantic argument reduction, after Bach and Partee (1980), an analysis recently revived by Pollard and Sag (1992) and Reinhart and Reuland (1993). A VP like *hit himself* in this approach is analyzed semantically as λx (*hit'*(x, x)). The fact that the predicate's two argument positions are filled by the same variable insures that the *arb* sortal restriction on the external argument which the Italian arbitrary *si* construction imposes is met by the anaphor as well as its antecedent. This analysis can easily be adapted to the analysis we put forth to account for similar data involving French *on* (see (19) above). We only need assume that the translation of the predicate *se laver* is as shown in (20); the meaning of (19) is then derived compositionally as before via ordinary β -reduction.

(20) 'se laver' translates as ' λv (*wash'*(v, v))'

According to this proposal then, reflexivization marks the semantic detransitivization of the predicate *wash'*. In so doing, it removes the need for the identification of the variables corresponding to the predicate's agent and patient arguments through discourse marker equality clauses: the identification is part of the lexical meaning of the derived predicate. The absence of discourse markers for the argument that *on* satisfies is not an impediment to the lexical identification of the two variables.

Unfortunately, a generalization of this approach to implicit a-definites and the PRO subject of rationale clauses is not forthcoming. The difficulty can best be seen by considering the analysis of rationale clauses proposed in Carpenter (1997). Carpenter assigns the following meaning to the infinitive marker *to* which introduces rationale clauses.

(21) $to \Rightarrow \lambda P. \lambda R. \lambda x. \mathbf{purpose} (R(x))(P(x))$

(22) a. Francis practiced to defeat Brooke. (Carpenter's example)

⁹Chierchia's analysis of the Italian data involves the use of sorted variables. See Koenig (1999) for arguments that Chierchia's analysis does not generalize to French *on* or to a-definites in general.

b. **purpose(*practice(f)*, defeat(f,b))**

The R variable in (21) corresponds to the meaning of the main clause that the rationale clause modifies, while the P variable corresponds to the meaning of the VP complement of *to*. The resulting semantic translation of a sentence containing a rationale clause is illustrated in (22a) and (22b). (Italicized material corresponds to R and underlined material to P .) The presence of the lambda-abstracted variable x in (21) insures — given the syntactic category of *to* not represented in (21) — that the unexpressed PRO subject of the rationale clause is bound to the surface subject of the VP it modifies. Of course, this is the wrong result in the case of short or agentive passives, as the sentences in example (23) illustrate. The house is not the agent of *pay*; rather, the unexpressed seller (23a) or Jane (23b) is.

(23) a. The house_{*i*} was sold [PRO_{*i*} to pay the inheritance tax].

b. The house_{*i*} was sold by Jane [PRO_{*i*} to pay the inheritance tax].

The problem with Carpenter’s semantic analysis is that the agent argument position of passive verbs in short passive sentences is satisfied within the VP and does not therefore have a lambda abstracted variable corresponding to its semantic translation. As a consequence, there is no possibility of identifying it with the variable x in (21). The difficulty does not lie in Carpenter’s particular proposal. In any (simple) Categorical Grammar style analysis, the representation of short passive verbs must follow the β -reduction of the variable corresponding to the agent argument, thereby preventing the unreduced variable of the rationale clause to be identified with it.

One possible solution to this difficulty is to adopt a “property” analysis of control along the lines of Chierchia (1989). In such an analysis, the determination of the controller of the PRO subject of infinitive complement VPs and rationale clauses is done through meaning postulates of the kind informally stated in (24):

(24) For every eventuality which involves a property $\lambda x P(x)$ as one of its semantic arguments, there is a corresponding eventuality whose property is replaced by the eventuality $P(a)$ in which the additional argument is the agent (or theme, or ...) of the verb the VP complements or modifies.

When applied to the semantic translation of (23), this meaning postulate replaces the expression on the left of the arrow in (25) with the expression on the right of the arrow, thus ensuring the appropriate identification of the variable for the agent of *sell* and the unexpressed PRO subject of *pay*.¹⁰

(25) $sell'(x, h, \lambda y \textit{pay}'(y, tax)) \rightarrow sell'(x, h, \textit{pay}'(x, tax))$

¹⁰We simplified somewhat Chierchia’s account in irrelevant ways. The reader is referred to his article for details. Note that rationale clauses in his analysis are a kind of “ad-verb” in the sense of McConnell-Ginet (1982) and thus augment the arity of any predicate they modify.

By relying on a meaning postulate to identify the PRO subject of rationale clauses with the implicit a-definite argument of short passives, Chierchia's property approach to control eliminates the need for discourse markers equality clauses, just like the semantic detransitivization analysis of reflexive marking did. The upshot, then, is that a-definites can enter into a grammatically induced relation of coreference, provided this relation is not mediated by discourse marker equality clauses (which would contravene their a-definite semantics). Semantic reflexivization and property control are two such cases; in both, coreference does not rely on the existence of available discourse markers, but rather, is the result of lexical semantic detransitivization or constraints on appropriate models (meaning postulates).

4 Coreference and Inference

4.1 Apparent counterexamples

We have until now considered two kinds of (broadly understood) anaphoric expressions: definite pronouns, for which neither explicit nor implicit a-definites can serve as the antecedent, and reflexives and unexpressed PRO subjects for which both can. Our explanation for the differential behavior of a-definites with respect to these two kinds of anaphoric processes lies in the way the anaphor is resolved in each case. Only the former requires the presence of a discourse marker for the antecedent and thus excludes a-definites from their purview. But the literature provides apparent counterexamples to our general claim on the discourse role of a-definites which we must now address. Consider example (26) from Mauner (1996).

- (26) a. The rebel priest was tortured for days.
 b. The rebel priest was being tormented for days.
 c. The rebel priest was profoundly tormented for days.
 d. They wanted him to reveal where the insurgents were hiding out.

The indefinite use of the pronoun *they* (synonymous with *someone*)¹¹ in sentence (26d) is anchored to the implicit agent of *tormented* or *tortured* in (26b) and (26a) respectively. The behavior of definite NPs parallels that of indefinite uses of *they*. They too seem to be able to refer back to an implicit argument, as argued by Carlson and Tanenhaus (1988) (see their example in (27)).

- (27) a. Bill hurried to catch his plane.
 b. Bill hurried to unload his car.

¹¹By 'indefinite use of *they*', we refer to its non-anaphoric, unspecific use, which can be paraphrased by either *someone* or *people*. This use of *they* is close, although not identical, to the a-definite uses of *on* in French or *Man* in German. See Condoravdi (1989) for a discussion of the semantics of this non-anaphoric, indefinite use of *they*.

c. The suitcases were very heavy.

The definite NP *the suitcases* in (27c) is anchored to the implicit theme argument of *unload*, that is, what is being unloaded. These two classes of examples thus show that subsequent indefinite uses of *they* and definite NPs behave differently from definite pronouns: they can find their antecedents in implicit a-definites.¹² What Mauner and Carlson and Tanenhaus observed for implicit a-definites holds of morphosyntactically realized a-definites too. Consider the following example:

- (29) On a tué le PDG de Renault.
INDEF have.PR murder.PPT the CEO of Renault
Les terroristes ont été impitoyables.
The terrorists have.PR be.PPT merciless
Renault's CEO was murdered. The terrorists were merciless.

The NP *les terroristes* in the second sentence of (29) is easily interpreted as coreferential with the referent of the variable satisfying the agent argument position of *tué* in the first sentence, in apparent contradiction to what we suggested in Section 2 (see Koenig 1999 for more examples). Such examples seem to contradict our hypothesis that implicit a-definites are inert in discourse. In fact, example (27) was used by Carlson and Tanenhaus to demonstrate the discourse relevance of implicit arguments.

The intuitive felicity of examples such as (27c) and (26d) was confirmed experimentally in Mauner (1996). Mauner investigated how well readers process a target sentence containing an indefinite pronominal subject (e.g. an indefinite use of *they* or *someone*) which is the intentional agent of its own sentence (e.g., (26d)), when it follows a short passive context sentence introducing either a volitional or nonvolitional implicit agent as a likely referent for the pronoun. In this experiment, participants read pairs of sentences one sentence at a time and judged whether target second sentences made sense given their context sentences. The coherence relation between the two sentences was kept constant throughout the experimental items (see Hobbs 1979, and Mann and Thompson 1988, among others, on the notion of coherence or rhetorical relation): the eventuality described by the second sentence was always the cause of the eventuality described by the first. Furthermore, the second sentence always described the referent of the indefinite pronoun's state of mind and strongly suggested that its referent intentionally brought about the event described by the

¹²This statement constitutes an oversimplification of the data. As demonstrated by various authors, definite pronouns can refer back to referents which are not explicitly introduced in discourse. In particular, as pointed out to us by a reviewer and discussed at length in Bosch (1983), "anaphoric island" examples (Postal 1969) or sentences which contain stressed definites pronouns contradict the claim that pronouns cannot refer back to antecedents which have not been explicitly introduced (see also Postal 1972 for additional examples).

- (28) a. John became a guitarist, because he thought it was a beautiful instrument.
b. I saw Mr. Smith the other day; you know SHE died last year. (Wasow (1972))

We address this issue at the end of this section.

first sentence as a result of this state of mind. For example, the desire felt by the referent of the second sentence's subject in (26d) is most plausibly the reason why (s)he/they intended to torment or torture the rebel priest in (26a)-(26c). A coherent interpretation of the three simple discourses consisting of any of (26a) through (26c) followed by (26d) thus relates the situations s and s' described by the two sentences via a causal relation, more precisely, via a reason relation: s' was the reason the second sentence's subject's referent causally initiated s . Furthermore, the establishment of a *reason* coherence relation between the two propositions expressed by the context and target sentences required the referent of the unspecific pronominal to be identified with the implicit agent of the preceding sentence. If s' is a reason for x to causally initiate s , then x must be the agent of s . Because the coherence relation was constant across conditions, the most natural interpretation of all experimental items had as the referent of *they* the implicit agent of the passive verb which occurred in the first sentence. That the referent of *they* was indeed equally likely to be taken as the implicit agent of the context sentences across all conditions was independently assessed through a prior questionnaire study. In this study, subjects were asked to rate on a 5-point scale how likely the referent of *they* in a target sentence was whoever or whatever was responsible for the event described by the context sentence. There was essentially no difference across contexts in how probable participants thought the implicit agent was as the referent of *they*. The results of this questionnaire study thus demonstrated that the materials were effective in equally inducing readers to treat *they* as co-referential with the implicit agent of the first clause.

Despite the equal likelihood that *they* be interpreted as co-referential with the implicit agent, the ease with which this co-reference was established on-line was predicted to differ across conditions. This is because two conditions included short passive context sentences whose main verb was either unambiguously eventive, e.g., (26a), or biased toward an eventive interpretation, e.g., (26b), while a third included short passive context sentences whose main verb was biased toward a stative interpretation (26c). Context sentences from the first two conditions described situations which required a volitional agent. By contrast, the main verbs of state-biased context sentences described situations which did not require a volitional agent. Now, the coherence relation (i.e., *reason*) which forms the basis of the identification of the referent of *they* and the implicit agent of the context sentence requires the effect of the mental state described by the target sentences to be an act. If s' is the reason for s , then s must be an act (under the sense of reason with which we are concerned here). State-biased context sentences do not therefore describe a situation of the right sort to serve as an argument of this coherence relation. Of course, coercing this state situation into a sortally appropriate act is not difficult; one need only evoke the process from which the state resulted. But this coercion, Mauner predicted, would affect readers judgments as to whether the second sentence made sense in the context of the first sentence. More precisely, the need to coerce the interpretation of state-biased context sentences for readers to establish the coherence relation (and the identity of the implicit agent and the referent of *they*) would lead to increased reading times for the corresponding target sentences and prompt some subjects to respond that these sentences did not make sense.

Table 1 illustrates the percentages of “No” judgments and reading times for target sentences following the three types of context sentences. As one can see, the experimental data support Mauner’s predictions. Targets following state-biased sentences which provided neither appropriate acts for the coherence relation nor volitional implicit antecedents for the unspecific pronouns elicited significantly more “No” judgments and longer reading times (to sentences that readers continued to judge sensical) than either type of eventive context sentence. Targets following eventive sentences did not differ from each other in judgments or reading times.

Sentence Type	% “No” judgments (and standard errors)	Reading times (ms) (and standard errors)
Unambiguously eventive (c.f. (26a))	17.9 (2.6)	3180 (183)
Event-biased (c.f. (26b))	23.6 (3.1)	3300 (203)
State-biased (c.f. (26c))	32 (3.5)	3484 (248)

Table 1: Mean percentages of “No” judgments, reading times and respective standard errors for target sentences following unambiguously eventive, event-biased, and state-biased short passive context sentences.

These results are plausibly explained by the hypothesis that the stative interpretation of *profoundly tormented* does not introduce an appropriately typed situation into the Discourse Representation Structure to support the most plausible coherence relation among the situations described by the context and target sentences. The sequence consisting of (26c) and (26d) requires additional inferencing to support the relation compared to the sequence consisting of (26b) and (26d). It therefore leads to an increase in total reading time for sentence (26d). For the purposes of this paper, Mauner’s results are important in that they support empirically the claim that indefinite uses of *they* can refer back to implicit a-definites in on-line processing, as the following reasoning explicates:

1. The degree to which the proposition expressed by the context sentence supported a reason relation was what was manipulated across conditions;
2. The establishment of a reason coherence relation demanded the identification of the referent of *they* and the implicit agent of the context sentence;
3. The presence of a difference in reading time between conditions suggests that speakers *did* perform the identification required by the coherence relation.

We conclude that examples (26), (27), and (29) and Mauner’s experimental results require us to qualify our main hypothesis that a-definites (be they implicit or morphosyntactically realized) are inert in discourse. Some NPs in subsequent sentences *can* target

a-definites and be anchored to the same individuals in the universe of discourse. But, under what conditions is such an anchoring possible? We turn to this issue in the next section.

4.2 Kinds of referential identification

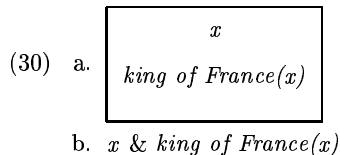
As was the case for the unexpressed PRO subject of rationale clauses and intrasentential reflexives, we claim that anaphoric identification of the referents of indefinite pronouns and definite NPs to the referents of a-definite “antecedents” differs from what typically happens in the case of definite pronouns (see (14a)). (This is an oversimplification. See footnote 12 for examples of atypical binding of definite pronouns.) Our hypothesis is that the discourse function of implicit arguments in the case of definite lexical NPs and indefinite pronouns (i.e. in (26), (27), or (29)) is mostly a matter of *inference* not *coreference*. More precisely, we suggest that the identification of referents follows from a process of accomodation (or bridging inference) of the kind described in Clark and Haviland (1977) or of factoring. (Hereafter, we use the terms *accomodation* as the name of the phenomenon and *bridging inferences* for the mechanism underlying it.) For clarity, we discuss each case individually. We begin with definite NPs, then discuss indefinite pronouns and indefinite uses of *they*. We then finally address atypical examples of binding of definite pronouns to which we alluded on several occasions.

Our hypothesis that the apparent discourse relevance of a-definites results from a process of accomodation is independently justified by recent work on presupposition in DRT, in particular, the work reported in Krahmer (1998) and Piwek and Krahmer (to appear). To present this corroborating analysis, we briefly digress on the treatment of definite NPs and their presuppositional behavior within DRT. As Beaver (1997) notes, the currently most successful theory of presuppositional phenomena is the DRT-based theory of presupposition-as-anaphor presented in van der Sandt (1992). According to this theory, presuppositions that are triggered by lexical or phrasal material are anaphors which need to find an accessible antecedent that binds them. Sentence (31) will serve as our illustration. Using a box representation for Discourse Representation Structures, the DRT representation of this sentence prior to the resolution of the presupposition carried by its consequent is as shown in Figure 1 (example from Krahmer 1998).¹³

(31) If France has a king, the king of France is bald.

The unresolved presupposition associated with the conditional’s consequent is indicated by the most embedded box to the right of the arrow. This box encodes the proposition

¹³Variables at the top of a box correspond to discourse markers. Material below these variables corresponds to predicative conditions. Thus, (30a) corresponds to (30b) in the linear representation we used until now.



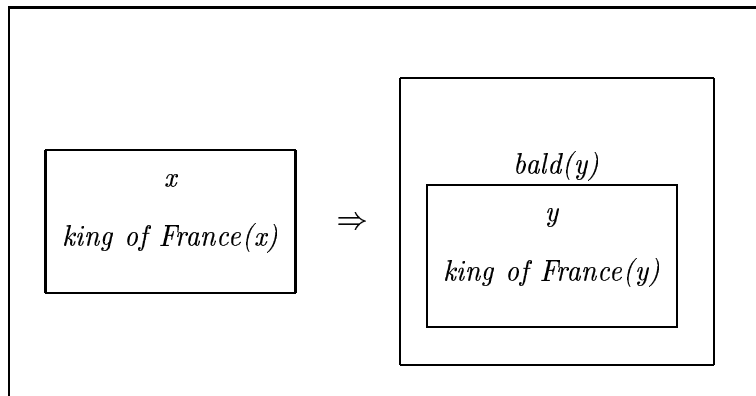


Figure 1: Unresolved presuppositional DRS

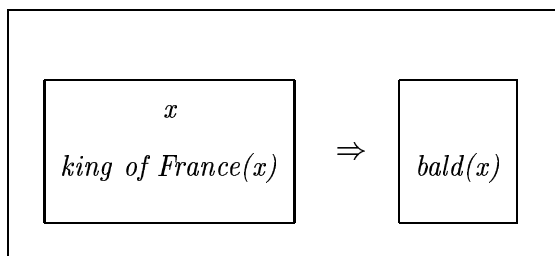


Figure 2: Resolved presuppositional DRS

that *there is a king of France*, the presupposition traditionally assumed to be carried by the consequent (see Strawson 1950). Resolving the anaphoric dependency introduced by this presupposition amounts to binding the variable y to an accessible active discourse marker (x in the representation of the antecedent of the conditional in Figure 1) and “moving” the predicative conditions associated with the newly bound variable to the location of the variable binding it (into the box which contains the antecedent discourse marker x in Figure 1). The result of the resolution of the anaphoric proposition *there is a king of France* (after elimination of redundant conditions) is shown in Figure 2.

This analysis of the presupposition associated with (31) models the well-known fact that definite NPs carry (at least) an existential presupposition, which may or may not correspond to a presupposition of the sentence as a whole. The difficulty that definite NPs raise for our hypothesis regarding a-definites can now be more explicitly stated as follows. If presuppositions are anaphors and definite NPs are presuppositional in nature, why does their behavior differ from that of definite pronouns?¹⁴ One property distinguishes definite

¹⁴Indefinite uses of *they* of the kind we discussed in the context of (26), which constitute another class of cases that present difficulty for our hypothesis regarding a-definites, are not anaphoric in the same sense as definite NPs and definite pronouns. Their anaphoricity is not grammatically induced and follows entirely

NPs from definite pronouns and presuppositions from non-presuppositional anaphora: the former’s lexical content facilitates the process dubbed *accomodation* by Lewis (1979). Lewis notes that presuppositions which are not satisfied are simply assumed by the hearer under some circumstances. Consider the following sentence:

(32) If I remember correctly, the king of France is bald.

When this sentence initiates a discourse, the presupposition associated with the definite NP *the king of France* cannot be bound to a preceding discourse referent. Under certain circumstances, the presupposition is then accommodated, i.e. introduced within the ordinary (non-presuppositional) part of the DRS. Of course, accommodation is a very powerful mechanism which should not be overused; otherwise, constraints on the context of utterance imposed by presuppositions would lose their force. Van der Sandt proposes a few conditions on accommodation. Our hypothesis is that the anaphoric nature of the definite NPs in (27) and (29) involves accommodation.

We are not alone in proposing that bridging inferences in the sense of Clark and Haviland (1977) underlies accommodation. Piwek and Krahmer (to appear) have recently suggested this is what is involved in the example from Hobbs, Stickel, Appelt, and Martin (1993) given in (33).

(33) I bought a new car last week. The engine is already giving me trouble.

The definite NP *the engine* is understood to be that of the speaker’s new car because of a contextually available rule to the effect that each car has an engine. Piwek and Krahmer (to appear) casts their formal model of bridging inferences within a reformulation of DRT in terms of Constructive Type Theory. The details of their analysis are not our concern here. More crucial for our point is that it is compatible with our hypothesis that the anchoring of the referent of *the terrorists* to the referent of the a-definite subject clitic *on* in (29) does not require the presence of a discourse marker for the agent argument of *tué*. Simplifying the representation for expository purposes, the representation of the discourse in (29), prior to the resolution of the existence presupposition associated with the subject of the second sentence is as shown in Figure 3.

No appropriate antecedent for the discourse marker z is present in this DRS. The resolution of the presupposition must therefore rely on accommodation and bridging inferences. It might, for example, rely on the knowledge that whenever a killing event occurs, an entity must be present which effects the killing and that terrorists “often” kill government officials and top executives. Such knowledge can then be used to infer that z should be accommodated to the x agent variable of *kill*. The result of this accommodation via bridging inferences is shown in Figure 4.

Although we view our hypothesis concerning presupposition resolution for discourses such as (29) as identical to Piwek and Krahmer’s claims concerning presupposition accommodation, it should be noted that the representational mechanisms they propose to model

from readers’ striving for discourse coherence. We discuss the issue shortly.

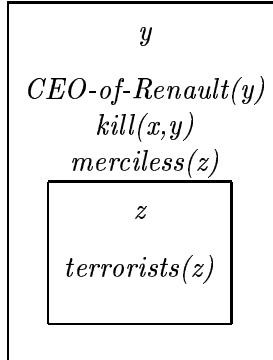


Figure 3: Unresolved presuppositional DRS for (29)

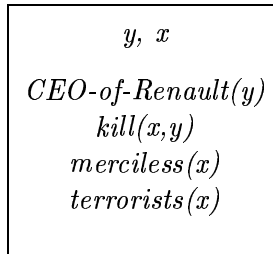


Figure 4: Resolved presuppositional DRS for (29)

accomodation are not rich enough to accomodate the difference between indefinites and a-definites. Indeed, their Constructive Type Theory representation wrongly nullifies the distinction between the introduction of a discourse marker and the satisfaction of a predicate's argument position, which we argue is needed to model a-definites. We will not pursue the matter in this paper, though, since the issue of the exact mechanisms through which accomodation takes place is less important than the consensus that definite NPs can find their antecedent through accomodation and inferential processes. It is sufficient to show that (29) does not violate our contention that a-definites are inert in discourse in the sense in which we introduced the term.

Identification of referents through inferences applies to more than definite NPs. As (26) indicates, indefinite uses of the pronoun *they* can also be resolved to the implicit agent of a preceding short passive verb. Again, we invoke inferential processes. In this particular case, the inference is not driven by a grammatically marked presupposition. It is not a bridging inference. Rather, it results from a hearer's drive to make the speaker's discourse coherent. As Hobbs and his colleagues argue, satisfying this maxim of interpretation requires (at least) establishing coherence or rhetorical relations between the eventualities described by discourse segments and reducing the number of entities involved in the model for a

stretch of discourse, what Hobbs et al. (1993) call “factoring”.¹⁵ “Factoring” in Hobbs’ terminology refers to all instances of identification of two predicates’ arguments. For clarity, we reserve the term for instances in which the inferred identity of the values of the argument positions is not grammatically marked. We use the term *identification* for the general case. We use the term *presuppositional binding* to refer to the identification that results from a presupposition of “availability” of antecedent discourse markers associated with definite NPs. Note that instances of both factoring and presuppositional binding can either target discourse markers explicitly introduced in the previous discourse or coerce the addressee or reader into accomodating the discourse with which she is presented and introduce an antecedent discourse marker after the fact, so to speak. We list in Table 2 the processes by which various kinds of NPs can find their antecedents that we have discussed so far. As indicated in the last column of the table, accomodation pervades non-lexical identification of anaphors to a-definites, whether that identification is grammatically marked or is the result of a linguistically unguided search for coherence. We also mention in the table instances of atypical binding of definite pronouns, to which we now turn.

	<i>Identification of argument positions</i>		<i>Cross-sentential anaphors</i>	
	<i>(In)definites</i>	<i>A-definites</i>	<i>(In)definites</i>	<i>A-definites</i>
<i>Reflexives and PRO subjects</i>	lexical identification	lexical identification		
<i>Definite lexical NPs</i>			(presuppositional) binding	(presuppositional) binding through accomodation
<i>Definite pronouns</i>			binding	binding through accomodation
<i>Indefinite pronouns</i>			factoring	factoring through accomodation

Table 2: Anaphoric possibilities per NP type for a-definite antecedents

Now that we have placed cross-sentential anaphors within the larger context of identification of referents during the process of text interpretation, we must make good on our promissory note and discuss instances of atypical binding of definite pronouns. In the framework of presupposition-as-anaphor, there is no difference in kind between definite pronouns like *he* and *she* and traditional presupposition-carrying definite NPs. Both involve

¹⁵Hobbs et al. derive these requirements from a general model of text interpretation dubbed interpretation-as-abduction. According to this model, readers strive to find the best explanation for what they have read or heard. In the case of the interpretation of an observed discourse, this abductive process amounts to inferring the best explanation for the validity or truth of the discourse with which they are faced. Since the fewer unproven assumptions a discourse comprises, the easier it is, all things being equal, to make it true, the presence of causal or other relations between eventualities, which reduces the number of unmotivated and unrelated events which the hearer must assume, should aid hearers’ interpretive goals. The same reasoning explains why reducing the number of existing entities in the discourse model helps the abductive process. Even though we find Hobbs’ framework for discourse interpretation quite appealing, our point does not depend on its correctness. It is sufficient for our purposes that discourse interpretation requires the establishment of coherence or rhetorical relations and the identification of participants even when no grammatical marking induces readers to do so. Both of these points seem uncontroversial.

an anaphor which must be resolved. In both cases, the absence of a previously introduced discourse marker prevents the anaphor attached to the definite pronoun or definite lexical NP to be bound. But, as already noted by van der Sandt (1992), whereas definite NPs often provide enough descriptive content for accomodation to take place (i.e. for the bridging inference to be supported by the speech participants' mutual knowledge), definite pronouns provide too little descriptive content (at most, the gender and number of the antecedent) to typically support accomodation. Because the anaphor cannot be resolved through either "direct" binding or binding through accomodation, (9) and (14) are judged infelicitous.¹⁶ By contrast, the descriptive content of the lexical NPs in (27) and (29) lets accomodation rescue the presupposition whose "direct" binding has failed. In other words, definite pronouns only differ from definite NPs in the degree to which they support bridging inferences when accomodation is required, not in kind. The fact that definite pronouns do not differ in kind from definite NPs explains the data presented in footnote 12. When the context sufficiently supports the identification of two arguments, definite pronouns, despite their impoverished descriptive content, can take implicit arguments as antecedents. As Bosch (1983) argues, one should distinguish between pronouns finding their antecedents and whether or not their antecedents are explicitly introduced by referring expressions. The antecedent might be introduced through means other than explicit morphosyntactic expression. In our terminology (excluding exophoric uses of pronouns for now), pronouns can coerce addressees and readers into introducing an additional discourse marker to serve as their antecedent. (See Bosch (1983) and (Bosch 1988) for more details on how antecedents of pronouns may be "implicitly" introduced.) But, since the descriptive content of pronouns is lower than that of most definite NPs, more contextual clues are needed for this accomodation to be possible. This is what happens in the case of the examples cited in footnote 12 where the occurrence of lexical items which are morphologically related to the names of the discourse antecedent to be introduced and marked stress help readers in accomodating the otherwise descriptively poor definite pronouns. We conclude that pronouns, like definite and indefinite NPs, *can* prompt the accomodative introduction of their antecedent discourse markers: accomodation may target all anaphors. It simply does not target all anaphors to the same degree because the ease with which readers accomodatively introduce antecedent discourse markers is, in part, a function of the lexical content of the anaphor. For ease of reference, we call the process by which cross-sentential anaphors whose lexical content is minimal binding *simpliciter* and reserve the term *presuppositional binding* for anaphors whose lexical content is rich, i.e. definite NPs.

The (partial) classification of anaphoric processes which we surveyed in this section embodies the following (revised) hypothesis regarding the discourse role of a-definites in the face of the data presented in section 4.1.

¹⁶It is worth noting that non-grammatically induced "factoring" inferences such as those necessary to identify the referent of *they* to the implicit argument of *tormented* or *tortured* can be drawn in the face of minimal lexical content (see examples (26)). This confirms that (presuppositional) binding and non-linguistically driven "factoring" constitute distinct processes.

Hypothesis 3 *A-definites can serve as antecedents for NPs only via accomodation (definite pronouns or definite lexical NPs) or factoring (indefinite pronouns).*

1. *Lexical NPs make such inferences easier than pronouns because of their additional lexical content.*
2. *Short passives make such inferences easier than middles because the presence of a lexically encoded agent can be used in bridging.*

This hypothesis leads to the following two predictions:

Prediction 1 *Sentences containing definite pronouns or definite lexical NPs should be harder to process when their only plausible antecedent is an a-definite than when it is an indefinite because this identification requires accomodation (i.e., additional inferencing) to take place.*

Prediction 2 *The increased processing difficulty should vary as a function of the lexical content of the anaphor and the availability of a lexically encoded argument position that can be used in bridging.*

These two predictions would rank the relative processing difficulty of the five sentences in (34) as their order of presentation suggests. The discourse in (34a) should be less difficult to process than those in (34b) or (34c), since the latter two require an additional bridging inference to introduce a discourse marker which can serve as antecedent of the definite pronoun or lexical NP. The discourses in (34b) and (34c) should be easier to process than either (34d) and (34e) since the latter do not lexically encode an agent argument to help the construction of a bridging inference. Finally, the discourses in (34b) and (34d) should be easier to process than those in (34c) and (34e), respectively, because the lexical content of the former guides the bridging inference (the owner of the second sentence is likely to be the seller of the first). Although it is difficult to compare (34a) and (34b), because of the slight pragmatic oddity of agentive passives whose agents are explicit indefinite pronouns, we think our predictions are borne out. In particular, it seems that (34b) < (34c) < (34d) in processing difficulty. We are currently testing these predictions experimentally.

- (34) a. The antique vase was sold to a wealthy woman by someone. The owner/He charged a lot of money for it.
- b. The antique vase was sold to a wealthy woman. The owner charged a lot of money for it.
- c. The antique vase was sold to a wealthy woman. He charged a lot of money for it.
- d. The antique vase had sold to a wealthy woman. The owner charged a lot of money for it.
- e. The antique vase had sold to a wealthy woman. He charged a lot of money for it.

5 Conclusion

This paper has focused on the semantic representation of implicit arguments. Its main claim is that implicit arguments are a particular kind of non-quantificational argument — what we call a-definites. As stressed throughout the paper, the category of a-definites is larger than that of implicit arguments. Morphosyntactically realized arguments can also be a-definites, as the example of French subject clitic *on* demonstrates. What characterizes a-definites is their inability to serve as antecedents for future reference, i.e., their discourse inertness. The existence of a-definites is theoretically important because it confirms the underlying assumption of Discourse Representation Theory that semantic representations must include two kinds of information, a set of available discourse markers and a set of predicative conditions. By only contributing to the latter kind of information, a-definites confirm the need for the dissociation of these two types of semantic contributions. The discourse inertness of a-definites is also important within the narrower theoretical context of dynamic approaches to meaning. Their existence favors a DRT-style approach to the dynamic aspect of meaning over other approaches such as that proposed in Chierchia (1995a). As we showed, if the protracted availability of discourse markers for coreference reduces to a dynamic interpretation of existential quantifiers, the difference between indefinites and a-definites cannot be represented.

The (relative) discourse inertness of a-definites does not entail their imperviousness to anaphoric processes. They can indeed serve as antecedents of anaphors. We discussed two such cases in this paper: intrasentential reflexive binding and cross-sentential (in)definite NPs and pronouns. We showed that in both cases, independently motivated analyses of the phenomena existed which did not require abandoning the claim that a-definites do not introduce discourse markers. Following work by Bach and Partee (1980) and Chierchia (1989), we claim that intrasentential reflexives and PRO subjects can be bound to a-definites through a semantic detransitivizing process or meaning postulates, neither of which require the presence of a discourse marker corresponding to the a-definite's referent. Binding of definite NPs or pronouns to a-definites is the result of an accommodation process by which the presupposition attached to definite NPs or definite pronouns is resolved through bridging inferences even when no appropriate antecedent is available (as is the case when the antecedent is an a-definite, according to our hypothesis). Finally, identification of an indefinite pronoun to a previously introduced discourse marker is the result of hearers' or readers' drive to make the discourse coherent. Within this more detailed view of the nature of cross-sentential anaphoric processes, the difference between definite pronouns and definite lexical NPs reduces to the availability of enough lexical content to support bridging inferences. As we pointed out in the last section, if correct, this analysis of cross-sentential anaphoric processes leads to a set of testable empirical predictions regarding the relative difficulty of processing clauses containing anaphors that must be resolved to a-definites.

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