

UNBOUND ANAPHORIC PRONOUNS: E-TYPE, DYNAMIC,
AND STRUCTURED-PROPOSITIONS APPROACHES*

ABSTRACT. Unbound anaphoric pronouns or ‘E-type pronouns’ have presented notorious problems for semantic theory, leading to the development of dynamic semantics, where the primary function of a sentence is not considered that of expressing a proposition that may act as the object of propositional attitudes, but rather that of changing the current information state. The older, ‘E-type’ account of unbound anaphora leaves the traditional notion of proposition intact and takes the unbound anaphor to be replaced by a full NP whose semantics is assumed to be known (e.g. a definite description). In this paper, I argue that there are serious problems with any version of the E-type account as well as the (original form of the) dynamic account. I will explore a new account based on structured propositions, which can be considered a conservative extension of a traditional proposition-based semantics, but which at the same time incorporates some crucial insights of the dynamic account.

Unbound anaphoric pronouns, as in (1a and b), relate to an indefinite noun phrase as linguistic antecedent, but are not in a position to naturally act as a variable bound by the antecedent:¹

- (1) a. Someone broke in. He stole the silver.
- b. If someone breaks in, he will steal the silver.
- c. Someone might break in. He might steal the silver.

On any reasonable logical analysis of the sentences in (1) (respecting minimal syntactic conditions), *someone* cannot be analysed as an existential quantifier binding the variable that *he* may stand for.

Unbound anaphoric pronouns have presented major challenges for semantic theory, giving rise to new developments of *dynamic semantic approaches*, which imply a major revision of the notion of sentence meaning in the traditional sense. A sentence on the dynamic semantic view does not express an independent proposition, but rather serves to change the previous information state in

certain ways so that it will be only the entire discourse that will have truth conditions.

There is an alternative to the dynamic semantic approach which is theoretically much less involving and is in fact entirely compatible with any traditional view of sentence meaning. This is what, following Evans (1985), is called the *E-type approach* to unbound anaphoric pronouns. The E-type approach, essentially, aims at reducing the problem of the semantic relationship between antecedent and unbound anaphoric pronoun to that of replacing the pronoun by a full NP whose semantics is taken to be well-known. The pronoun then is not interpreted directly, but rather first replaced by a nonpronominal NP whose content is retrieved from the previous discourse context (generally a definite description).

The dynamic semantic approach takes unbound anaphoric pronouns to be interpreted as they are, by assimilating them to variables of formal languages. The appropriate interpretation of the pronoun is then achieved by exploiting a certain notion of context: the pronoun can be treated as if it was a variable bound by the antecedent because of the role the preceding sentential or discourse context plays in the interpretation of a sentence.

The E-type approach has enjoyed renewed interest because it appears to be a solution to the problem of unbound anaphoric pronouns that does not require a reconception of meaning beyond the treatment of those pronouns themselves. It is one of the aims of this paper to examine the viability of the E-type approach in its various versions – with an overall negative conclusion. The various difficulties an E-type account faces result from the aim of solving the problem of unbound anaphora in a purely formal way, by replacing the pronoun by a full NP whose semantics is taken to be wellknown. The problems concern the identification of the descriptive content of the replacement, certain purely semantic conditions involving antecedent and pronoun, and the choice of an appropriate determiner for the replacing NP.

The second goal of the paper is to evaluate the dynamic semantic approach to unbound anaphoric pronouns. This approach, which treats unbound anaphora as variables or as variable-like, appears more adequate as an account of the various kinds of occurrences of unbound anaphoric pronouns once it is extended in a certain way to modal and attitude contexts. Despite the seeming superiority of the dynamic semantic approach for the treatment of unbound anaphoric pronouns, however, the overall reconception of meaning

raises serious problems regarding embedded sentences. Plausible as it may seem for independent assertions, it leads to serious problems when propositional anaphora and truth conditions of individual sentences are taken into account – problems that would never arise on an E-type account, which leaves the traditional notion of propositional content intact.

A third goal of the paper, therefore, is to outline a new account of unbound anaphora that preserves the insights of the dynamic account as regards the variable-like status of anaphora and the role of the discourse context for their semantic evaluation, but at the same time does not lead to the problems of the dynamic account, by assigning a central status to the notion of proposition as the meaning of individual sentences and the object of propositional attitudes. This account is based on structured propositions and introduces a notion of a bipartite propositional content of sentences (in an utterance context). A bipartite propositional content consists of a proposition and a background, which, itself construed as a set of structured propositions, possibly provides the truth conditional completion of the proposition, which in turn may contain variable-like objects for the representation of unbound anaphora.

1. THE CONTEXTS FOR UNBOUND ANAPHORIC PRONOUNS

1.1. *Extensional Contexts*

There are three main contexts in which unbound anaphoric pronouns occur. The first context is one in which the sentence containing the pronoun stands in a *conjunctive* relationship to the sentences containing the antecedent, a relationship that obtains both when one sentence merely follows the other, as in (1a), and when the sentences are conjoined by an explicit conjunction, as in (2):

- (2) Someone broke into the house, and he stole the silver.

Because of the kind of examples standardly used, such sentences can also be called ‘conjunctive *donkey*-sentences’. In conjunctive *donkey*-sentences, the antecedent may either be specific, as is possible in (1a) or nonspecific, as more plausibly in (2).

The second context for unbound anaphoric pronouns is one in which the pronoun occurs in the consequent and its antecedent in

the antecedent of a conditional, as in (1b) and (3), with the adverb of quantification *usually*:

- (3) If a farmer owns a donkey, he usually beats it.

Again, because of the kind of examples standardly used, such sentences can be called ‘conditional *donkey*-sentences’.

In a third context, the pronoun occurs in the scope of a quantifier and the antecedent in the quantifier restriction:

- (4) a. Every farmer who owns a donkey beats it.
 b. Most farmers who own a donkey beat it.
 c. Someone who owns a donkey beats it.

These sentences thus are ‘quantificational *donkey*-sentences’.

What is characteristic about all three contexts for unbound anaphoric pronouns is that the pronoun cannot be taken as a variable bound by the existential quantifier the antecedent stands for – given any plausible analysis of the relevant sentences and standard assumptions about existential quantification and about variable binding.

1.2. *Intensional Subordination*

There is a fourth type of context in which unbound anaphoric pronouns may occur, namely contexts of what, following Roberts (1987, 1989), is called *modal subordination*. The phenomenon in question actually is not restricted to modals, but occurs in the same way with conditionals, temporal operators, and attitude verbs. Since what these four contexts (modal, conditional, temporal, and attitudinal contexts) share is constitute an intensional context, the phenomenon in its most general form is better called *intensional subordination*. Once intensional subordination constructions are ‘completed’ in the appropriate way, the pronoun in such constructions is in fact related to its antecedent in just the same way as in contexts of ordinary conditionals and conjunctions.

Intensional subordination is characterized by a pronoun in the scope of an intensional operator being related to an NP in a preceding clause as antecedent that occurs in the scope of a similar intensional operator. A familiar example is (5), where *it* occurs in the scope of the modal *would* and is related to *a wolf* as antecedent which occurs in the scope of the modal *might*:

- (5) A wolf might come in. It would eat you first.

There are two quite different types of intensional subordination: *conditional intensional subordination* and *conjunctive intensional subordination*. The first type is exemplified by (5) because here the second sentence is to be understood as a conditional of the following sort (cf. Roberts 1987, 1989):^{2,3}

- (6) If a wolf came in, it would eat you first.

Obviously the pronoun in (6) can get *a wolf* as antecedent because it occurs in what is to be understood as a conditional *donkey*-sentence. I will disregard this kind of intensional subordination henceforth since it arguably involves simply a modal taking an implicit argument (an antecedent) coming from the preceding discourse, without thus presenting a specific semantic challenge as such.

With conjunctive intensional subordination, the clause required for the evaluation of the pronoun stands in a conjunctive relation to the clause containing the pronoun:

- (7) a. John must write a paper. He must hand it in tomorrow.
 b. John might buy a car. He might buy it soon.
- (8) a. John believes that somebody broke into the house. He believes that he is a relative.
 b. John believes that someone broke into the house. Mary believes that he stole the silver.

These are cases of conjunctive intensional subordination because they are to be understood as if a single intensional operator applied to a conjunction. That is, (7a) is equivalent to (9a), and similarly (8a) to (9b):⁴

- (9) a. John must write a paper and hand it in tomorrow.
 b. John believes that somebody broke into the house and that he is a relative.

(8b) is a case of so-called *intentional identity* describing the attitudinal states of two different agents involving the same possibly only conceived object. It is also a case of conjunctive modal subordination because the second sentence is understood as ‘Mary believes that someone broke into the house and stole the silver’.

It is quite clear that the three sorts of contexts for unbound anaphoric pronouns together define one phenomenon of unbound anaphora, requiring a unified theory rather than separate accounts. First, the sentence-sequencing and conjunctive cases should not be separated from the conditional cases. Otherwise it would lead to difficulties when trying to classify the quantifier restriction case, where, depending on the quantifier, we get both conjunctive (*some, no*) and conditional (*every*) relationships (and the same quantificational construction should better have a unified semantic analysis). Also the intensional subordination cases should not be set aside from the others because once analysed properly, intensional subordination simply divides into conjunctive and conditional *donkey*-sentence constructions, and once an analysis is developed for one of those, there is no reason why it should not apply to the relevant intensional subordination sentences as well. One might argue that intentional identity cases should be treated in a special way in that here the embedded sentences involve some sort of nonexistent object and therefore do not express general propositions. However, the general properties of unbound anaphora that we will identify will hold for intentional identity cases in just the same way as for the others, and thus the same account should apply to them as well.

1.3. *The Readings of Unbound Anaphoric Pronouns*

It is a well-known fact that there need not be a unique entity satisfying the descriptive conditions associated with the antecedent of an unbound anaphoric pronoun – in short the *antecedent conditions* of the pronoun. These are standard examples:

- (10) a. Everyone who has a dog has to register it.
b. If someone has a dog, he has to register it.

- (11) a. Everyone who has a dime should put it in the meter.
b. If someone has a dime, he should put it in the meter.

(10a and b) may be true even if some of the relevant people have more than one dog, and (11a and b) may be true even if some of the people have more than one dime. What (10a) and (10b) claim is that everyone should register every dog he has (as long as he has at least one dog), and what (11a) and (11b) claim is that everyone should put some dime in the meter (as long as he has a dime).

In the absence of uniqueness, as we have just seen, an unbound anaphoric pronoun may display either of two sorts of readings: an *existential* ('weak') reading and a *universal* ('strong') reading.⁵

The possibility of uniqueness not being satisfied is obvious in the case of relative clauses and conditionals. It is less obvious in the case of conjunctions. In fact, Evans (1985) argues that in conjunctions as in (12), uniqueness is generally implied:

- (12) John has a dog. He feeds it daily.

However, even in conjunctive constructions, a uniqueness condition may clearly be violated, for example in (13a), and, most obviously, in conjunctive intensional subordination contexts, as in (13b):

- (13) a. John had a dime. He put it in the meter.
b. Someone might come in. He might want to sit down.

(13a) can be true even if John has more than one dime. It simply claims that John put one of them in the meter. Similarly, (13b) does not imply that only one person might come in.

Somewhat different cases exhibiting failure of uniqueness are the familiar examples in (14):

- (14) a. If a bishop meets another bishop, he blesses him. (attributed to Kamp)
b. Everyone who bought a sage plant, bought two others along with it. (cf. Heim 1982)

In (14a), the pronouns *he* and *him* cannot obviously be replaced by descriptions obtained from the information given by the antecedent. Similarly, no description satisfying the uniqueness condition can be obtained from the relative clause in (14b) to replace *it*.

The Uniqueness Problem is a notorious problem for E-type theories on which the pronoun is to be replaced by a definite description, and it has been a chief motivation for the development of the alternative, dynamic semantic theories.

2. THE E-TYPE APPROACH

2.1. Types of E-type Accounts

Let me now turn to a number of other important semantic properties of unbound anaphoric pronouns and the problems the varieties

of E-type accounts face that try to account for those properties as well as the Uniqueness Problem.

There are different versions of the E-type account. On the original account proposed by Evans (1985), an unbound anaphoric pronoun is to be replaced by a definite description, which is retrieved in some way from the antecedent clause. The relevant sentence is then interpreted by applying a familiar Russelian semantics to the replacing definite NP. Thus, the second sentence of (1a) will receive its meaning by interpreting (15):⁶

(15) The person who broke in stole the silver.

Later versions of the E-type account deviate from Evans's version or elaborate it further in at least one of three respects:

- [1] the way the pronoun relates to the antecedent,
- [2] the formal or contextual identification of the descriptive content of the replacement,
- [3] the nature of the replacement of the pronoun.

These three respects correspond to three general difficulties for any E-type analysis: getting the connection between pronoun and antecedent right, identifying the descriptive content of the replacement, and choosing an appropriate determiner for the replacement. In addition to that, there are two truly semantic conditions on unbound anaphoric pronouns that are hard to account for within an E-type analysis, namely what I will call the Common-Source Condition and the Same-Value Condition. Let us now see what those difficulties are by examining the variations of the E-type account in the three respects.

2.2. *The antecedent-relatedness of unbound anaphoric pronouns*

Unbound anaphora require an explicit antecedent (cf. Heim 1982, 1990; Kadmon 1987). In this respect they differ from definite descriptions, both (more or less) complete ones, as seen in the contrast between (16a) and (16b) (as opposed to (16c)), and incomplete ones (even when their descriptive content is just as impoverished as the one of definite pronouns seems to be), as seen in (17):

- (16) a. John is married. His wife is French.
- b. ??John is married. She is French.
- c. John married someone. She is French.

- (17) a. Mary was raped. But the man was never found.
 b. ??Mary was raped. But he was never found.
 c. Someone raped Mary. He was never found.

The antecedent moreover, needs to be of the right kind (definite or indefinite) and be in the right semantic context, as the classic pair of examples below illustrates:

- (18) a. ?? It is not the case that no man₁ is walking in the park.
 He₁ is in a hurry.
 b. A man₁ is walking in the park. He₁ is in a hurry.

This *antecedent-relatedness* of unbound anaphora is not captured by all versions of the E-type account, for example not by an account on which the antecedent is only part of a pragmatic context that supplies the replacement of the pronoun. One such account, proposed by Cooper (1979) and Heim and Kratzer (1998) says that an unbound anaphoric pronoun has an underlying syntactic form of the sort [D [R]_{NP}]_{DP}, where D is a variable for a determiner and R a variable for a restriction that needs to be supplied either from the linguistic or the nonlinguistic context. Another version proposed by van der Does (1986) says that the pronoun denotes a context-dependent generalized quantifier of the form D(X) where both the determiner D and its restriction X are contextually provided.⁷

What a more adequate E-type account needs to say is that an unbound anaphoric pronoun is to be replaced by a description on the basis of some syntactic relation of the pronoun to an NP antecedent (and perhaps other parts of the antecedent clause). The strongest version of such a syntactic-antecedent account takes *it* in (12) to be syntactically related to the NP *a dog* and to be replaced by a description whose content corresponds to syntactically identifiable parts of the antecedent clause, such as the description '*the N' which VP*' in a syntactic context '*a N' VP*' (cf. Evans 1985, Heim 1990). Weaker versions of the syntactic-antecedent account allow for a weaker descriptive content, including perhaps not all of the predicate's information (cf. Neale 1990) or allowing additional contextual information to complete the description (cf. Ludlow and Neale 1991). The strong version, as we will see next, is hardly tenable.

2.3. *Deviations from Antecedent Conditions and the Discourse-drivenness of Unbound Anaphoric Pronouns*

Often the replacement of the pronoun is not or not entirely syntactically identifiable from the antecedent clause, and thus not all the information provided by the antecedent clause should be part of the description replacing the pronoun. Such *deviations from antecedent conditions*, as I will call them, can occur both across utterances of independent sentences and in cases of modal subordination

The first case, as in (19), due to Strawson (1952), involves correction or contradiction, which takes place, typically, across utterances of different speakers:

- (19) A: A man fell over the bridge.
 B: He did not fall. He jumped.

Here *he* refers to a person of which only part of the conditions expressed by the antecedent clause hold – only a movement ‘over the bridge’.

It is quite easy to see that deviations from antecedent conditions may involve any part of the antecedent conditions.

Deviation from antecedent conditions also occurs with intentional identity cases. One such case, discussed by Edelberg (1985), is this. Suppose X and Y died and detectives A and B (falsely) believe that both were murdered. B believes that X and Y were murdered by the same person, but A does not. Moreover, A believes that X is the mayor, but B does not believe that. In this scenario, the following will be true:

- (20) A believes that someone killed the mayor and B believes that he killed Y.

Here, *he* cannot be replaced by *the one who killed the mayor*, but would have to be replaced by *the one who killed X*.

There are some limits, though, as to the extent of deviation. Edelberg (1985) points out that in general the content of the belief of the first described agent is taken over as part of the belief content of the second agent – but not conversely. Consider (21):

- (21) A believes that someone killed X and B believes that he killed Y.

(21) implies that B believes that the person that killed Y also killed X. The converse does not hold – that is, A need not believe that the person that killed X also killed Y. This asymmetry between the reported belief of A and the reported belief of B is a problem for any account that deals with intentional identity by means of existential quantification over intentional objects (as pointed out by Edelberg 1985). The asymmetry shows instead that the evaluation of a pronoun depends, in an important sense, on the context of the discourse that precedes the pronoun: at least some minimal part of the antecedent conditions needs to be taken over by the replacement of the pronoun.⁸

This *Discourse-drivenness* of unbound anaphora, as I will call it, is captured by the E-type account, which always involves some form of copying of at least some of the antecedent conditions onto what is to replace the pronoun. The problem, however, is that no formal rule of copying can be given that could identify the replacement of the pronoun. At the same time, though, the antecedent-relatedness of unbound anaphora does indicate a formal relationship between the pronoun and the antecedent. This conflict between a formal requirement for obtaining a replacement and the lack at the same time of any formal condition on fully identifying replacement certainly does not help the case of an E-type account.

2.4. *The Regress Problem*

A rather different kind of problem with identifying the descriptive content of the pronoun's replacement is analogous to the one posed by so-called Bach–Peters sentences, as in (22a). Any replacement of the pronouns in (22a) by a description would lead to an infinitive regress, as in (22b), or else lead to the wrong interpretation:

- (22) a. Every pilot who shot at it hit the MIG that chased him.
 b. Every pilot who shot at the MIG that chased every pilot ... hit the MIG that chased him.

The same problem arises with *donkey*-sentences, as was noted by Martin Stokhof (p.c.):

- (23) a. If a farmer owns a donkey, he beats it.
 b. If a farmer owns a donkey, the farmer who owns the donkey ... beats the donkey he owns.

If *he* in (23a) is replaced by *the farmer who owns it*, then we have a description with a *donkey*-pronoun and hence not yet an interpretable full NP, and if *he* is replaced by *the farmer who owns the donkey the farmer owns*, we will not get the right interpretation, since *the farmer* alone is not a complete description. If *he* is replaced by *the farmer who owns a donkey*, then we have a problem with the replacement of *it*: if *it* is replaced by *the donkey he owns*, we still have a *donkey*-pronoun. But if it is replaced by *the donkey a farmer owns*, we get the wrong interpretation for the entire sentence.

As in the case of Bach–Peters sentences, this points at the status of unbound anaphora as variable-like rather than descriptive pronouns (though, as we will see, there are also situation-based solutions available).⁹

2.5. *The Common Source Condition*

Another general problem for the E-type account – as replacing the pronoun by an NP with a known semantics – is that there are purely semantic conditions governing the evaluation of the pronoun in relation to its antecedent. One such condition, noted and/or discussed by Asher (1987), Dekker and van Rooy (1998), Groenendijk et al. (1996b), and Zimmermann (1998), is what I will call the *Common Source Condition*. This condition manifests itself in sentences with intentional identity as in (24a and b):

- (24) a. A believes that someone killed X. B believes that he killed Y.
 b. John said that someone broke into the apartment. Mary said that he stole the silver.

(24a) is acceptable only if A and B have a common source for their belief (e.g. having been presented with the same piece of evidence), or else if there is a communicative link between A's and B's belief (cf. Asher 1987). Similarly, for the report about John's and Mary's utterances in (24b) to be acceptable John and Mary must have been exposed jointly to the same evidence or have talked about some evidence to one another.

The Common-Source Condition is fully general: it holds whenever an anaphoric pronoun takes an antecedent from the attitude context of a different agent. It can be observed even across utterances of different speakers:

- (25) a. A: Someone killed Mary.
 b. B: ?? He is insane / He must be insane.

As Groenendijk et al. (1996b) observe, the first sentence in (25b) is inappropriate if B does not express his thoughts on the basis of the same direct evidence as A (and hence A and B act as a single agent). In this case, rather, the epistemic modal *must* has to be used. The Common Source Condition may manifest itself in various forms; what always matters, though, is that the agents seem to act as a single agent with respect to their beliefs or speech acts or whatever reported propositional attitude.

There is a fundamental difficulty for any E-type account to explain the Common-Source Condition. If crossattitudinal anaphora are handled as at a purely formal level, by replacing them with appropriate full NPs, there is no reason to expect there to be any content-related condition between the attitude reports. An E-type account could only stipulate such a condition.

2.6. *The Same Value Condition and Covariation*

Unbound anaphoric pronouns are subject to another condition that can hardly be conceived as a purely formal condition on the antecedent or the replacement of the pronoun. This condition, which I will call the *Same Value Condition*, says that it is not sufficient for the pronoun to be provided with descriptive conditions coming from the environment of the antecedent, but that it also has to have only semantic values shared by the antecedent. The Same Value Condition manifests itself in cases such as the following in which the antecedent NP contains a pronoun acting as a variable:

- (26) a. Many women saw portraits that resembled them. Many men saw *them* too.
 b. Last year, John met a student who would become his first assistant. Bill met *him* then too.

The pronouns in the second sentences in (26) cannot have a reading on which the pronoun in question would stand for a description containing a variable bound by the subject. Thus, (26a) cannot mean ‘many women saw portraits that resembled them and many men saw portraits that resembled them (the men)’, and (26b) cannot mean that John and Bill both met their future assistants last year.¹⁰

There is a second variant of the Same-Value Condition and that is that the definite NP, were it to replace an unbound anaphora, has to have a rigid interpretation (cf. Evans 1985), or better, has to be interpreted as covariant with its antecedent (Soames 1989, Neale 1990) – that is, the replacing definite NP has to have the same value as its antecedent at a given context of evaluation in intensional contexts. This is illustrated by the coherence of the following examples:

- (27) a. John owns a donkey and it likes carrots. But it might have been that it did not like carrots.
 b. John hired a very good assistant. But he soon won't be his assistant anymore.

Let me call this property of unbound anaphoric pronouns in modal contexts *covariation*.

Thus, the Same Value Condition prohibits antecedent and pronoun to take different values across changes of contexts induced by variable assignments and by an intensional operator. It is hard to account for a purely semantic condition such as the Same Value Condition within an E-type account other than by supplementing it by that very same condition.

Covariation only obtains for modal and temporal contexts, not for contexts of propositional attitudes. Thus, no rigidity effect can be observed in (28):

- (28) Someone broke into the house. Mary believes that he stole the silver.

The natural reading for *he* in the second sentence is not a *de re* reading, as covariation would have it, but a *de dicto* reading (Mary believes that whoever broke into the house stole the silver). The reason obviously is that Mary shares the speaker's assumption, namely that someone broke into the house. If unbound anaphora can take into account such implicit information, then clearly the second sentence of (28) is simply a case of intensional subordination rather than a violation of covariation.

2.7. Problems with the Choice of the Determiner

We have seen that unbound anaphoric pronouns may fail to denote a unique entity, as is necessary to satisfy the Russellian seman-

tics of any replacing definite descriptions. This obvious failure of uniqueness as well as the possibility of weak and strong readings have led to various proposals of how to modify Evans' original E-type account. The proposals fall into two kinds. One kind takes the pronoun to be responsible for the weak and strong readings in the absence of uniqueness, positing two other sorts of replacements of the pronoun besides a singular description. The other proposal modifies the evaluation of the antecedent so as to retain the uniqueness condition, relativising the values of the antecedent to situations or events. The general problem of those proposals, we will see, is that the proposed modifications of the semantics of sentences with unbound anaphoric pronouns always lead to problems in some cases or other that ultimately should fall under the same account.

2.7.1. *Modifying the Replacement of the Pronoun*

One proposal of the first sort allows singular unbound anaphoric pronouns to stand for groups (or sums) rather than individuals, where groups are taken to be the kind of objects that definite plurals such as *the donkeys* refer to, given the most common view of the semantics of plurals (cf. Link 1983 and others). Let me call this the *group-referential (E-type) account*. This account has been proposed for both the weak and the strong reading by Lappin and Frances (1995) and Krifka (1996) and for only the strong reading by Chierchia (1995).

On the group-referential E-type account, the strong reading of a *donkey*-sentence would be represented as in (29a) or as in (29b), where f is a function mapping farmers to the groups of donkeys they own:

- (29) a. Every farmer who owns a donkey beats the donkeys he owns.
 b. Every farmer x who owns a donkey beats $f(x)$.

To account for the weak reading, Lappin and Frances (1995) allow the function f to, alternatively, act as a selection function, mapping a farmer to some group consisting of donkeys that the farmer owns (rather than necessarily the maximal group).

The obvious advantage of this proposal is that different occurrences of unbound anaphoric pronouns – those meeting the uniqueness condition, those displaying a universal reading, and those displaying an existential reading – are given a unified treatment.

However, the proposal faces also some rather critical problems, as discussed in great detail by Kanazawa (2001). The use of group-valued functions generates readings of singular pronouns analogous to those of plural pronouns in places where such readings are entirely unavailable. For example, with an appropriate predicate such as *weigh* or *gather* the group-referential E-type account would predict collective readings to be possible:

- (30) a. Every farmer who owns a donkey weighed it.
 b. Every farmer who owns a donkey gathered it in the yard.

Weighed in (30a) should have a collective reading on which every donkey-owning farmer measured the ‘collective’ weight of the donkeys he owns. But (30a) only allows the reading on which the weight of any individual donkey a given farmer owns is measured. Similarly, one would expect (30b) with an obligatorily collective predicate to be acceptable, which it isn’t.

A way of rescuing the proposal might be by stipulating that group-referring singular pronouns have to be obligatorily interpreted distributively. But even then problems arise, for example with (31a) and (31b):

- (31) a. Every man who has a dog complained about the doctor that examined it.
 b. Every man who has a daughter told her teacher that she is talented.

(31a) allows for a universal reading; hence *it* in the relative clause would be interpreted as referring to the entire group of dogs of a given man. Now if at least one man has more than one dog, the sentence would imply that all the dogs were examined by the same doctor. But the sentence does not imply that. Also (31b) has a universal reading. Then *she* would have to refer to the group of daughters a single man has. This, however, implies that each man told the teacher (or the teachers) of his daughters this: ‘they are talented’. But (31b) allows each man to have uttered only sentences of the form ‘she is talented’ for each daughter. Thus, *she* in (31b) cannot generally refer to the entire group of daughters a given man has.¹¹

The other proposal that modifies the replacement of the pronoun allows the pronoun to be replaced by a quantifier other than a definite description. Thus, for the strong reading, the pronoun would be replaced by a universal quantifier and for the weak reading by an

existential one. Let me call this the *quantificational (E-type) account*. For the universal reading, such an account has been proposed by Neale (1990), and in its full generality, by van der Does (1996).¹²

On the quantificational view of E-type pronouns, (10a) would be interpreted as equivalent to (32a) and (11a) to (32b):

- (32) a. Every man who has a dog has to register every dog he has.
- b. Every man who has a dime should put some dime he has in the meter.

There are two serious problems with the quantificational E-type account. First, E-type pronouns do not display any of the scope interactions with other quantifiers or operators that ordinary quantifiers do. The universal quantifiers E-type pronouns are supposed to stand for can, for example, never take narrow scope with respect to negation:

- (33) Every farmer who has a donkey does not beat it.

(33) disallows a reading on which the sentence is true just in case one of the donkeys of any given farmer fails to be beaten.

Also the supposed quantifiers do not interact in scope with any other quantifiers:

- (34) a. Every man who has a dog bought exactly one leash for it.
- b. Every man who has a dog told a neighbour about it.

Given a universal reading with some men owning more than one dog, it is impossible to interpret *it* in (34a) with narrow scope (so that every man bought exactly one leash for every dog he owns). (34a) can mean only that each man bought exactly one leash for each of his dogs. (34b), similarly, excludes a reading on which every man must have told the same neighbour about each of his dogs.

Another problem with the quantificational E-type account is that like the group-referential account, it yields wrong results with relative clauses and clauses embedded under attitude verbs as in (35):

- (35) Every man who has a daughter told the professor she wanted to study with that she was very talented.

Given a universal reading (35) would be interpreted as equivalent to (36), which is not an available reading (given that at least one of the men has more than one daughter):

- (36) Every man who has a daughter told the professor every daughter wanted to study with that every daughter he has is very talented.

This type of problem also occurs within conditionals, as was pointed out by Barker (1987). Thus, in (37), the first *it* does not allow for a replacement by a universal quantifier, and the second *it* does not allow one by either a universal or an existential quantifier:

- (37) If a theory is classical, then if it is consistent, it is (usually) trivial.

Let me call the problem posed by (35) and (37), i.e. the problem that the pronoun acts like a singular term yet cannot stand just for a single object, *Barker's problem*.

Given the problems with modifying the replacement of the pronoun discussed in this section, we can more generally say that the different readings of sentences with unbound anaphoric pronouns cannot be traced to the interpretation of the pronoun itself, but rather must somehow be traced to the interpretation of the antecedent. This leads to the second way of modifying the E-type account to solve the uniqueness problem, the use of situations.

2.7.2. *Using Situations*

Using situations or events is a popular and often fruitful strategy in semantic analysis and it is no surprise to find the strategy taken in various efforts to rescue the E-type account of unbound anaphoric pronouns. The idea is that a singular definite description, in order to ensure uniqueness, is relativized to a situation or event (cf. Berman 1987; Kadmon 1987; Heim 1990; Ludlow 1994; Elbourne 2001). Let me call this the *situation-based E-type-account*. Because it seems at first sight so promising, it is appropriate to discuss the possibilities this account permits at some greater length.

A situation-based E-type-account generally takes situations to be introduced by an implicit situation quantifier that is associated with the context in which the antecedent of the pronoun occurs. Let us see how this works first with a conditional such as (38):

- (38) If a farmer owns a donkey, he beats it.

On the situation-based view (38) expresses universal quantification over situations and is equivalent to (39):

- (39) Every minimal situation s in which a farmer owns a donkey can be extended to a situation s' in which the farmer in s beats the donkey he has in s .

The minimality condition is necessary to guarantee the uniqueness of the referent of the description. It is necessary also to account for adverbs of quantification like *usually* as in (40a), which are taken to range only over minimal situations described by the restriction of the adverb of quantification, i.e. the antecedent in (40a):

- (40) a. If a farmer owns a donkey, he usually beats it.
 b. For most situations s such that s is a minimal situation in which a farmer owns a donkey, there is an extension s' of s such that the farmer in s beats the donkey he owns in s .

Quantification over situations seems fairly well motivated for certain indicative conditionals, especially those with adverbs of quantification.¹³

The situation-based E-type account also allows for ways to avoid the Regress Problem. First, the problem would be avoided if it is not required that all of the antecedent conditions make up the replacing description. Thus in a minimal situation s in which a farmer owns a donkey in (40a), *the farmer in s* and *the donkey in s* will already satisfy the uniqueness condition.¹⁴ Moreover, even suitably chosen full descriptions would do, namely *the farmer who owns a donkey* and *the donkey that the farmer who owns a donkey owns*.

However, the situation-based account would have to posit situations for all contexts in which unbound anaphora can occur (since the Uniqueness Problem is general), which is hard to motivate.

First, the situation-based account needs to be extended to unbound anaphora with an antecedent occurring in the relative clause of a quantified NP. Implicit quantification over situations must then somehow go along with the quantification expressed by that NP. Thus (41a) would have the analysis in (41b), on a universal reading:

- (41) a. Every farmer who has a donkey beats it.
 b. For every farmer x : every minimal situation s such that x has a donkey in s can be extended to a situation s' in which x beats the donkey he has in s .

But why should (41a) be about situations in addition to being about farmers and donkeys? There does not seem to be any motivation

for introducing implicit situation quantifiers for quantificational *donkey*-sentences other than the Uniqueness Problem itself arising within the E-type account.

Besides that, technical problems arise when trying to accommodate the weak reading of an unbound anaphoric pronoun, as in (42a), which cannot be analysed as in (42b):

- (42) a. Everyone who had a dime put it in the meter.
 b. For every person x : if there is a minimal situation s such that x has a dime in s , then s can be extended to a situation s' such that x puts the dime in s in the meter in s' .

In (42b), an existential quantifier ranging over situations occurs in the antecedent of a conditional which would have to bind the variable s in the consequent – thus, we have the familiar ‘*donkey*-problem’ in another form.

Other cases where situations are hard to motivate are subjunctive conditionals as well as indicative conditionals with an ‘epistemic use’, relating to the world as such, rather than describing regularities among situations. These conditionals say something about a counterfactual state of the entire world or about inferences one would draw about it on the basis of new beliefs. Thus, it is hard to see how conditionals such as (43a) and (43b) can be taken as quantifying over situations, since there is neither partiality nor any spatio-temporal limitation involved:

- (43) a. If Mary had a son, she would have sent him to a good school.
 b. If Mary has a son, she will have sent him to a good school.

(43a) and (43b) say something about how the world would be if Mary had a son, not something about a particular situation, there does not seem to be a reason to take them to quantify over situations in which Mary has a son.

Another problem with the situation-based view, discussed in Heim (1990) and Ludlow (1994), is that situations do not provide sufficient information to guarantee the uniqueness of the referent, as in (14a) and (14b), where the pronouns in the consequent cannot be replaced by a definite description even when relativized to a minimal situation described by the antecedent. To account for such cases, one might take situations to be very fine-grained. For (14a) such a situation may

include only the information that x meets y without including the information that y meets x or it may involve different thematic roles for different thematic roles for *he* and *him* (cf. Ludlow 1994). This way, however, not only do situations lose their intuitive content, but also cases such as (14b) are still not accounted for. An alternative pursued in Heim (1990) is to have the conditional in (14a) quantify over minimal situations containing one bishop, claiming that any such situation s when extended to any situation s' containing another bishop so that the two bishops met in s' can be extended to a situation in which the bishop in s blesses the other bishop in s' . But this account does not work for examples such as (44):

- (44) If a book very similar to another book is published at the same time, it is generally immediately compared to the other book.

Here any situation in which the antecedent is true, must already contain at least two books.

Another problem with the situation-based E-type account arises with nonpersistent quantifiers – that is, quantifiers like *no*, *exactly two*, *at most two*, and *few*, which do not yield the same truth value under extensions of the model or domain. On the situation-based view as formulated so far, the following examples will not get the interpretations they in fact have:

- (45) a. If a farmer has exactly one donkey, he beats it.
 b. If a farmer has no donkey, he is poor.
- (46) a. Every farmer who has exactly one donkey beats it.
 b. Every farmer who has no donkey has nothing to do.

(45a) would be true if any minimal situation in which a farmer owns exactly one donkey can be extended to a situation in which the farmer beats the donkey. But for any farmer who owns n donkeys there will be n minimal situations in which he owns exactly one donkey. This means that (45a) expresses the proposition that every farmer whatsoever beats every donkey he owns, which is clearly wrong. Also, for (45b), the proposal leads to a disaster. The sentence would express the proposition that every farmer – regardless of whether he has a donkey or not – is poor. (46a) and (46a) would be misinterpreted, too. The quantified NP in (46a) would range over all farmers that have one or more donkeys, not only those with exactly one donkey,

and the NP in (46b) would range over all farmers, whether they have a donkey or not. The proposal actually makes it impossible to talk about farmers who own a limited number of donkeys, since when minimal situations are invoked, such farmers would not be distinguished from farmers who own an unlimited number of donkeys.

There are two potential ways of modifying the account so as to accommodate sentences with nonpersistent quantifiers. The first one is to modify the interpretation of nonpersistent quantifiers, as has been proposed by Kratzer (1989) in the context of a situation-semantic treatment of conditionals. She gives the following rules for the interpretation of nonpersistent quantifiers in a situation, where w_s is the world that the situation s belongs to:

(47) *Persistent interpretation of quantifiers*

For a quantifier Q , $[Qx, Fx: Gx]^s = \text{true}$ in a situation s iff for Q -many x -alternatives g' of g such that $[Fx]^{g'} = \text{true}$ in w_s , $[Fx]^{g'} = \text{true}$ in s and $[Gx]^{g'} = \text{true}$ in s .

That is, when a quantifier in a sentence S is interpreted persistently in a situation s , then for S to be true in s , the entities in the entire world have to be counted that satisfy the restriction and the scope of the quantifier, not just those in s .

(47), however, leads to problems when applied to E-type pronouns. If quantifiers are systematically interpreted persistently, then also the definite description replacing an E-type pronoun should be interpretable that way – since a definite description, on a Russellian account, simply denotes a particular nonpersistent quantifier. But if (47) also applies to definite descriptions, the very idea of the situation-based E-type account is missed – namely, that of making the description satisfy the uniqueness condition when relativized to a situation.

One might try to somehow exempt definite descriptions generally from (47). But this gives wrong results in other cases – for example, when an overt definite description occurs in the antecedent of a conditional or in a relative clause, as in (48):

- (48) a. If a student finds the solution to the problem, he will write it down.
 b. If a student finds a solution to the problem, he will write it down.

(48a), unlike (48b), presupposes that there is exactly one solution in the world to the problem in question. Thus, the uniqueness condition of

overt descriptions may have to be satisfied relative to the world rather than a minimal situation, requiring the persistent interpretation.

Alternatively, one might take definite NPs to be interpreted persistently only in certain contexts – namely only when occurring in the antecedent of a conditional or the restriction of a quantifier, but not in the consequent or in the quantifier scope. But also this would be wrong. For example, (47) should not apply to the definite NP replacing a pronoun in a conjunctive *donkey*-construction when it occurs in the antecedent of a conditional, as in (49):

- (49) If John owns a donkey and beats it, Mary will be upset.

The exemption from (47) in the relevant contexts, thus, would have to be limited to descriptions replacing pronouns, rather than applying to descriptions in general. But then the replacement of the pronoun would not be interpreted like any other NP of the same form (and thus a reduction of the semantics of unbound anaphora to the semantics of ordinary full NPs would not be achieved). Recall also from Section 2.2. that definite NPs may act just like *donkey*-pronouns, in which case they are clearly not interpreted by (47).

There is another possible way of rescuing the situation-based view of E-type pronouns, and that is to modify the notion of situation. The proposal would be that a (nonpersistent) quantifier plays a fundamentally different role in a situation than an indefinite or referential NP. A quantifier would contribute not an individual as part of a situation, but a set of properties (a generalized quantifier); only indefinite and referential NPs would contribute an individual. Thus, the situations described by the antecedent of (45a) would be something like sequences of the form $\langle \text{OWN}, a, [\textit{exactly one donkey}] \rangle$, where a is a farmer and $[\textit{exactly one donkey}]$ the set of sets containing just one donkey.

The problem with this is that certain quantified NPs behave just like indefinites in their support of unbound anaphoric pronouns. (48a) and (48b) are examples that are still accounted for since the consequent has to be true with respect to an extension of a minimal situation satisfying the antecedent, which means a situation to which a donkey could have been added. However, a case like (50) is a real problem:

- (50) If a couple has exactly three children and they receive only 200 dollar a month child support for them, they may not be satisfied.

If *exactly two children* in (50) contributes a property of properties to a situation, rather than individuals, then there is no guarantee that there will be an appropriate object in the minimal situation satisfying the antecedent that would be the referent of *them*. For if *them* as an E-type pronoun is replaced by *the children they have*, a minimal situation could just contain one or two children to act as the referent of that description relativized to the situation. Nothing will ensure that only the total of the three children can be the referent of *them*.^{15,16}

2.8. Conclusions

We have seen a number of general difficulties arising with the E-type approach. First, there are difficulties with the identification of the replacement of the pronoun, given that the pronoun must stand in a formal relation to an antecedent. Second, the E-type approach has general difficulties getting the choice of the determiner right that replaces the NP. Finally, the E-type account is unable to account for purely semantic conditions governing the relation between antecedent and pronoun, namely the Common-Source Condition and the Same-Value Condition. The source of these problems is the general strategy on which the E-type account rests, namely trying to solve the problem of the semantics of unbound anaphoric pronouns in a purely formal way, by a formal process of replacing the pronoun by a full NP so that the interpretation of the result can take care of itself.

Overall one can say that the two crucial characteristics of unbound anaphora are first their variable-like status and second the particular way the discourse-driven conditions are identified that govern their evaluation. With this in mind, turn to the alternative treatment of unbound anaphora, the dynamic semantic account.¹⁷

3. THE DYNAMIC SEMANTIC APPROACH

3.1. Essentials of the Approach

The move the dynamic semantic account makes in order to account for unbound anaphora is twofold. First, instead of treating the unbound anaphor as a semantically complete expression, the dynamic approach treats it as open, assigning to a context the task of providing the ‘semantic completion’. Second, the dynamic account

assumes a revision of the notion of sentence meaning, a conceptual proposal that is taken to go along with the first, more technical proposal. The second proposal consists in treating sentence meanings not as propositions, but as contributions to the discourse, as *context change potentials*. Sentence meanings, being potential operations on contexts, thus are taken to be what used to be considered the pragmatic effect of an assertion.

While the first proposal is well-motivated, it appears it does not require the second proposal, which is much more problematic.

The notion of context as the current state of information is of central importance in dynamic theories. The utterance of a sentence relates to a context not only to be evaluated semantically: an utterance also changes the context, generally increasing its information content. In fact this is the only function of a sentence formally implemented in dynamic theories such as Dynamic Predicate Logic (Groenendijk and Stokhof 1991; Groenendijk et al. 1996a) and Discourse Representation Theory (Kamp 1981): the semantic function of a sentence there is taken to be exhausted by the way an utterance of the sentence changes the relevant context.

On dynamic semantic approaches, unbound anaphoric pronouns are assimilated to variables of formal logic. They then receive their value from the context which specifies in some way what objects are being assigned to them. There are differences among dynamic semantic theories with respect to the way the semantic link between the pronoun and the antecedent is conceived. One version of the dynamic semantic account, exemplified by Discourse Representation Theory (Kamp 1981) and File Change Semantics (Heim 1982) regards the antecedent as representing an occurrence of the same variable as the pronoun and posits what amounts to an independent quantifier binding both antecedent and pronoun. On another version, exemplified by Dynamic Predicate Logic (Groenendijk and Stokhof 1991), the existential quantifier interpreting the antecedent is taken to be able to bind a variable outside its scope.

Dynamic semantic theories also divide in another respect – namely as regards the nature of the context. One version, the *semantic dynamic approach*, exemplified by Dynamic Predicate Logic (Groenendijk and Stokhof 1991, Groenendijk et al. 1996a) and (one version of) File Change Semantics (Heim 1982), takes a context to be a semantic object, an information state, which generally is construed as a set of pairs consisting of a possible world and a variable-assignment (namely those world-assignment pairs in which the

assignment assigns objects to the variables in use that satisfy the relevant discourse-given conditions in the world). Another version, the *representationalist dynamic approach*, exemplified by Discourse Representation Theory (Kamp 1981), takes a context to be a purely formal object, a ‘discourse representation structure’.

I will briefly introduce and discuss one representative version of the semantic dynamic approach, namely Dynamic Predicate Logic, in its original version, with its most obvious extension to attitude reports. The problems I will point out will not hold for all subsequent technical modifications or elaborations of that approach, a discussion of which falls outside the scope of this paper. Rather the discussion should serve to highlight the advantages as well as the problems of the dynamic semantic approach (in its more original format) for the treatment of unbound anaphora and thus prepare for structured propositions account I will outline later.

Formally, in Dynamic Predicate Logic (DPL) (with possible worlds), a sentence maps a set of assignments to another set of assignments in various ways: in the case of a simple sentence, by retaining only those world-assignment pairs that make the sentence true; in the case of a negative sentence, by eliminating the world-assignment pairs that make the sentence true; and in the case of an existentially quantified sentence, by adding new world-assignment pairs which make the corresponding open sentence true:

- (51) a. $c + Rt_1 \dots t_n = \{ \langle w, g \rangle \in c \mid \langle [t_1]^{w,g}, \dots, [t_n]^{w,g} \rangle \in [R]^w \}$, if the presuppositions of ‘ $Rt_1 \dots t_n$ ’ are satisfied in c
 = undefined otherwise.
- b. $c + (p \ \& \ q) = (c + p) + q$
- c. $c + \textit{not } p = c \setminus \{ \langle w, g \rangle \mid \{ \langle w, g \rangle \} + p \neq \emptyset \}$
- d. $c + \exists x p = \{ \langle w, g \rangle \mid \exists k (\langle w, k \rangle \in c \ \& \ g[x]k \ \& \ \{ \langle w, g \rangle \} + p \neq \emptyset) \}$
- e. $c + p \rightarrow q = c + (\textit{not } (p + \textit{not } q))$

An atomic formula maps a context to a possibly smaller context by preserving only those world-assignment pairs in the original context that make the formula true. A conjunction applies to a context by applying the conjuncts successively. A negated sentence applies to a context by taking away all those world-assignment pairs that make the sentence without the negation true – that is, those world-assignment pairs that when taken as a singleton set

to which the sentence without the negation applies, will lead to the empty information state. An existentially quantified formula involving a variable x applies to a context by changing the assignment k of any world-assignment pair in the context to those x -alternatives g of $k(g[x]k)$ that make the scope of the existential quantifier true. Finally, a conditional changes a context by having the negation of the conjunction of the antecedent and the negation of the consequent applied to that context – which means, by taking away those world-assignment pairs, which, when verifying the antecedent, would not also verify the consequent (i.e., which would lead to the empty information state when, taken as singleton sets, the consequent is applied to them).

To see how the account works more concretely, take the conjunctive *donkey*-sentence (1a). Based on coindexing of the pronoun and the antecedent as in (52a), this sentence will be translated into DPL as in (52b) with the antecedent and pronoun translated by the same variable:

- (52) a. Someone_i broke in. He_i stole the silver.
 b. $\exists x(\text{person}(x) \ \& \ \text{break in}(x)) \ \& \ \text{steal}(x, \text{ the silver})$

After evaluating the first conjunct, the resulting information state consists only in world-assignment pairs $\langle g, w \rangle$ where g assigns some object a to the variable x in w so that a is a person and broke in in w . When the second conjunct is evaluated, this information state will be changed so that only those world-assignment pairs remain in which the object assigned to x also stole the silver in the relevant world.

Now consider the conditional *donkey*-sentence (1b) with the translation into DPL as in (53) (based on coindexing of antecedent and pronoun):

- (53) $(\exists x (\text{person}(x) \ \& \ \text{breaks in}(x)) \rightarrow \text{will steal}(x, \text{ the silver}))$.

When the antecedent is uttered relative to an information state c , all those world-assignment pairs $\langle g, w \rangle$ will be eliminated from c that have the property that under a minimal change, x is assigned an object by g that is a person and breaks in in w , but then does not steal the silver in w .

DPL must make use of a formal relation (coindexing) between the pronoun and the antecedent, which will make sure that the pronoun is translated by the same variable as the antecedent. The

Antecedent-Relatedness of unbound anaphora thus is accounted for, as is, of course, the Regress Problem and the Problem of Determiner Choice (the pronoun always being treated as a variable). The dynamic view also accounts for the Same Value Condition and for the Discourse-Drivenness of unbound anaphora: When the sentence containing the antecedent is uttered, the context will store the information about what entities are assigned as values to the antecedent variable and satisfy the antecedent conditions; the evaluation of the utterance of the sentence containing the pronoun then takes precisely this information into account so that the pronoun variable will be assigned the same objects as values. Depending on how the antecedent is treated or the context in which antecedent and pronoun occur, the account may be able to construe a weak and a strong reading (in the relevant contexts) (cf. Kanazawa 1994). However, it is less clear whether the semantic dynamic account can cope with disagreement and deviations from antecedent conditions. Moreover, the account needs to be extended to apply to sentences embedded under attitude verbs and modals, which may not be without problems.

3.2. *Extensions of the Semantic Dynamic Approach for Sentences Embedded under Attitude and Modal Verbs*

The question of how the dynamic account applies to clauses embedded under attitude verbs can best be answered by looking at anaphora across different attitude contexts, as in (54):

- (54) Mary believes that somebody broke into the house. She believes that he stole the silver.

In (54), *he* must relate to the variable assignments that were introduced by the embedded clause in the previous sentence. All these assignments assign an object to the variable translating *he* which is specified as a person that broke into the apartment. But since there need not be anybody in the actual world that broke into the house (for all the speaker knows), the variable-assignments should not be associated with the worlds in the speaker's information state, but rather with the worlds that are taken to make up Mary's belief state.

The embedded clause in the first sentence thus sets up a context representing the information about Mary's beliefs, a context that

contains just the information that somebody broke into the apartment. This will be the context to which the embedded clause *he stole the silver* in the second sentence applies, so that *he* will take as its values people that broke into the apartment in Mary's belief worlds. Contexts set up by embedded clauses, thus, play the same role for the evaluation of certain other embedded clauses as contexts set up by independent sentences do for the evaluation of subsequent independent sentences.

The dynamic semantics of attitude reports then looks as follows: a clause embedded under an attitude verb does not apply to the context that constitutes the common ground (representing the information about the world speaker and addressee share), but rather to another context, a context that represents shared information about the content of the relevant propositional attitude of the described agent. Let me call the first sort of context the *primary context* and the second one the *secondary context*.¹⁸

The secondary context is not independent of the primary context, as far as the worlds are concerned. Let us take a context to simply be a set of worlds and suppose every world w in the primary context is associated with an accessibility relation R_a for a given propositional attitude of an agent a . Then the state of information about the content of this attitude relative to c is the union of the sets of worlds determined by the worlds in c . So the secondary context c_2 corresponding to R would be determined by a primary context c_1 as follows:

$$(55) \quad c_2 = \bigcup_{w \in c_1} \{w' | w'R_a w\}$$

However, a reduction of a secondary context to a primary context is by far not straightforward if contexts should include variable assignments. The primary context does not tell us which variable assignments make up a secondary context. For this reason I will use c_1 and c_2 further as terms for primary and secondary context.

Just to note, a formal alternative to that in (55) of conceiving of a secondary context would be to identify it with the set of sets of worlds standing in the relevant accessibility to a given world in the primary context, as in Heim (1992) (without variable assignments) and van Rooy (1998) (with variable assignments).

An attitude report will now be interpreted, roughly, as in (56), where the embedded clause applies to a secondary context c_2 , which

forms part of a complex context $\langle c_1, c_2 \rangle$, with c_1 being the primary context:

$$(56) \quad \langle c_1, c_2 \rangle + \textit{Mary believes that S} = \langle c_1, c_2 + S \rangle$$

This account carries over straightforwardly to conjunctive modal subordination, as in (7a) repeated here as (57):

$$(57) \quad \textit{John must write a paper. He must hand it in tomorrow.}$$

Here the complement of *must* in the first sentence introduces a secondary context that represents the information about a certain kind of necessity (namely that John writes a paper). The complement of *must* in the second sentence then applies to this secondary context, and the anaphor *it* will take as its values whatever is provided by the assignments in that context.

The notion of a context now required will obviously be rather complex and may comprise a hierarchy of subcontexts, including one primary and generally a number of secondary contexts (representing the information about modalities or propositional attitudes). Without further elaborating on this, the potential problems this leads to are how sentences embedded under different attitude verbs (*fear, hope, regret, remember, doubt*) can choose the right secondary context and of what kind of status to give to the context they yield, for subsequent sentences to apply to.¹⁹

3.3. *Problems with the Dynamic Semantic Approach*

3.3.1. *Deviations from Antecedent Conditions and the de dicto Problem*

The dynamic account that I have sketched also has problems with Deviations from Antecedent Conditions. To take care of those, the account would need to make use of information states that are not set up directly by a sentence or discourse, but only partly influenced by one that is. Such *derived contexts*, as I will call them, are driven not by structure, but rather by inference on the part of the hearer and intention on the part of the speaker. Derived contexts would require an operation of revising contexts and formally, they should be made dependent directly on particular interlocutors and particular times, rather than construed as the output of the preceding discourse.

Using derived contexts would solve what I will call the *de dicto* Problem, the possibility that an unbound anaphoric pronoun in an

attitude context takes an antecedent in an un-embedded sentences, as in (28), repeated here as (58):

- (58) Someone broke into the house. Mary believes that he stole the silver.

For the dynamic account (in the form presented) (58) is a problem if *he* has a *de dicto*, rather than a *de re* reading. But (58) is unproblematic if a derived context for the second sentence is postulated, namely a context of belief of Mary that someone broke into the house.

3.3.2. *The Propositional Content Problem*

More serious problems arise with the conceptual move made by the dynamic account, according to which sentences do not express independent propositions, but rather express context change potentials. This view of sentence meaning captures only one aspect of the semantic function of sentences, namely the ability to increase information in a discourse. Sentences, however, also serve to express the content of propositional attitudes, namely both as independent sentences and when embedded under attitude verbs. Such contents, moreover, act as semantically accessible objects, namely for propositional anaphora, referring, as it appears, to the semantic value of *that*-clauses, as is possible in (59):

- (59) a. The conference was good. Mary gave an excellent paper.
Bill thought so too.
b. John believes that the conference was good. He thought that Mary gave an excellent paper. Bill thought so too.
c. Mary believes that someone broke into the house and that she forgot to lock the back door. She believes that he stole the silver. Bill believes the same thing.

So and *same thing* clearly need not refer to the entire secondary information state set up by the embedded sentences of the preceding discourse, as the semantic dynamic view would have to have it. Instead, they may refer to the content of only one sentence. The last sentence of (59a) may just mean that Bill shared the speaker's evaluation of Mary's paper, but not that of the conference. Similarly, in (59b) Bill need to share only John's evaluation of Mary's paper, not that of the conference. Also in (59c), Bill may believe

only that someone broke into the house and stole the silver, but not that Mary forgot to lock the back door.

Let me call the problem of separating the contribution of the *that*-clause from the previous information state the *Separation Problem*.

Propositional anaphora raise another problem for the dynamic approach, and that is that the information content of the previous context could only act as a presupposition, whereas the contribution of the *that*-clause must contribute assertive information:

- (60) Mary believes that someone broke into the house. She believes that he stole the silver. But Bill doubts that.

The last sentence of (60) implies that Bill believes that someone broke into the house (the presupposition of Bill's doubt), but the target of Bill's doubt is only that that person stole the silver (the assertive content of Bill's attitude). Thus, not all of the previous context needs to be 'included' in the value of a propositional anaphor, and if it is so included, it may act only as a presupposition. Let me call this the *Presupposition Problem*.

Related to the Presupposition Problem is what I will call the *Problem of Independent Truthconditions*. Generally, only that part of the information content of a previous context constitutes a precondition for the truth of the *that*-clause that involves unbound anaphora in the *that*-clause.

- (61) a. Mary believes that someone broke into the house. She believes she forgot to lock the door. She believes that he stole the silver.
 b. What Mary believes is true.

(61b), referring to the last embedded clause in (61a), requires only the truth of her belief that someone broke into the house, not of her belief that she forgot to lock the door. Let me call this the *Problem of Minimal Presuppositions*.

The Presupposition Problem arises also with the description of different kinds of attitudes of the same agent, as in (62):

- (62) a. Mary believes that someone might break in. She fears that he might steal the silver.
 b. John revealed that he stole a book. But he concealed that it belonged to Mary.

In (62a), the content of the attitude of belief is distinct from the content of the attitude of fear. But the belief content serves as the presupposition for the fear. In the case of (62a), one might argue that the content of the fear is conjunctive (the actual content of Mary's fear being that someone might break in and steal the silver, with 'fear' not distributing over the conjuncts). But this is not an option in the case of (62b), where the attitude of concealing certainly has no such conjunctive content (John concealing that he stole the book and stole it from Mary).

What this shows is that when unbound anaphora are involved, truth-conditionally incomplete contents are needed not only for the meaning of sentences, but also as the contents of attitudes. That is, the content of one attitude may be truthconditionally dependent on the content of another, that is, it will have truth conditions only in conjunction with the content of the other attitude. This of course goes against the traditional notion of proposition, as an object that has truth conditions inherently and can act both as the meaning of sentences and the context of propositional attitudes.

When we look back at the by now discredited E-type approach, we see that this approach fares considerably better with respect to the problems at hand. The Separation Problem and the Presupposition Problem hardly arise on an E-type approach. On an E-type approach, the notion of an independent proposition is left intact (and at least if a Strawsonian semantics of definite NPs adopted), the separation of presuppositional and asserted information is obtained for free. Also the *de dicto* problem does not arise: there is no problem for a definite or other NP replacing an unbound anaphoric pronoun to be interpreted *de dicto* in a conditional context.

But despite such advantages, the E-type account, as we have seen, displays serious problems in other areas. The task ahead thus is to preserve the insights of the dynamic account regarding both the status of unbound anaphora as variables and the importance of a discourse-related context without running into the problems that arise with the particular way sentence meanings are conceived.

What is needed is appropriate objects that can serve both as the meaning of sentences (and thus the referents of propositional anaphora) and as the contents of propositional attitudes. Such objects should be able to act as the meanings of both independent and embedded sentences and thus be able to also act as the meanings of the antecedent and consequent of conditional *donkey*-sentences and as restriction and scope in quantificational

donkey-sentences. Such objects may have to be truthconditionally incomplete, depending for their truth on relevant propositions in the context. Before elaborating a proposal for such objects, let me briefly discuss the representationalist dynamic theory of Discourse Representation Theory (DRT) (Kamp 1981; Kamp and Reyle 1993). DRT naturally provides a notion of a truthconditionally incomplete content, yet still faces other serious problems.

3.4. *Discourse Representation Theory*

DRT takes the primary semantic function of a sentence to consist in contributing in a certain way to the construction of a Discourse Representation Structure (DRS) representing the entire discourse. It is thus not individual sentences that will have truth conditions, but only the entire DRS which they serve to contribute to. A DRS, in the simplest case, is a pair consisting of a set of discourse markers (acting like variables) and a set of conditions associated with them. Thus, for example (63a) serves to define the DRS in (64a), and the continuation of (63a) in (63b) to expand (64a) to the DRS in (64b):

- (63) a. Someone came in.
b. He sat down.

- (64) a. $\langle \{x\}, \{\text{PERSON}(x), \text{COME IN}(x)\} \rangle$
b. $\langle \{x, y\}, \{\text{PERSON}(x), \text{COME IN}(x), \text{SIT DOWN}(y), x = y\} \rangle$

The truth of a DRS such as (64b) in a model M requires the existence of an embedding function mapping the discourse markers of the DRS onto objects satisfying the conditions of the DRS in M :

- (65) A DRS K is true in a model M iff there is an embedding function mapping the discourse markers in K onto M .

Conditional and quantificational sentences lead to implicational conditions involving two DRSs, as in (66b) and (66d) for (66a) and (66c), which have the truth conditions in (66e):

- (66) a. If someone comes in, he will sit down.
b. $\langle \{x\}, \{\text{PERSON}(x), \text{COME IN}(x)\} \rangle \Rightarrow \langle \{y\}, \{y = x, \text{SIT DOWN}(y)\} \rangle$
c. Every famer who owns a donkey beats it.

- d. $\langle \{x, y\}, \{\text{FARMER}(x), \text{DONKEY}(y), \text{OWN}(x, y)\} \rangle \Rightarrow \langle \{u\}, \{u = y, \text{BEAT}(x, u)\} \rangle$
- e. A condition $K \Rightarrow K'$ is true in a model M iff for every embedding function f mapping the discourse markers of K onto M , there is an extension f' of M mapping the discourse markers of K' onto M .

DRT allows in principle for a separation of the semantic contributions of individual sentences. There are compositional versions of DRT on which individual sentences are associated with partial DRSs (Asher 1993). Thus, (63a) and (63b) first define the partial DRSs (67a) and (67b), which then undergo an operation of union to yield the DRS in (64b):

- (67) a. $\langle \{x\}, \{\text{PERSON}(x), \text{COME IN}(x)\} \rangle$
 b. $\langle \{y\}, \{\text{SIT DOWN}(y), y = ?\} \rangle$

DRSs also serve as the object of propositional attitudes (or as characterizers of attitudinal states) (cf. Kamp 1990).²⁰ Thus, for the discourse in (62a), the content of Mary's belief and of Mary's fear are naturally taken to be the partial DRSs such as (67a) and (67b). The *De Dicto* Problem is also obviously accounted for.

DRT thus seems to provide appropriate entities to serve as potentially truthconditionally incomplete objects of propositional attitudes.

There is, however, the Problem of Minimal Truthconditions, which remains: the truth of a partial DRS that corresponds to a given sentence still depends on the entire previous context. The problem is that any new partial DRS is supposed to be joined with a DRS constructed already stepwise from the previous discourse. In order to leave out irrelevant parts of the discourse not containing information about the relevant pronoun, a compositional approach to DRT would have to explicitly state that union can apply to two DRSs only when they share discourse referents. This, however, goes against the general motivation of DRT of giving a formal account of the processing of a continuous discourse.

3.5. *Barker's Problem for Dynamic Semantics*

Barker's sentence (37) repeated here as (68) poses yet another problem for the dynamic account:

- (68) If a theory is classical, then if it is consistent, it is usually trivial.

Without *usually* (68) is unproblematic for a dynamic account as well as DRT: (68) says that given a variable assignment (for DPL) or embedding function (for DRT) making the first antecedent true, any extension of it making the second antecedent true can be extended to one making the consequent true. But with *usually*, (68) is a serious problem for the dynamic semantic account and DRT (as well as the situation-based E-type account). In (68), the quantification domain of *usually* is given by the variable assignments or embedding functions that make the antecedent of the embedded conditional true. However, when evaluating the entire conditional, one will start out with one function for which an extension has to be found that will satisfy the consequent. This means there will be only one extension to satisfy the embedded antecedent, and *usually* requires that the majority of such functions – thus this one function – satisfy the embedded consequent. The problem arises, in fact, in the same way for the situation-based E-type account, using minimal extensions of a situation. What is needed is to have the entire set of functions available that make the first antecedent in (68) true when evaluating *usually*.

4. AN ACCOUNT OF UNBOUND ANAPHORA WITH STRUCTURED PROPOSITIONS

4.1. *The Basic Ideas*

I will propose an account of unbound anaphora based on structured propositions, that is, the view roughly that propositions are complex entities made up of the contributions of parts of the sentence. The structured propositions view comes in different varieties and has different philosophical and linguistic motivations. The two main different philosophical motivations for taking the meanings of sentences to be structured propositions rather than sets of possible worlds are first and most importantly to get a more fine-grained notion of the content of propositional attitudes (the structured-intensions account of Carnap 1947, Lewis 1972, and Cresswell 1985) and second to get a transparent representation of direct reference and rigid designation, on which names and other rigid designators contribute the objects they stand for to a proposition (the neo-Russellian account of Kaplan 1977, Soames 1985, 1987, and Salmon 1986).²¹

Because of the obvious problems with a possible worlds conception of propositions (logical omniscience), structured propositions

are now preferred conception of propositions in the philosophy of language. But also linguists have made use of structured propositions, not only for the semantics of propositional attitudes (Cresswell and von Stechow 1982), but also for the semantics of questions and answers (cf. Krifka 2001) and the semantics of focus (cf. Krifka 1993).

The advantages of structured propositions for the present purposes are twofold. First of all, structured propositions are suited both for the meaning of sentences and the content of propositional attitudes (and in the latter case, are certainly more adequate than sets of possible worlds or situations). The most important reason for using structured propositions for our current purposes is that they may be truthconditionally incomplete and allow for a representation of anaphoric connections across different structured propositions. A structured proposition will not as such have truth conditions, but only relative to a *background* providing its anaphoric completion (if necessary). A background itself is a set of structured propositions (generally coming from the previous discourse). We thus have a notion of a bipartite propositional content which is truth-conditionally complete, but which may contain a propositional content that is not. The other advantage is that structured propositions may contain variable-like objects as components which will allow for establishing anaphoric connections among different structured propositions. Formally, the account of structured propositions that I will make use of is a further development of that of Soames (1987) (whose motivations, avoiding closure of belief states under logical consequences and providing a transparent representation of direct reference, are rather different from mine). What is crucially added to Soames conception of structured propositions is variable-like elements (parametric objects, as I will call them) and bipartite propositional contents which make up the full content of a sentence in a context of utterance.

The account of unbound anaphora that I will outline will carry over crucial insights of the dynamic account without giving up the traditional notion of propositional content. It aims to account for the requirements of a propositional content (as shown by the Separation Problem and the Presupposition Problem) as well as the various conditions on an adequate account of unbound anaphora that I have discussed, in particular the variable-like status of unbound anaphora and the particular ways the descriptive conditions are determined that govern the semantic evaluation of such a variable-like expression.

I will first present a Soames-style account of structured propositions without taking unbound anaphora into account (and limiting myself to sentences of a rather simple sort). I will then extend the account to sentences with unbound anaphora, introducing parametric objects and bipartite propositional contents.

4.2. *Structured Propositions without Backgrounds*

Structured propositions are sequences composed of the meanings of – generally – primitive constituents, reflecting the syntactic structure of the sentence. Generally, those meanings are the intensions of the constituents (rather than characters in the sense of Kaplan 1977). As in Soames (1987), however, I assume that (directly) referential NPs such as proper names and demonstratives contribute to the structured proposition just the individual they refer to. One-place predicates, by contrast, contribute a property and n -place relational predicates an n -place relation. In the simplest case, such as (69a) with only referential NPs and no embeddings, a structured proposition consists in an n -place property (represented by capital letters) and n objects, as in (69b):²²

- (69) a. John likes Mary.
 b. <LIKE, John, Mary>

Structured propositions require a separate formulation of truth conditions, which in the case of (69a) requires the application of the function LIKE at the world in question to the pair consisting of John and Mary, as in (70):

- (70) $\llbracket \langle \text{LIKE, John, Mary} \rangle \rrbracket^w = 1$ iff $\text{LIKE}^w(\langle \text{John, Mary} \rangle) = 1$

Here $\llbracket \]$ acts as a function mapping a structured proposition onto its intension.

Quantificational NPs contribute a generalized quantifier to a structured proposition, as in (71a) for the simple sentence *every man left*, where the first component is the generalized quantifier defined in (71b), which has as its intension a function from possible worlds to a function from properties to truth values:

- (71) a. <EVERY(MAN), LEAVE>
 b. For a one-place property P, $\text{EVERY(MAN)}^w(P) = 1$ iff $\text{MAN}^w \subseteq P^w$

More generally, structured propositions consist of sequences of an n -place property and n objects a_1, \dots, a_n such that (72) holds:²³

$$(72) \quad \llbracket \langle P, a_1, \dots, a_n \rangle \rrbracket^w = 1 \text{ iff } P^w(a_1, \dots, a_n) = 1$$

For more complex quantificational sentences such as (73a), I will make use of variables as well as a λ -operator. Thus, (73a) will express the structured proposition in (73b), where $\langle \lambda x, \text{LIKE}, j, x \rangle$ will be evaluated as the property in (73c):²⁴

- (73) a. John likes every woman.
 b. $\langle \text{EVERY}(\text{WOMAN}), \langle \lambda x, \text{LIKE}, \text{John}, x \rangle \rangle$
 c. $\llbracket \langle \lambda x, \text{LIKE}, \text{John}, x \rangle \rrbracket =$ the function f such that for any world w and object d , $f^w(d) = 1$ iff $\text{LIKE}^w(\text{John}, d) = 1$

I will restrict myself to the connectives of conditional and conjunction as constituents of structured propositions. Following Soames (1987), I will construe conjunction (simplified) and the conditional as two-place truth functions, so that (74a) will express the structured proposition in (74b) and (75a) that in (75b) (disregarding tense):

- (74) a. John came and Mary left.
 b. $\llbracket \langle \text{AND}, \langle \text{COME}, \text{John} \rangle, \langle \text{LEAVE}, \text{Mary} \rangle \rangle \rrbracket^w = 1$ iff $\text{AND}^w(\llbracket \langle \text{COME}, \text{John} \rangle \rrbracket^w, \llbracket \langle \text{LEAVE}, \text{Mary} \rangle \rrbracket^w) = 1$
 (75) a. If John comes, Mary leaves.
 b. $\llbracket \langle \text{IF}, \langle \text{COME}, \text{John} \rangle, \langle \text{LEAVE}, \text{Mary} \rangle \rangle \rrbracket^w = 1$ iff $\text{IF}^w(\llbracket \langle \text{COME}, \text{John} \rangle \rrbracket^w, \llbracket \langle \text{LEAVE}, \text{Mary} \rangle \rrbracket^w) = 1$

Here AND at a world w maps two truth values to 1 just in case the two truth values are both true, and IF, viewed as material implication, maps, at a world w , two truth values t and t' to 1 just in case t is false or t' is true.

Structured propositions will be embedded in larger structured propositions also of course with sentences involving intensional contexts, as with modals in (76a) and attitude verbs in (76b):

- (76) a. $[\text{John might like Mary}] = \langle \text{MIGHT}, \langle \text{LIKE}, \text{John}, \text{Mary} \rangle \rangle$
 b. $[\text{John believes that Mary is happy}] = \langle \text{BELIEVE}, \text{John}, \langle \text{HAPPY}, \text{Mary} \rangle \rangle$

The contribution of modals to a structured proposition can itself be conceived of as a function mapping structured propositions to truth values, as for *might* in (77):

$$(77) \quad \text{MIGHT}^w(p) = 1 \text{ ff } \forall w'(w' R w \rightarrow p^{w'} = 1)$$

The particular choice of a variable with a lambda operator should not matter for the identity of a structured proposition that acts as the object of a propositional attitude. Strictly speaking, therefore, instead of a single structured proposition p , attitude verbs should take as their argument an equivalence class $\text{Equ}(p)$ of structured propositions that are alphabetic variants of p , for example $\text{Equ}(\langle \text{EVERY}(\text{WOMAN}), \langle \lambda x, \text{LIKE}, j, x \rangle \rangle)$ rather than the structured proposition (73b).

Structured propositions as introduced so far fulfil the traditional purposes of both acting as compositionally determined meanings of sentences and as objects of propositional attitudes. This traditional notion of a structured proposition, however, needs to be extended to account for ways in which structured propositions may be either related to a preceding discourse or to the content of a background attitude. This is achieved by supplementing a structured proposition with a background, the material that provides the ‘anaphoric completion’ of the sentence in question.

4.3. *Structured Propositions with Parametric Objects*

When sentences contain unbound anaphora, they will express structured propositions that contain what I will call *parametric objects*.²⁵ As constituents of structured propositions, parametric objects (symbolized by ‘ x_1 ’, ‘ x_2 ’, ...) have the function of connecting argument positions to each other and to be replaced by real objects in the evaluation of the proposition as either true or false.

As with variables, there will be functions mapping parametric objects onto real objects, functions that I will call *anchoring functions*. Anchoring functions are partial functions from parametric objects to actual objects. Sometimes I will indicate by subscript for which parametric object an anchoring function is defined. For example, an anchoring function f_{x_1} will be a function mapping only the parametric object x_1 onto an actual object.

Both indefinite NPs and pronouns contribute parametric objects to a structured proposition. Indefinites usually also contribute a

restriction on the parametric object, yielding a parametric object x_{1P} for a property P . It must then be the case that $f(x_{1P}) \in P^w$ for the relevant world w .

The interpretation of indefinites and pronouns as the same parametric object will be based on coindexing relations as in (78), which, as in DPL, accounts for the antecedent-relatedness of unbound anaphora:²⁶

(78) Someone₁ walked in. He₁ sat down.

Indefinite NPs then can be distinguished from anaphoric pronouns by having to bear a new index.

Parametric objects play the role of so-called discourse referents, which means they play the role that variables play in the semantic dynamic account and that discourse markers play in DRT. As such they raise the same issue as their correlates raise within those theories and the same two different options present themselves as well.²⁷ First, parametric objects may act as mere placeholders in a structured proposition, to be replaced by real objects in the evaluation of a sentence as true. In this case, especially when acting as the objects of attitudes, propositions should count as the same if they are alphabetic variants of each other with respect to the parametric objects occurring in them. Alternatively, parametric objects may be given more of an ontological status, with some properties of their own besides that of being replaced in the evaluation of a sentence by real objects. In this case, two propositions differing only in a parametric object may count as different. I will come back to these two options at the end when discussing possible explanations of the Common Source Condition.

4.4. *Structured Propositions with backgrounds*

4.4.1. *Backgrounds and background contexts*

Structured propositions may go along with a *background*. A background is a set of structured propositions whose crucial function is to provide the anaphoric completion of unbound anaphora in the sentence. A structured proposition p and a background B together will then form a *bipartite propositional content* $\langle p, B \rangle$.

A background in turn is a subset of what I will call the *background context*. A background context is a context that represents all the speaker's activated pragmatic presuppositions that go along

with the utterance of the sentence. Thus if c is a context of utterance, a background context $b(c)$ will be defined as follows:

- (79) For an utterance context c , the *background context* $b(c)$ is the set of structured propositions p such that p is an activated pragmatic presupposition of the speaker of c .

Because of the Problem of Minimal Truthconditions a background should contain only material that relates to the unbound anaphor in the sentence in question.²⁸ However, a structured proposition involving the parametric object in question may itself involve another parametric object shared by another structured proposition in the background context. Such a proposition needs to be included as well. The background $B_{b(c),p}$ for a structured proposition p relative to a background context $b(c)$ should thus be defined as follows:

- (80) The *background* of a structured proposition p with respect to a background context $b(c)$ is the maximal subset $B_{b(c),p}$ of $b(c)$ such that any proposition p in $B_{b(c),p}$ shares a parametric object with p or else is connected to one by a chain of structured propositions sharing parametric objects.

Formally, bipartite propositional contents can now be obtained from a sentence and a background context as in (81):

- (81) $\text{bipart-prop}(S, b(c)) = \langle [S], B_{(c),[S]} \rangle$, where $[S]$ is the structured proposition expressed by S and $B_{(c),[S]}$ is the background of $[S]$ with respect to $b(c)$

For a sentence to be evaluated as a structured proposition relative to a background $b(c)$, a pronoun in the sentence may be coindexed with a parametric object in a proposition in $b(c)$, which requires the pronoun to be interpreted as the same parametric object. For example, in (78) we have the sentence he_1 sat down and the background $\{ \langle \text{WALK IN}, x_1 \rangle \}$, which will require he_1 to be evaluated as x_1 . The background context thus should also act as a parameter of evaluation for the sentence as in (82a) and in particular we will have the rule in (82b) (but in the following I will generally disregard the dependency of a structured proposition on a background):

- (82) a. $\text{bipart-prop}(S, b(c)) = \langle [S]^{b(c)}, B_{S, b(c)} \rangle$
 b. $[he_i] \{ \langle \dots, x_i, \dots \rangle \} = x_i$, for any index i

A background context as the set of activated pragmatic presuppositions is obviously not just the accumulation of the content of the preceding discourse. Instead, it allows for deviations from antecedent conditions: in independent sentences because the activated pragmatic presuppositions may be different from speaker to speaker (and may change even for the same speaker) thus involving different background contexts $b(c)$ and $b(c')$; in embedded sentences because a speaker may make different assumptions about the contents of the propositional attitudes of different agents even if this has not been explicitly reported.

The background context itself may change in the course of a discourse, even within the utterance of a sentence. This is the case when during the utterance of the sentence, information is added that will constitute the content of an activated pragmatic presuppositions, as is the case with conjunctions and conditionals. The following conditions on evaluating conjunctions and conditionals relative to a background context take care of this:

- (83) a. $\text{bipart-prop}(S \text{ and } S', b(c)) = \langle \text{AND}, \text{bipart-prop}(S, b(c)), \text{bipart-prop}(S', b(c, S)) \rangle$
 b. $\text{bipart-prop}(\text{if } S, \text{ then } S', b(c)) = \langle \text{IF}, \text{bipart-prop}(S, b(c)), \text{bipart-prop}(S', b(c, S)) \rangle$

Here the account obviously incorporates a dynamic feature. Note that this feature consists simply in a change of context determining the background, not in some sort of dynamic meaning itself.

4.4.2. *Backgrounds in Embedded Contexts*

Further conditions need to be posited on backgrounds for sentences embedded under attitude or modal verbs. Crucially, bipartite propositional contents as such may form the objects of propositional attitudes, as seen in the structured proposition in (84b) expressed by the second sentence in (84a):

- (84) a. Mary believes that someone broke in. She believes that he is a relative.
 b. $\langle \text{BELIEVE}, \text{Mary}, \langle \langle \text{RELATIVE}, x_1 \rangle, \{ \langle \text{BREAK IN}, x_{1 \text{ PERSON}} \rangle \} \rangle \rangle$

As such, backgrounds will also be objects of reference for propositional anaphora.

The proposition of a bipartite content will literally be the object of the described attitude. But also the background will be the content of a propositional attitude. In (84a) in fact both proposition and background are contents of the attitude of belief. However, in a case like (62a), repeated here as (85), the proposition will be the content of the attitude of fear, whereas the background will be the content of the attitude of belief:

- (85) Mary believes that someone might break in. She fears that he might steal the silver.

The background *need* not constitute the content of a separate attitude, though (the background belief, as opposed to whatever kind of attitude is reported). It may just constitute part of the content of the same attitudinal state, reflecting simply the order of the attitude reports. This means that attitude reports with a bipartite content are subject to a genuinely disjunctive semantic condition:

- (86) For an attitudinal relation A , an agent a , and a bipartite content $\langle p, B \rangle$, if $[\langle A, a, \langle p, B \rangle \rangle]^w = 1$, then for every $q \in B$, $[\langle A, a, q \rangle]^w = 1$ or $[\langle \text{BELIEVE}, a, q \rangle]^w = 1$.

But how do we get from a background context $b(c)$ to the background $B_{b(c)}$ for a sentence embedded under an attitude verb? Here it is crucial that B consists of propositions suitably associated with the same attitude or else belief:

- (87) For an attitude verb V , bipart-prop(NP V that S , $b(c)$) = $\langle [V], [NP], \langle [S], B' \rangle, B_{b(c), [NP \text{ } V \text{ that } S]} \rangle$, where B' is the set of structured propositions p sharing a parametric object with $[S]$ (or connected to $[S]$ by a chain of propositions sharing parametric objects) such that either $\langle [V], [NP], p \rangle \in b(c)$ or $\langle \text{BEL}, [NP], p \rangle \in b(c)$.

The separation of truth conditions from the propositional content as such (the structured proposition itself) is the crucial advantage in the present context of using structured propositions: it allows to account for the truthconditional dependence among structured propositions, while maintaining a notion of propositional content as a

single object associated with a sentence. It means that the truth of a structured proposition with parametric objects will depend on the truth of the propositions in the background of that proposition (if the background is nonempty). While the truth conditions for a single structured proposition will be relative to an anchoring function as in (88a), for a bipartite content $\langle p, B \rangle$ they will involve quantification over anchoring functions as in (88b), that is, existential quantification over anchoring functions making both the proposition p true and all the structured propositions in B :

- (88) a. A structured proposition p is true relative to a world w and an anchoring function f ($[p]^{w,f} = 1$) iff f is defined for all the parametric objects in p and p' is true in w , where p' is like p except that all parametric objects x in p are replaced by objects $f(x)$.
- b. A bipartite proposition $\langle p, B \rangle$ is true in a world w iff for some anchoring function f , p is true in w relative to f and for all $q \in B$, q is true in w relative to f .

That is, a simple structured proposition may be truth-conditionally incomplete, whereas a bipartite propositional content will be truth-conditionally complete.

Of course, propositions without parametric objects are truth-conditionally complete. In order to have an absolute notion of truth as in (88b) be applicable to them as well, they are to be associated with an empty background, constituting bipartite propositions of the form $\langle p, \emptyset \rangle$ (and requiring (87) and (88) to be suitably modified).

Also modals may take a bipartite propositional content as an argument. A case in point is (conjunctive) modal subordination, as in (89a), where the second sentence will express the structured proposition in (89b):

- (89) a. Someone might walk in. He might sit down.
 b. $\langle \text{MIGHT}, \langle \langle \text{SIT DOWN}, x_1 \rangle, \{ \langle \text{WALK IN}, x_{1\text{PERSON}} \rangle \} \rangle \rangle$

(87) thus goes along with a condition for modal subordination, as in (90), for the modal *might*:

- (90) $f([it\ might\ be\ that\ S], b(c)) = \langle \langle \text{MIGHT}, \langle [S], B' \rangle \rangle, B_{b(c),[it\ might\ be\ that\ S]} \rangle$, where B' consists only of propositions q sharing parametric objects with $[S]$ (or

connected to [S] by a chain of structured propositions sharing parametric objects) such that $\langle \text{MIGHT}, q \rangle \in b(c)$.

The condition that the choice of propositions in the background respect the right degree of embedding is crucial for explaining the second part of the Same-Value Condition (Covariation). Covariation is guaranteed just in case a background carries over the degree and kind of embedding of the antecedent context.

We can now see how the present account does not run into the *de dicto* problem. Consider (28), repeated here as (91):

- (91) Someone broke into the house. Mary believes that he stole the silver.

After the utterance of the first sentence the activated presuppositions of the speaker may not just consist in that someone broke into the house, but also that Mary believes that (in which case $\langle \text{BELIEVE}, \text{Mary}, \langle \text{BREAK INTO}, x_1, \text{the house} \rangle \rangle \in b(c)$). The proposition $\langle \text{BREAK IN}, x_1 \rangle$, because it is suitably embedded, will then be an appropriate element for the background of Mary's belief, whose bipartite content will be $\langle \langle \text{STEAL}, x_1, \text{the silver} \rangle, \{ \langle \text{BREAK INTO}, x_1, \text{the house} \rangle \} \rangle$.²⁹

4.4.3. *Backgrounds in Conditional Contexts*

(88b) contains a simplification: the truth conditions of certain sentences do not require existential quantification over anchoring functions. First, adverbs of quantification like *usually* as in (92a) (together with *if*) are best treated as connecting two parametric propositions and quantifying over anchoring functions, with their own particular quantificational force, as for (92a) in (92b) (with simplifications, leaving out the world component):

- (92) a. If someone owns a dog, he usually will register it.
 b. $\langle \text{USUALLY-IF}, \langle \text{OWN}, x_1 \text{PERSON}, x_2 \text{DOG} \rangle, \langle \text{REGISTER}, x_1, x_2 \rangle \rangle$
 c. For most $f_{x_1 x_2}$ such that $[\langle \text{OWN}, x_1 \text{PERSON}, x_2 \text{DOG} \rangle]^{f_{x_1 x_2}} = 1$, $[\langle \text{REGISTER}, x_1, x_2 \rangle]^{f_{x_1 x_2}} = 1$.

Similarly conditionals (without adverbs of quantification) obviously involve universal quantification over anchoring functions, as in (93b) for (93a):

- (93) a. If someone owns a dog, he has to register it.
 b. For all $f_{x_1x_2}$, if $[\langle O, x_1, x_2 \rangle]^{w, f_{x_1x_2}} = 1$ then $[\langle R, x_1, x_2 \rangle]^{w, f_{x_1x_2}} = 1$.

For evaluating the truth value of a conditional proposition, we actually need to make use of extensions of anchoring functions, since the consequent of a conditional may contain more parametric objects than the antecedent (again leaving out possible worlds):

- (94) For structured propositions p and q , $\langle \text{IF}, p, q \rangle$ is true in w relative to f iff any extension f' of f defined for the parametric objects in p such that p is true with respect to f' , has an extension f'' defined for the parametric objects in q such that q is true with respect to f'' .

(94b) captures only the strong reading of unbound anaphora. But the weak reading can also rather naturally be accounted for. First of all we need to admit the possibility of nonempty backgrounds of antecedent and consequent, given (83b). Then (94) has to be revised as follows:

- (95) *The strong reading of unbound anaphora in conditionals* $\langle \langle \text{IF}, \langle p, B \rangle, \langle q, B \cup \{p\} \rangle \rangle \rangle$ is true in w relative to f iff any extension f' of f defined for p and the parametric objects in the structured propositions in B such that $\langle p, B \rangle$ is true with respect to f' , f' can be extended to an anchoring function f'' such that f'' is defined for q and $\langle q, B \cup \{p\} \rangle$ is true with respect to f'' .

The weak reading can be obtained by having the consequent be evaluated again by existential quantification over anchoring functions. The truth conditions for the weak reading will then be:

- (96) *The weak reading of unbound anaphora in conditionals* $\langle \langle \text{IF}, \langle p, B \rangle, \langle q, B \cup \{p\} \rangle \rangle \rangle$ is true in a world w relative to an anchoring function f iff: if for some extension f' of f defined for the parametric objects in p and in the propositions in B , $\langle p, B \rangle$ is true with respect to f' , then for some extension f'' of f defined for the parametric objects in q and in the propositions in $B \cup \{p\}$, $\langle q, B \cup \{p\} \rangle$ is true with respect to f'' .

Thus, on the weak reading, antecedent and consequent are evaluated rather like independent sentences, whereas on the strong reading there is a single universal quantifier ranging over anchoring functions. As is common for the analysis of unbound anaphora with adverbs of quantification, I will assume that in the absence of an adverb of quantification, conditionals involve an implicit generic operator *O*, binding the indefinite in the antecedent. I will moreover assume that such an operator together with *if* will contribute an element $O_{x_1 \dots x_n}$ to a structured proposition (for parametric objects $x_1 \dots x_n$) with the interpretation given in (97):

- (97) [$\langle O_{x_1 \dots x_n}, \langle p, B \rangle, \langle q, B \cup \{p\} \rangle \rangle$] = 1 iff for all anchoring functions $f_{x_1 \dots x_n}$, if there is an extension f' of $f_{x_1 \dots x_n}$ defined for the parametric objects in p and in the propositions in B making p and the propositions in B true, then there is an extension f'' of f' defined for the parametric objects in p and in $B \cup \{p\}$ such that f'' makes p and the propositions in $B \cup \{p\}$ true.

This allows us now to account for a mixed case like (98a). (98a) will have the syntactic representation in (98b) (with two indices for *someone*: one for the operator, one for the subsequent pronoun). (98b) in turn will denote the structured proposition in (98c):

- (98) a. If someone has a dime, he will use it (for the parking meter).
 b. O_i If someone_{*i*} has a dime_{*2*}, he_{*1*} will use it_{*2*}.
 c. $\langle O\text{-If}_{x_1}, \langle \langle \text{HAVE}, x_1 \text{PERSON}, x_2 \text{DIME} \rangle, \emptyset \rangle, \langle \langle \text{USE}, x_1, x_2 \rangle, \{ \langle \text{HAVE}, x_1 \text{PERSON}, x_2 \text{DIME} \rangle \} \rangle \rangle$

The evaluation of the consequent of a conditional by existentially quantifying over anchoring functions that need to satisfy both the proposition and the relevant background provides a solution to Barker's problem. Barker's example (37), repeated here as (99a), will be assigned the structured proposition in (99b), where both the embedded conditional and its consequent have their own background:

- (99) a. If a theory is classical, then if it is consistent, it is usually trivial.
 b. $\langle \text{IF}, \langle \text{CLASSICAL}, x_1 \text{THEORY} \rangle, \langle \text{USUALLY}_{x_1}, \langle \langle \text{CONSISTENT}, x_1 \rangle, \{ \langle \text{CLASSICAL}, x_1 \text{THEORY} \rangle \} \rangle, \langle \text{TRIVIAL}, x_1 \rangle \rangle, \{ \langle \text{CONSISTENT}, x_1 \rangle, \langle \text{CLASSICAL}, x_1 \text{THEORY} \rangle \} \rangle \rangle$

(99b) is based on a simple application of (83b) to the two conditionals in (99a), as in (100):

- (100) $\text{bipart-prop}(if\ S, \text{ then if } S', S'') = \langle \text{IF, bipart-prop}(S, b(c)), \text{ bipart-prop}(if\ S', \text{ then } S'', b(c, S)) \rangle = \langle \text{IF, bipart-prop}(S, b(c)), \langle \text{IF, bipart-prop}(S', b(c, S)), \text{ bipart-prop}(S'', b(c, S, S)) \rangle \rangle = \langle \text{IF, } \langle [S], B \rangle, \langle \text{IF, } \langle [S'], B \cup [S] \rangle, \langle [S''], B \cup [S] \cup [S'] \rangle \rangle \rangle$

Without *usually*, (94a) is as unproblematic as it is on the semantic dynamic account and in DRT. But also with *usually*, we now get the right interpretation, given that *usually* will be able to bind only the first occurrence of *it* (as *usually* should have its scope limited to the embedded conditional). The truth conditions of (99a) will then be as follows:

- (101) For every anchoring function f , if there is an extension f_{x_1} of f such that $\langle \text{CLASSICAL}, x_{1\text{THEORY}} \rangle$ is true relative to f_{x_1} , then for most extensions f_{x_1} of f such that $\langle \langle \text{CONSISTENT}, x_1 \rangle, \{ \langle \text{CLASSICAL}, x_{1\text{THEORY}} \rangle \} \rangle$ is true with respect to f_{x_1} , $\langle \text{TRIVIAL}, x_1 \rangle$ is true with respect to f_{x_1} .

The reason why this account, unlike any dynamic account, works for such cases is because the embedded conditional as well as its consequent go along with their own backgrounds and because the background of the consequent (which includes the content of the antecedent) will in a way provide the domain of quantification for *usually*.³⁰

4.5. Derivation of some Examples

To show in some detail and more explicitly how the account works, let us apply it to some crucial examples. In the following, we have first sentences with coindexing involving indefinites and anaphora or an adverb of quantification and indefinites. In all cases, it is assumed that the sentences are uttered out of the blue with no activated pragmatic presuppositions being in place:

- (102) a. Someone₁ walked in. He_i sat down.
 b. $[someone_1\ \text{walked in}]^{b(c)} = \langle [walked\ in]^{b(c)}, [someone_1]^{b(c)} \rangle = \langle \text{WALKED IN}, x_{1\text{PERSON}} \rangle$

- c. $\text{bipart-prop}(he_1 \text{ sat down}, \{ \langle \text{WALKED IN}, x_{1\text{PERSON}} \rangle \}) = ([he_1 \text{ sat down}]^{\langle \text{WALKED IN}, x_{1\text{PERSON}} \rangle}, \{ \langle \text{WALKED IN}, x_{1\text{PERSON}} \rangle \}) = \langle \langle \text{SIT DOWN}, [he_1]^{\langle \text{WALKED IN}, x_{1\text{PERSON}} \rangle} \rangle, \{ \langle \text{WALKED IN}, x_{1\text{PERSON}} \rangle \} \rangle = \langle \langle \text{SIT DOWN}, x_1 \rangle, \{ \langle \text{WALKED IN}, x_{1\text{PERSON}} \rangle \} \rangle$
- (103) a. Someone₁ broke in. Mary believes that he₁ is a thief.
 b. $[someone_1 \text{ broke in}] = \langle \text{BREAK IN}, x_{1\text{PERSON}} \rangle$
 c. $\text{bipart-prop}(Mary \text{ believes that } he_1 \text{ is a thief}, \{ \langle \text{BELIEVE}, Mary, \langle \text{BREAK IN}, x_{1\text{PERSON}} \rangle \rangle \}) = \langle \langle \text{BELIEVE}, Mary, \langle \langle \text{THIEF}, x_1 \rangle, \{ \langle \text{BREAK IN}, x_{1\text{PERSON}} \rangle \} \rangle \rangle, \{ \langle \text{BREAK IN}, x_{1\text{PERSON}} \rangle \} \rangle$
- (104) a. Someone₁ broke in. He₁ might be a thief.
 b. $[someone_1 \text{ broke in}] = \langle \text{BREAK IN}, x_{1\text{PERSON}} \rangle$
 c. $\text{bipart-prop}(he_1 \text{ might be a thief}, \langle \text{BREAK IN}, x_{1\text{PERSON}} \rangle) = \langle \langle \text{MIGHT}, \langle \langle \text{THIEF}, x_1 \rangle, \{ \langle \text{BREAK IN}, x_{1\text{PERSON}} \rangle \} \rangle \rangle, \{ \langle \text{BREAK IN}, x_{1\text{PERSON}} \rangle \} \rangle$
- (105) a. O_i If someone_{i1} has a dime₂, he₁ will use it₂.
 b. $\text{bipart-prop}(O_i \text{ If someone}_{i1} \text{ has a dime}_2, he_1 \text{ will use it}_2, \emptyset) = \langle \text{O-IF}_{x_1}, \text{bipart-prop}(\langle someone_{i1} \text{ has a dime}_2, \emptyset \rangle), \text{bipart-prop}(he_1 \text{ will use it}_2, \emptyset \cup \{ someone_{i1} \text{ has a dime}_2 \}) \rangle = \langle \text{O-IF}_{x_1}, \langle \langle \text{HAVE}, x_{1\text{PERSON}}, x_{2\text{DIME}} \rangle, \emptyset \rangle, \langle \langle \text{USE}, x_1, x_2 \rangle, \{ \langle \text{HAVE}, x_{1\text{PERSON}}, x_{2\text{DIME}} \rangle \} \rangle \rangle$

4.6. Deriving the Common Source Condition

Let me at the end briefly address the question of how the Common Source Condition could be explained, just mentioning two options without going into any greater discussion. On the present account the Common Source Condition can be derived in two different ways, depending on how parametric objects are conceived. There are two possible views about parametric objects: [1] Parametric objects act as mere place holders that serve to link argument positions to each other. [2] Parametric objects have some epistemic content of their own. On the first view, belief contents reported with the help of unbound anaphora constitute beliefs that may be purely general and that are dependent on each other truthconditionally. On that view, the dialogue in (106) could be reported by the discourse in (107):

- (106) A: Break-ins are really easy in this house.
 B: Yes, and should it happen, I am really afraid for my jewelry
- (107) A believes that someone might break in. B believes that he might steal the silver.

On the first view, (106) would be an adequate report of the general beliefs of A and B; on the second view the report would be inadequate because the parametric objects have an epistemic content of their own. The crucial question for the first view is whether a reinterpretation of all the contexts in which parametric objects have been used is possible that would not make reference to them. The crucial question for the second view is what exactly the epistemic content of the parametric objects should be (cf. Zimmermann 1998). The two different views are naturally associated with different explanations of the Common Source Condition.

If parametric objects indeed have the status of epistemic objects of some sort, then the Common Source Condition is naturally viewed as an individuation condition on such objects, in particular as a condition on when parametric objects can be shared by different agents (cf. Dekker and van Rooy 1998; Zimmermann 1998).

On the other view, the Common Source Condition could be viewed as a condition on when it is possible for an agent to form a background on the basis of the background of a different agent. The condition would require that this is possible only when the two agents can be said to share a collective mental state. That is, in the transition from the first sentence in (108a) to the second sentence we have propositions as in (108b) and (108c), the latter requiring John and Mary (the sum John v Mary) to share a collective belief state:

- (108) a. John believes that someone broke into the house. Mary believes that he just stumbled in.
 b. <BELIEVE, John, <BREAK IN, $x_{1PERSON}$, the house>>
 c. <BELIEVE, John v Mary, <ENTER, $x_{1PERSON}$, the house>, <BELIEVE, MARY, <STUMBLE IN, x_1 >>

For John and Mary to have a collective belief state that someone entered the house, that belief needs to have been formed on the basis of the same evidence or else there needs to have been a communicative link between John and Mary. Thus, the Common Source Condition would be an individuation condition on contexts representing collective intentional states of two or more agents – that is,

intentional states in which the agents act as one single agent. A context of this kind does not just represent shared attitudinal contents, but rather the content of one single attitudinal state or act with several agents as participants. The participating agents must then have arrived at the relevant content on the basis of the same external source or by having communicated among each other. The required link between the attitudinal states of the agents with crossattitudinal anaphora would, on that view, result from conditions on setting up a context representing the content of a collective propositional attitude when only a context representing the content of an individual propositional attitude has been introduced explicitly.

A full discussion of the two possibilities of deriving the Common Source Condition and the associated issue of how to understand parametric objects goes far beyond this paper. The foregoing remarks were simply to indicate what the two options are for explaining the Common Source Condition.

5. CONCLUSIONS

In this paper, we have seen some fundamental problems with the E-type account as well as the dynamic semantic account. Whereas the crucial advantages of the E-types account were the preservation of the traditional notion of proposition with its truth conditions being independent of those of the previous discourse context, the advantages of the dynamic semantic account included the variable-like treatment of unbound anaphora. The present account incorporates both of those aspects: [1] by using structured propositions which are meanings associated with individual sentence (though possibly with truth conditions that need to be supplemented by a background) and [2] by using parametric objects, thus giving justice to the variable-like status of unbound anaphora.

The account deals with Antecedent-Relatedness and Discourse-Drivenness of unbound anaphora, the Regress Problem, the Same-Value Condition, and the problem of determiner choice, in essential the way the dynamic account does. The account moreover, did give some importance to the notion of context change, but in the sense that backgrounds of static meanings are determined by background contexts that themselves may change within the utterance of a sentence. The crucial empirical advantages of the present account over the dynamic account

are that it gives a more immediate or better account of deviations from antecedent conditions and that it provides a solution to Barker's problem.

However, what the account most importantly achieves is to provide a notion of proposition that can act simultaneously as the meaning of sentences, as the potential object of a propositional attitude, and as the semantic value of propositional anaphora. With this, it avoids the kinds of problems with the treatment of propositional attitudes that the semantic dynamic account tends to face. With the bipartite notion of proposition, it also give justice to the fact that the content of a propositional attitude may be truthconditionally incomplete, requiring truthconditional completion from the content of the relevant background attitude.

NOTES

* Previous versions have been presented at a graduate seminar at CUNY, the University of Amsterdam, the University of Stuttgart, the University of Tuebingen, the University of Berlin, and the University Paris 7. A much older version had been circulated under the title 'E-type and Dynamic Approaches to Unbound Anaphoric Pronouns'. The paper throughout its various versions has profited from discussions with or comments from Brad Armour-Garb, Bob Fienngo, Kit Fine, Hans Kamp, Jeroen Groenendijk, Polly Jacobson, Gary Ostertag, Brian Loar, Peter Ludlow, Francois Recanati, Stephen Schiffer, Robert Stalnaker, Martin Stokhof, and especially Paul Dekker.

¹ Other terms are used in the literature for more or less the same class of pronoun occurrences, namely 'E-type pronoun' or '*donkey*-pronoun'. I refrain from using the first term because it is theory-laden and the second because it does not necessarily include conjunctions or sequences of sentences without conditional or quantifier.

² Conditional intensional subordination also occurs in overt conditionals as in (1a) and temporal contexts as in (1b):

- (1) a. If John bought a car, he would drive it to work. He would use it a lot.
- b. John always drinks a cup of coffee in the morning. Sometimes, he puts sugar in it.

The second sentences of (1a) and (1b) must be understood as (2a) and (2b):

- (2) a. If John bought a car, he would use it a lot.
- b. When John drinks a cup of coffee in the morning, he sometimes puts sugar in it.

³ Roberts (1996) takes intensional subordination to always involve a domain restriction, which means the intensional operator in the second sentence of a

modal subordination construction always takes as a domain a set of worlds, times, or situations specified somehow by part of the preceding sentence. Thus, in the case of conditional intensional subordination with modal operators, the antecedent of the conditional of the first sentence serves to restrict the domain of the modal in the second sentence. This account in terms of domain restrictions, however, applies only to conditional intensional subordination. Roberts (1996) in fact takes all cases of intensional subordination to be of the conditional sort and does not recognize the conjunctive type.

⁴ There are more complicated cases of conjunctive modal subordination, for example (1):

- (1) John believes he made a mistake. He hopes he can correct it.

(1) is clearly not a case of conditional intensional subordination — though it is also not so obviously construable as a case of conjunctive intensional subordination. For (1) is not equivalent to (2):

- (2) John hopes that he made a mistake and can correct it.

In (1) John's belief figures as a presupposition of John's hope.

⁵ Even though the contrast between (10) and (11) may suggest that it is a matter of background knowledge or perhaps the information content of the sentence, other factors also play a role. For example, when the pronoun occurs in the restriction of a quantifier, it also depends on certain logical properties of the quantifier. Following Kanazawa (1994), the existential reading is obligatory with quantifiers that are monotone decreasing in both argument positions (e.g. *few*, *no*, *at most two*) and those that are monotone increasing in both argument positions (e.g. *some*, *three*, *at least two*). Thus, in (1a) and (1b) below only an existential reading of *it* makes sense:

- (1) a. No one who owns a donkey beats it.
b. Some people who own a donkey beat it.

If the monotonicity of the first and second argument position of a quantifier do not match, then, according to Kanazawa (1994), both the existential and the universal reading are available, the actual choice of the reading being dependent on semantic and pragmatic factors.

⁶ There is an inherent problem with the idea that the definite NPs is interpreted like a Russellian definite description, referring to the unique object satisfying the descriptive content. It is rather controversial that definite NPs are always Russellian definite descriptions. Thus, even in contexts displaying lack of uniqueness (including donkey-pronoun contexts) definite NPs are perfectly acceptable:

- (1) a. Everyone who has a dog has to register the dog.
b. If anyone has a dog, he has to register the dog.
(2) a. Everyone who has a dime should put the dime in the meter.
b. If anyone has a dime, he should put the dime in the meter.
(3) a. If a bishop meets another bishop, the bishop blesses the other bishop.

- b. Everyone who bought a sage plant bought two others along with the sage plant.

If the semantics of definite NPs is not generally the Russellian one (or any other that involves uniqueness), the semantics of the replacing definite NP is not any better known than the semantics of the pronoun that is to be replaced.

There is good reason not to allow the replacement of an unbound anaphoric pronoun to be interpreted in a different or more restricted way (i.e. only as a Russellian definite description) than the corresponding overt full NP. It is in the nature of the E-type account – and it is its main appeal – to reduce the semantics of unbound anaphoric pronouns to the semantics of overt full NPs: once a replacement of the pronoun by a full NP is found, its interpretation should take care of itself. If the replacement of the pronoun takes the form of an ordinary full NP, but is not interpretable in the same way, no reduction is being achieved, and the appeal of the E-type account is certainly lost.

⁷ The requirement of an NP-antecedent is not entirely strict. Even pronouns that relate to the previous linguistic context can be interpreted without an NP-antecedent. Thus, (16b) and (17b) are not entirely impossible – in particular, when there is a sufficient pause between the utterance of the first and the utterance of the second sentence, and even more so when the sentences are uttered by different speakers. Related to this observation is the fact that pronouns may also occur deictically without relating to any linguistic context at all.

⁸ In the literature, it has sometimes been claimed that all of the antecedent conditions may be denied (cf. van Rooy 1996, Dekker and van Rooy 1998, and even Geach 1967, for the original examples of intentional identity). But I would claim that there is always what I would call an *implicit antecedent condition* that needs to be carried over for the evaluation of the pronoun.

⁹ Note that the phenomenon also occurs in attitude contexts and in particular with intentional identity:

- (1) John thinks a farmer bought a donkey. Mary thinks that that the farmer beats the donkey.

This again indicates that unbound anaphora in attitude contexts should not be treated any different from this in independent sentences.

¹⁰ The Same-Value Condition distinguishes unbound anaphoric pronouns from pronouns that occur in so-called *paycheck*-sentences, as in (1):

- (1) a. The man who gave his paycheck to his wife is wiser than the one who gave it to his mistress.
 b. John picked up his passport today. Bill picked it up yesterday.
 c. Mary met her supervisor yesterday. John met him today.

In (1a), *it* has a reading in which it stands for *his paycheck* where *his* is bound not by *the man*, but by *the one*, and similarly for *it* and *him* in (1b) and (1c). Unlike true unbound anaphora, the *paycheck*-phenomenon is quite limited, subject to particular conditions on the antecedent NP. In the following cases, ‘*paycheck*-interpretations’ of the pronoun are hardly available:

- (2) a. The man who gave the books he recently bought to his wife is wiser than the one who gave them to his mistress.
 b. Today John picked up the umbrella he left in my house. Yesterday Bill picked it up.
 c. Mary met her sister today. Sue met her yesterday.

Since, the overall structure of the sentences is parallel, the difference between the examples in (1) and those in (2) should be attributed to the kinds of NPs acting as the antecedent for the pronoun. In (1), the NPs contain a head noun that denotes a function: *paycheck* denotes a function from people to paychecks, *passport* a function from people to passports, and *supervisor* a function from people to supervisors. By contrast, the NPs in (2) are not functional in nature. They simply consist in a description with a bound variable. (This is in accordance with the fact that if the discussion is explicitly about recent book-buyings, people who left an umbrella in the speaker's house, or sisters that play a particular role (and thus involve pragmatically 'established' functions) even (2a–c) become acceptable.) For an NP to denote a function thus is a necessary condition for a paycheck interpretation. Pronouns in *paycheck*-sentences then are special in that they obtain their semantic value by means of a function given by the antecedent NP. For such pronouns, an E-type analysis is neither necessary nor plausible, unlike what has been argued by Chierchia (1995).

¹¹ In the cases of (31a) and (31b), appeal to an obligatory distributive reading does not help. Distributivity of the standard sort with full NPs generally affects only a plural argument and its predicate. It generally cannot reach outside a tensed clause, as can be seen below:

- (1) a. Bill met the doctor that examined Bill's dogs.
 b. Bill told me that John's daughters are talented.

In (1a), the object NP must refer to a single doctor that examined all of Bill's dogs and cannot refer to as many doctors as there were dogs of Bill examined. Similarly, (1b) implies that Bill made an utterance about all of John's daughters, not an utterance about each one of them. Thus, no independently motivated rule of distributivity is available to explain the absence of collective readings in (31a) and (31b).

¹² Neale (1990) takes the pronoun to stand for a 'numberless description', as in (1):

- (1) '[*wh x: Fx*] (*Gx*)' is true iff $|\mathbf{F} \setminus \mathbf{G}| = \emptyset$

For (1) to be true, this simply amounts to the pronoun standing for a universal quantifier ranging over individuals – not to the pronoun standing for description referring to a group of unspecified number, as Chierchia (1995) and Lappin and Frances (1995) seem to take the view to be.

¹³ But even for adverbs of quantification, quantification over situations *only* is problematic, as has been carefully shown by Dekker (1997). Dekker's general conclusion is that situations within the situation-based approach lose their intuitive content if they are to account for all cases of E-type pronouns.

¹⁴ Slightly more problematic may be examples such as (1a) and (1b):

- (1) a. If woman loses a husband, she should mourn him for at least a year.
 b. If a mother criticizes a daughter, she should be careful not to antagonize her.

In (1a) a regress results if the description to replace *him* contains the noun *husband*. To avoid a regress, the replacement needs to be further impoverished as something like ‘the man in *s*’ or the husband of someone in *s*’, for *s* the relevant situation. While this is not necessarily as such a problem for the situation-based E-type account, it does not make it more attractive either.

¹⁵ Using quantifiers as parts of situations would also be the way of accounting for the asymmetric reading, e.g. the reading of (1) where *usually* counts only students, not student-mistake pairs.

- (1) If a student finds a mistake, he usually corrects it.

This requires, again, extending situations by adding single mistakes, to act as the referent of the situation-relative description ‘the mistake in *s*’.

¹⁶ The situation-based account of E-type pronouns is closely related to the way incomplete attributive definite NPs are treated in Situation Semantics (Barwise and Perry 1983). In Barwise and Perry (1983), the uniqueness of the referent of an attributive incomplete description such as *the murderer* in (1a) is taken to be guaranteed by sentences describing situations, rather than possible worlds. The truth conditions of (1a) given by Barwise and Perry (1983) are roughly as in (1b):

- (1) a. The murderer is insane.
 b. [*the murderer is insane*] = true if there is a factual situation *s* such that the only murderer in *s* is insane in *s*

(1a) will be true in a situation *s* just in case *s* contains exactly one murderer and that murderer is insane.

(1b) makes use only of situations, not of minimal situations. Nonetheless – and not surprisingly – the same problems arise here (and were pointed out by Soames 1986), as in the case of the situation-based E-type account. First of all, situations do not sufficiently discriminate entities that can be referred to by incomplete descriptions, as in Soames’s (1986) example (2):

- (2) The cook is better than the cook that prepared the main course.

Given the semantics of definite NPs as in (1b), it is impossible for (2) to be true in any situation. No situation providing a unique referent for *the cook* in (2) will have space for another cook for the second NP.

On the situation-semantic account, problems also arise with nonpersistent quantifiers. Given (1b), for (3) below to be true, it is sufficient to find some situations not containing any student failing the exam – regardless of how many students actually failed:

- (3) No student failed the exam.

In order to account for nonpersistent quantifiers, Barwise and Perry (1985) modify their earlier proposal for incomplete definite descriptions. But see again Soames (1989) for a criticism of the new proposal.

¹⁷ The E-type account is not always viewed as an alternative to the dynamic semantic approach. Van der Does (1996), for example, investigates an E-type account within a dynamic semantic framework. Also the use of abstraction in Kamp and Reyle (1993) within Discourse Representation Theory comes close to an E-type account.

¹⁸ The distinction between primary and secondary contexts for the semantics of attitude contexts, has been made first by Stalnaker (1987). It is, moreover, a distinction customarily made for the treatment of attitude reports as well as modal subordination within the representationalist dynamic account of Discourse Representation Theory (see in particular Kamp 1987, 1990 and Asher 1986, 1987). Within the semantic dynamic approach, the distinction has, in a way, been made by Heim (1992) and van Rooy (1998), cf. Fn. 17.

¹⁹ In fact a variety of different secondary contexts of different attitudes (of the same or different speakers) would need to be distinguished, unless one likes to attempt to reduce propositional attitudes generally to that of belief, as Heim (1992) seems to suggest.

Van Rooy (1998) in fact posits coindexing of an attitude report and a secondary context in order to get the choice right.

²⁰ As such, as Kamp (1990) acknowledges, the content of a propositional attitudes may be truth conditionally incomplete and depend on other contents.

²¹ See King (2001) for an overview of philosophical accounts of structured propositions.

²² In order to account for cases of hyperintensionality, LIKE should actually better not be taken as an intension (a function from pairs of individuals to truth values), but rather as a primitive object which *has* an intension (a function from worlds to a function from pairs of individuals to truth values). However, for the sake of simplicity, I will disregard this in what follows.

²³ A component of a structured proposition may also itself be a sequence of an n -place intensional function and n objects. Such embedded semantic structures are needed for more complex sentences, involving modifiers, connectives, or sentence-embedding expressions. For example, (1a) will express the structured proposition in (1b):

- (1) a. John likes the mother of Mary.
 b. <LIKE, John, <MOTHER, Mary>>

²⁴ Such structured propositions in turn can be based on logical forms obtained from Quantifier Raising, as below:

- (1) Every man_i [John likes t_i].

²⁵ For a very similar use of parametric objects, within Situation Semantics see Gawron and Peters (1990).

²⁶ The syntactic relation an unbound anaphoric pronoun enters with an NP-antecedent is not of the usual sort. Syntactic relations are generally limited to sentences and do not obtain across sentence boundaries. Moreover, there does not

seem to be significant syntactic conditions on when an NP can relate as an antecedent to a pronoun. But still the anaphor-antecedent relation can be conceived of as a syntactic relation, one that simply does not impose particular structural conditions on when it may obtain. This peculiar syntactic relation correlates with the special nature of the interpretation of such pronouns, in that the interpretation of unbound anaphoric pronouns is only partly determined linguistically, another factor being speaker's intentions.

²⁷ One might think that a background should include also presuppositions of the sentence in question and thus not be limited to material involving unbound anaphora. A background should indeed include presuppositions. However, I endorse a treatment of presuppositions according to which in the relevant cases they count as unbound anaphora. See Moltmann (to appear).

²⁸ See Zimmermann (1998) for a very insightful discussion of different views of the epistemic status of discourse referents.

²⁹ One problem the account still has to deal with is the possibility of quantified antecedents of unbound anaphora such as *exactly one donkey* in (1):

- (1) If John has exactly one donkey, he beats it.

Obviously, *exactly one donkey* cannot just be treated as standing for a restricted parametric object. A possible solution to the problem is to have *exactly one donkey* make two contributions to a propositions: one being a free parametric object, the other one a quantifier. (1) would then stand for the following structured proposition:

- (2) <IF, <<HAVE, John, $x_{1\text{DONKEY}}$ >, <EXACTLY ONE, <DONKEY, < λz , HAVE, John, z >>>, <BEAT, John, x_1 >>

Obviously, such an account needs more motivation and has to be worked out properly.

³⁰ Barker discusses another case, given in (1a), which may seem more problematic for the current proposal. (1b) is equivalent to (2):

- (1) a. If Sophie wins, she will give the money to charity.
b. It will be a worthy one.
(2) It – the charity she will give the money to if she wins – will be a worthy one.

The current account only has the means of assigning the second sentence a single background, consisting of the information that Sophie wins and gives the money to charity. This, though, would make the sentence a case of conjunctive modal subordination. Conditional subordination should perhaps better be treated by assigning the sentence an implicit propositional argument, acting as the antecedent of an implicit conditional. However, in order to evaluate the pronoun, this proposition would have to be a conjunctive proposition, making (1b) equivalent to (3):

- (3) If Sophie wins and gives the money to charity, it will be a worthy one.

Although Barker argues that (1b) should not be analysed as (3), I don't see much of a problem in such an analysis. (2) is stronger than (3) in that it implies that Sophie will give the money to charity just in case she wins. But this is what the first sentence already states, and so it need not be said again in the interpretation of the second sentence.

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