A Proper Architecture for Presupposition and Quantification

Paul Dekker

Work in Progress / Handle with Care

Abstract
In this paper we present a three-dimensional architecture for the interpretation of a fragment of natural language which combines insights from presupposition theory, dynamic interpretation and the theory of generalized quantifiers. The semantics is shown to be a proper extension of a classical one, and to enable a flexible treatment of presupposition resolution along the lines of, in particular, Geurts, Kamp, and van der Sandt.

1 Introduction

Probably the most successful treatment of presupposition is the procedural one presented in the so-called AB theory of Bart Geurts and Rob van der Sandt. However, this theory avoids the semantic question about presupposition. Arguably, the theory deals only with the triggering and resolution of presuppositions at a representational level and it leaves the question about the intermediate entities unanswered. In this paper we want to answer precisely this question. We hereby follow the strategy advocated by Jeroen Groenendijk and Martin Stokhof, when they seeked to answer the very same question with regard to Hans Kamp's procedural treatment of anaphora. Groenendijk and Stokhof answered that question by adopting a dynamic notion of meaning. In this paper we want to proceed in a more conservative way. We want to characterize a notion of meaning, which is, provably, a conservative extension of a classical notion of meaning, and which enables a formulation of the dynamics of presupposition, anaphora, and quantification, consistent with the resolution procedures of discourse representation theory and others.

From the outset, there are at least two requirements which such an enterprise must meet. First, the AB-theory treats presuppositions as structured entities in their own right, so this requires us to adopt an (at least) two-dimensional notion of meaning. Second, such a notion of meaning must allow for a flexible treatment of presupposition projection and resolution. In this paper we will only indirectly address the second requirement, trusting that the reader is creative enough too think up alternatives to the projection mechanism which we

tentatively propose. With respect to the first requirement a historical comment is in order.

With the architecture proposed in this paper we revive the two-dimensional approach from (Karttunen and Peters 1975; Karttunen and Peters 1979), which can be characterized as both the climax of a decade of lively discussion, as well as a case of sudden (apparent) death. The last-mentioned paper seems to have heralded an era of embarrassed silence about the subject as it concluded with observing a structural and sometimes deemed fatal gap: the principled inability for a two-dimensional theory of meaning to account for structural dependencies between presupposition and assertion.[1] However, in their note, Karttunen and Peters already envisaged the possibility of stopping this gap, and ironically, van der Sandt and Geurts have inconspicuously filled it, be it in a representational way. For, as soon as one can account for dependencies (anaphoric or other) between two assertions—as one can in all versions of discourse representation theory and dynamic semantics—one can account for the same dependencies between presuppositions and assertions.

I have made this suggestion elsewhere (cf., e.g., Dekker 1998), but, as simple as it may seem, it is not totally obvious how it should be worked out. So that is one of the main reasons to actually do so in this paper. And for this to be more than a proof of concept I have decided to formulate a structured interpretation of a small fragment of natural language with generalized quantifiers. As will be seen in due course, in order to account for the interdependencies in anaphora, presupposition and quantification, some more formal encoding is required which, however, we aim to keep as minimal as possible. Every now and then it will be seen that, apart from the tools required to do our job, everything is like it used to be. Terms denote individuals, nouns and verbs denote sets of individuals, quantifiers denote sets of sets of individuals, etc.

We will proceed as follows. In the next section we present a minimal satisfaction semantics for a language of first order predicate logic with anaphora (*PLA*). This system gives a most simple account of anaphoric relationships between indefinites and pronouns, and serves as a base of operation upon which a first, provisional, definition of presupposition can be given using a two-dimensional notion of satisfaction. In section (3) we motivate and present a three-dimensional interpretation of a small montagovian fragment of natural language *PTPQ* which includes a fully general definition of generalized quantifiers. For as far as we know this section is the first to present a non-dynamic and non-E-type semantics of donkey-sentences. In sections (4) we compare our system with logic-oriented approaches to presupposition. In section (5) we compare it with representational ones.

1. Or 'implicature' and 'extension', as Karttunen and Peters had it.

2 Pronouns and Presuppositions

Although the system of *PLA* has grown out of the tradition of discourse representation and dynamic interpretation (cf., Kamp and Reyle 1993; Groenendijk and Stokhof 1991) it tries to deviate from a classical semantics only minimally (cf., Dekker 2002a). It is mainly inspired by (van Rooy 1997a; Stalnaker 1998) and formally develops the idea that indefinite noun phrases can be used with referential intentions, and that anaphoric pronouns can be coreferential with these indefinites by picking up individuals which may satisfy these intentions.

The language of *PLA* is like that of first order predicate logic except for the fact that it also contains a category of pronouns $P = \{\mathtt{p}_1, \mathtt{p}_2, \ldots\}$. For ease of exposition, we focus on a minimal language which is built up from variables, names, pronouns, $=$ and n-ary relation expressions, by means of negation $\neg$, existential quantification $\exists x$ and conjunction $\wedge$. As is usual, we use existentially quantified expressions to model indefinite noun phrases. Conditional sentences can be modeled using implication $\rightarrow$, defined by $(\phi \rightarrow \psi) \equiv \neg(\phi \wedge \neg\psi)$.

The semantics of *PLA* is spelled out by means of a satisfaction relation $\models$, which may hold between an ordinary first order model M with domain E, an ordinary variable assignment g, and a sequence of individuals e on the one hand and a formula ϕ on the other. The sequences of individuals e are the possible referents of terms (indefinite and pronominal) in ϕ. Besides the use of these possible witnesses, the only deviation from a classical semantics is that we also take into account what is referred to as $n(\phi)$, the number of (surface) existentials in ϕ. Satisfaction is defined as follows:

Definition 1 (Satisfaction in PLA)

- $[t]_{M,g,e} = M(c)$ if $t \equiv c$ $\quad [t]_{M,g,e} = g(x)$ if $t \equiv x$ $\quad [t]_{M,g,e} = e_i$ if $t \equiv \mathtt{p}_i$
- $M, g, e \models Rt_1 \ldots t_m$ iff $\langle [t_1]_{M,g,e}, \ldots, [t_m]_{M,g,e} \rangle \in M(R)$
  $M, g, e \models \neg\phi$ iff $M, g, ce \models \phi$ for no $c \in E^{n(\phi)}$
  $M, g, dce \models \exists x\phi$ iff $M, g[x/d], ce \models \phi$ for $d \in E$
  $M, g, ace \models \phi \wedge \psi$ iff $M, g, ce \models \phi$ and $M, g, ce \models \psi$, with $a \in E^{n(\psi)}$

The crucial clauses are that of existential quantification and conjunction. If a sequence ce satisfies ϕ under an assignment $g[x/d]$ mapping x to d, then dce, the sequence with d added as a witness, satisfies $\exists x\phi$ under g. Except for the addition of the witness, this clause is totally standard. The 'dynamics of interpretation' is located entirely in the dynamics of conjunction, which models nothing more than the fact that if a conjunction is actually used, the first conjunct literally precedes the second. If a sequence ce satisfies ϕ, where c is the sequence of witnesses for existentials in ϕ relative to e, and if ace satisfies ψ, where a is a sequence of witnesses for the existentials in ψ relative to ce, then the whole sequence ace also satisfies the conjunction of ϕ and ψ. The difference with a classical notion of conjunction is the use of witnesses only.

Before we proceed we may have to make a point about notation. Through-

out, our sequences of witnesses are cut up so as to correspond to the direct constituents of a formula, plus a tail e which is supposed to supply previously introduced witnesses which can be picked up by pronouns. Thus, in the case of a conjunction, we use the sequence ace, where sequence a represents the possible contribution of ψ, c that of ϕ, and e relates to previous discourse.[2]

Existentials and pronouns are quite similar in *PLA*, for:

Observation 1 (Indefinites and Pronouns)

- $M, g, de \models \exists x Fx$ iff $M, g, de \models F\mathtt{p}_1$
  $M, g, bde \models \exists x \exists y Rxy$ iff $M, g, bde \models R\mathtt{p}_1\mathtt{p}_2$

The difference between the two types of terms resides in the way they are taken up in various configurations. Indefinites can be seen to introduce 'new' referents, whereas pronouns refer back to 'old' ones. Besides, indefinites are existentially quantified away under a negation, whereas pronouns, of course, are not. It is also interesting to notice that pronouns and variables have a complementary distribution. Variables can only be bound by quantifiers in whose scope they find themselves; pronouns, however, do not 'see' these quantifiers, and only refer back to witnesses which pop up after an existential formula has been closed. Notice that this implements the A and B principles from Chomsky's binding theory. (See Butler 2002 for more discussion.)

The special use of witnesses in *PLA* enables a straightforward account of cross-sentential anaphoric relationships. Basic results of discourse representation theory and dynamic semantics are captured, as the reader can verify by checking the validity of the following equivalences:

Observation 2 (Anaphoric Relations)

- $\exists x(Dx \wedge \exists y(Py \wedge Fxy)) \wedge L\mathtt{p}_1\mathtt{p}_2 \Leftrightarrow \exists x(Dx \wedge \exists y(Py \wedge Fxy \wedge Lxy))$
- $\exists x(Fx \wedge \exists y(Dy \wedge Oxy)) \rightarrow B\mathtt{p}_1\mathtt{p}_2 \Leftrightarrow \forall x(Fx \rightarrow \forall y((Dy \wedge Oxy) \rightarrow Bxy))$

Indeed, these formal equivalences correlate to the intuitive equivalence of the following examples, with our apologies for the worn-out second one:

(1) A diver found a pearl but she lost it again.
    A diver lost a pearl she just found.
(2) If a farmer owns a donkey he beats it.
    Every farmer beats every donkey he owns.

PLA has been developed as a (negative) answer to the claim that a semantic account of anaphoric dependencies requires a representational or dynamic notion of meaning. Like we said, our semantics extends a classical satisfaction relation with witnesses only, and the dynamics is located entirely in its (asymmetric) notion of conjunction. Besides, this use of witnesses has been given independent motivation in (Dekker 200x) which in its turn is inspired almost entirely

2. With this notation convention, reference to $n(\phi)$ and $n(\psi)$ can be suppressed throughout.

by (Kamp 1990; van Rooy 1997a; Stalnaker 1998). The underlying idea is that indefinite terms, like other terms, are generally used with referential intentions. A speaker may use an indefinite because the identity of the intended referent is not relevant, or because he does not have adequate means to identify that referent. However, also in the latter case it is assumed that there is a true (but unknown) answer to the question which individual it is about, in order for subsequent pronouns not to be opaque.

Formally *PLA* fleshes out the assumption that indefinite descriptions are used to introduce possible witnesses, but it does not do justice to the fact that the descriptive material by means of which they do so has what seems to be a special informational status. For although we can deny:

(3) Yesterday some student wanted to hear my ideas about negative polarity.

by means of (4) and (5):

(4) No, nobody wanted to know anything from you yesterday.
(5) No, she only wanted to impose herself on you.

it seems awkward to reply with:

(6) No, she is not a student any longer.

Rather, if something like the latter is what is intended, a better reply would be:

(7) Well, maybe she indeed wanted to hear your ideas (something I doubt by the way), but she is not a student any longer.

In this respect indefinite noun phrases are used in a way like definite ones are.[3] If indeed various parts of sentences can be used to convey information with different informational status, we want our architecture to be able to express that.

A most obvious way to account for the relevant differences consists in adopting a two- or more-dimensional notion of meaning or satisfaction. In the remainder of this section we will sketch how the basics of such a two-dimensional system of interpretation can be developed for the system of *PLA*. For the purpose of exposition we present a two-dimensional approach along the lines of (Karttunen and Peters 1979) and show that our use of witnesses solves the main problem that faced their approach in the days it was presented. We will use 'presupposition' and 'assertion' as two technical terms to indicate the two informational roles which we want to lay our hand upon, without thereby aiming to give any substance to the natural interpretation of these two terms. The reader should be warned, in addition, that the *PLA* treatment of presupposition and assertion is, at best, a test case showing how one can lift a one- into a two-dimensional architecture of interpretation. Some reflection upon the informational status of definites (including pronouns), indefinites, and (assumed focal) predications, reveals that at least a three-dimensional architecture is called for,

3. Of course, the informed reader can see the parallels with the examples which figured in the Donnellan/Kripke debate, cf. Dekker 1998 and below.

and this will be offered in the next section. Even so, it is instructive to first inspect a two-dimensional system.

A presuppositional and an assertional dimension can be incorporated in *PLA* by explicitly distinguishing presupposition satisfaction $\models^p$ and assertion satisfaction $\models^a$ and adding a presupposition operator in the style of (Beaver 1995). Simple satisfaction $\models$ is defined as the conjunction of $\models^p$ and $\models^a$, which implies that the very same sequences will be relevant in both presupposition and assertion. As a consequence, these sequences allow us to state interdependencies.

Just to get things started in a most obvious way, we render $\models_a$ as $\models$ for any formula ϕ in the language of *PLA*, and $\models_p$ as trivially true. (The core language of *PLA* expresses only assertions, and conveys no presuppositions.) Presuppositions may enter the stage along with a presupposition device $\langle\phi\rangle$, much in the style of (Beaver 1995).[4] Our satisfaction semantics then can be adapted in the following way (^{x} here is a variable for ^{p} (presupposition) and ^{a} (assertion), respectively):

Definition 2 (Presupposition in PLA)

- $M, g, ace \models^p \langle\phi\rangle\psi$ iff $M, g, ce \models \phi$ and $M, g, ace \models^p \psi$
  $M, g, ace \models^a \langle\phi\rangle\psi$ iff $M, g, ace \models^a \psi$
- $M, g, e \models^p \neg\phi$ iff $\exists c$: $M, g, ce \models^p \phi$
  $M, g, ce \models^a \neg\phi$ iff $\neg\exists c$: $M, g, ce \models^a \phi$
- $M, g, dce \models^x \exists x\phi$ iff $M, g[x/d], ce \models^x \phi$
- $M, g, ace \models^x \phi \wedge \psi$ iff $M, g, ce \models^x \phi$ and $M, g, ace \models^x \psi$

If sequence a satisfies the presuppositions of ψ relative to ce, and if c satisfies ϕ, simpliciter, then ace satisfies the presupposition of ψ upon the presupposition that ϕ. What is asserted is, of course, what is asserted by ψ, As is fairly usual, a negation preserves the presuppositions of a negated formula, and negates its contents. An existentially quantified formula presupposes and asserts what the embedded formula presupposes and asserts, with a suitable switch of the witness from the sequence to the assignment. Presupposition and assertion simply distribute over a conjunction.

It should be emphasized that nothing in the above definition rigidly corresponds to anything in the semantics of natural language. What we have given here, and as will become much clearer below, are the basics, the underlying fundaments, of an architecture which will enable us to model the interpretation of concrete utterances. For one thing, a negation, as defined here, does not give us pressupposed witnesses, as one might want in certain cases. For another, there are various alternative (and viable!) ways in which we can conjoin the contribution of two conjuncts. Some alternatives will be mentioned below, as

4. We must note here that, first, we will do away with this presupposition device in the next section, where presuppositions are directly encoded in the semantics of their triggers. Second, the definitions to be presented are all provisional, in a sense to be explained and favoured in due course.

well as the impact of having a possibility to choose.

Even so, the reader can easily see that the above definition gives us a handle on the type of example that troubled Karttunen and Peters so much, their so-called management problem. Consider:

(8) Someone managed to succeed George V on the throne of England.

According to the theory of (Karttunen and Peters 1979), an utterance of this sentence presupposes that someone had a hard time trying to succeed George V, and asserts that someone eventually succeeded him. The problem for this theory then is (or was) that it doesn't (didn't) account for the intuition that the presupposition and the assertion relate to one and the same individual. No such problem troubles *PLA*, of course.[5] One and the same witness is said to satisfy both the presupposition and the assertion of this sentence. Schematically:

Observation 3 (Solving a Management Problem (1))

- $M, g, de \models^p \exists x(\langle TRYxs\rangle SUCCxs)$ iff d tries s
- $M, g, de \models^a \exists x(\langle TRYxs\rangle SUCCxs)$ iff d succeeds with s

An utterance of (8) thus can be said to presuppose that someone had succession difficulties, and to assert that *he* (that very same person) eventually succeeded. And, as argued by Karttunen and Peters themselves, the sentence is judged odd, because the witness for the assertion (the successor) had no problems at all succeeding George V.

Since the assertion of (8) is satisfied, the negation of the sentence is not:

(9) Noone managed to succeed George V on the throne of England.

For observe:

Observation 4 (Solving a Management Problem (2))

- $M, g, e \models^p \neg\exists x(\langle TRYxs\rangle SUCCxs)$ iff somebody tries s
- $M, g, e \models^a \neg\exists x(\langle TRYxs\rangle SUCCxs)$ iff nobody succeeds with s

Even though the actual successor of George V did not have a hard job with this, he did succeed George V, and this suffices to make (9) false. One might object that this is too strong, and take (9) to assert that none of those who tried hard did succeed George V. We indeed agree that such an interpretation is possible, but we don't want to make a big point out of it.

We will not make any further suggestions about how to deal with negation in the remainder of this paper. If so required, it can be interpreted as a two

5. The present solution to this problem, which is implicit in the work of van der Sandt, has been anticipated by Karttunen and Peters, witness: "What our rules as stated lack is any way of linking the choice of a person who is implicated to have difficulty to the choice of a person who is asserted to have succeeded. We expect that this deficiency will be remedied through further research, but we note here that this task is not a trivial one." (Karttunen and Peters 1979, p. 53).

place operator, denying what can be asserted by the negated formula against the background of what it presupposes. Such an information structure sensitive interpretation has been proposed in (Kratzer 1989), and the above interpretation presents an attempt towards an implementation of this idea. However, the interface properties of negation, and in particular of that of denial, are much more involved and their semantic and pragmatic interaction with discourse and information structure is an issue too involved to be dealt with in one paper. More importantly, the mechanics of such an interaction can be studied better along syntactically more transparent quantified structures, which we will deal with in the next section, and we think the discussion in the ensuing sections will supply the reader with enough machinery to enable him or her to come up with his or her own definition of negation.

Before we can turn to our treatment of terms and generalized quantifiers two more issues have to be addressed. We may first observe that any combinatory operator (like that of conjunction, implication, but also generalized quantifiers) allows for alternative ways of managing the information structure of the combined material, as discourse and context seem to require. We will end this section with some provisional suggestions about conjunction. (Sections (4) and (5) will discuss this issue in more explicit detail.) We, second, have to be more explicit about the different informational status of definites (including pronouns), indefinites, and other (focal) material. This will be dealt with in the next section.

Various alternative interpretations of conjunctions are conceivable and useful for the specific ways in which one may want to structure a discourse. For instance, the presupposition of one conjunct may be dependent upon the assertive contribution of another. Consider:

(10) Jones bought a house in France.
The previous owner has moved to Hungary.

A conjunction of these two utterances can be said to presuppose that there is some person d known under the name of 'Jones' and, that it asserts he bought a house h in France. What about the presupposition, coming from the second utterance, that h has a definite owner o, and the assertion that o moved to Hungary? We can simply collect the separate contributions, as we suggested above. In that case an utterance of (10) presupposes that d is Jones and that o is the owner of h, and asserts that h is a house d bought and that o moved to Hungary. We can also make the contribution of the second utterance functionally dependent upon that of the first, which is more in the style of what we will propose below. We can also turn the assertive contribution of the first utterance into a presupposition of the whole utterance.[6]

Pending further considerations about the contexts in which an utterance of (10) is made, we deem these solutions equally likely, and we do not want to

6. Actually the last option is a truly stalnakerian one: what is first asserted is later presupposed, and cannot, without ado, be denied, see (Stalnaker 1978).

decide between them. The most important conclusion to be taken from an example like (10) is that we need an architecture which can accommodate all such interpretations—which we can, in the multi-dimensional framework presented in the next section.

3 Terms and Quantifiers

It is certainly not common knowledge, but equally certainly it is agreed upon by those interested in the subject, that definite noun phrase (including proper names and pronouns) and indefinite noun phrases make similar but different types of contributions to the actual interpretation of sentences, which is different from other predicative (assumed focal) material.[7] Hans Kamp and Irene Heim's seminal work is absolutely to be credited first in this respect, although, to mention just a few, Chastain, Geach, Kripke, Donnellan, Evans, and Neale ventilate similar opinions (in the philosophical tradition), as do Reinhart, Abusch, von Heusinger, Kratzer, Winter (in an, arguably, more linguistic tradition).[8] Van der Sandt, Geurts, and Kamp (in joint work with Roßdeutscher and Bende Farkas) have given a formal, and quite attractive, implementation of these insights in the procedural framework of *DRT*. But despite numerous attempts to the contrary (Beaver, Krifka, van Rooy, Breheny, Jäger, which will be discussed in the next section) no convincing interpretative semantics for this procedure has been offered so far. In this section we want to fill this gap, presenting a minimal (multi-dimensional) interpretation of terms, and, because it is really necessary by now, present an architecture for the interpretation of generalized quantifiers which adequately deals with these terms.

The main ideas to be substantiated are these. We build upon the Montagovian interpretation algebra from the seventies, employing the tools and machinery from generalized quantifier theory (also from the seventies), and we reformulate it in a multi-dimensional framework (also from the seventies) using the discourse theoretical insights deriving from the eighties and the nineties. The most important ideas to be implemented are that indefinite noun phrases come with referential intentions, and introduce discourse referents, but that they are not presuppositional in the sense that definites and pronouns are. Typically, definites do not get bound (existentially closed) by other operators, whereas indefinites do get, or at least seem to get.

The ideas about the interpretation of terms and quantified noun phrases will be fleshed out in the interpretation of a fragment of natural language in

7. We ought to include *Wh*-phrases, which behave like terms, semantically, but whose conditions of use are different again.

8. A three-way distinction in semantic interpretation is also (remotely) similar in spirit to Vallduví's three partite distinction between three types of sentential constituents. First level presuppositions may count as given, and indefinite contributions and assertions as new. Furthermore, the pressuppositions and contributions made by terms can be conceived of as the ground, and the assertion as the focus.

three dimensions, which are labelled 'presupposition', 'contribution' and 'assertion', respectively. (Again, these terms are meant to be technical terms only.)

We distinguish terms (proper names, pronouns, definite and indefinite descriptions) and generalized quantifiers. Descriptions and quantifiers are obtained by combining an article or determiner with a common noun phrase (a one-place predicate or a formula abstracted over). Together with a verb phrase (also a one-place predicate or λ term) they make up a sentence or formula. Thus, for instance, *gives some book to Mary* will be rendered as $\lambda x\ MARY(\lambda y\ SOME(BOOK)(\lambda z\ GIVExyz))$. Basic predicates like *BOOK* and *GIVE* are interpreted like the corresponding relational constants in *PLA*: without any presupposition or contribution they denote sets of individuals (books) and sets of triples of entities which stand in the give relation. More in general, for any expression E, we define $[\![E]\!]_{M,g,ce}$, the interpretation of E relative to M, g and ce as the intersection of $[\![E]\!]^p_{M,g,ce}$, $[\![E]\!]^c_{M,g,ce}$ and $[\![E]\!]^a_{M,g,ce}$, the presupposition of E, the contribution of E, and the assertion or denotation of E, respectively. As the reader will see, all three are given in the same, familiar, type, although they are conditional upon sequences of witnesses.

Before we can turn to the interpretation of terms and quantifiers we have to introduce first order abstraction and to allow witnesses to be functionally dependent upon things abstracted over. We use the following notation conventions. If fh is a sequence of (possibly functional) witnesses, $(fh)(d)$ is short for $f(d)h(d)$ (where $e(d)$ is e if e is a witness itself):

- $[\![\lambda z\ \phi]\!]^x_{M,g,fh} = \{d \mid M, g[z/d], (fh)(d) \models^x \phi\}$

A λ-term $\lambda x\ \phi$ is thus associated with a presupposed set of individuals, a contributed set of individuals, and an asserted set.s It may be clear that the interpretation of such a term may fail to include all elements which as a value of x satisfy ϕ, if the wrong witness or witness-function is chosen. For this reason we also employ the notation $!\lambda x\ \phi$ which gets interpreted as the maximal set for which we can find witnesses, and which employs a witness-function that generates that set:

- $[\![!\pi]\!]_{M,g,fh} = \{d \mid \exists c\colon d \in [\![\pi]\!]_{M,g,ce}\ \&\ f = \{\langle d, c\rangle \mid d \in [\![\pi]\!]_{M,g,ce}\}\}$

For the sake of simplicity we have hereby introduced a uniqueness requirement on functional witnesses. This is not at all essential, but it simplifies matters considerably, as we will see below. We can now turn to the *PTPQ* interpretation of terms. In the following definition we also employ $(\lambda d\ ce) = (\lambda d\ c)(\lambda d\ e)$ for an arbitrary sequence of functions fh such that $fh(d) = f(d)h(d) = ce$:

Definition 3 (PTPQ Interpretation of Terms)

- $[\![MARY]\!]^p_{M,g,de} = \{Q \mid d = [m]_{M,g,e}\ \&\ d \in Q\}$
  $[\![MARY]\!]^c_{M,g,de} = \{Q \mid d \in Q\}$
  $[\![MARY]\!]^a_{M,g,de} = \{Q \mid d \in Q\}$
- $[\![HE_i]\!]^p_{M,g,de} = \{Q \mid d = e_i\ \&\ d \in Q\}$
  $[\![HE_i]\!]^c_{M,g,de} = \{Q \mid d \in Q\}$
  $[\![HE_i]\!]^a_{M,g,de} = \{Q \mid d \in Q\}$

- $[\![SOME(\pi)]\!]^p_{M,g,dce} = \{Q \mid d \in [\![\pi]\!]^p_{M,g,ce}\ \&\ d \in Q\}$
  $[\![SOME(\pi)]\!]^c_{M,g,dce} = \{Q \mid d \in [\![\pi]\!]^{c\&a}_{M,g,ce}\ \&\ d \in Q\}$
  $[\![SOME(\pi)]\!]^a_{M,g,dce} = \{Q \mid d \in Q\}$
- $[\![THE(\pi)]\!]^p_{M,g,dce} = \{Q \mid \{d\} = [\![!\pi]\!]_{M,g,\lambda d\ ce}\ \&\ d \in Q\}$
  $[\![THE(\pi)]\!]^c_{M,g,dce} = \{Q \mid d \in Q\}$
  $[\![THE(\pi)]\!]^a_{M,g,dce} = \{Q \mid d \in Q\}$
- $M, g, dace \models^x T(\rho)$ iff $[\![\rho]\!]^x_{M,g,ace} \in [\![T]\!]^x_{M,g,dce}$

The interpretation of the name *MARY* is paradigmatic of the way expressions are dealt with in *PTPQ*. A use of the term presupposes a witness d for Mary ($d = [m]_{M,g,e}$), which, in addition, satisfies the presuppositions of an associated verb phrase (Q, which is abstracted over). A use of this term furthermore doesn't add anything to a contribution or assertion, except for the witness d itself. So if "Mary" is combined with a verb phrase ρ, the presupposition is that the witness d is Mary and that d satisfies the presuppositions of ρ; the contribution is whatever ρ contributes to d, and the assertion is whatever ρ asserts about d.

The interpretation of the other terms follows a similar pattern. Pronouns come with the explicit presupposition that they are defined, and they only contribute their witness.[9] Since indefinites are compound expressions, their interpretation is a little bit more involved. They inherit the presuppositions of the description π involved, and they contribute their own witness as an individual which satisfies both the contributive and assertive interpretation of π. Thus, for instance, *a daughter of John*, or $SOME(\lambda x\ JOHN(\lambda y\ DTR(x, y))$, presupposes a witness d' who is John, and it contributes a witness d who is a daughter of John. That is, relative to $dd'e$, this expression is interpreted as the set of sets of individuals Q such that it is presupposed that $d' = [j]_{M,g,e}$, contributed that $\langle d, d' \rangle \in M(DTR)$, and asserted that $d \in Q$.

The interpretation of definites is fairly straightforward. They presuppose a witness d which is the one and only individual which satisfies the presupposition, contribution and assertion expressed by π. Thus, relative to $dd'e$, *the daughter of some woman*, or $THE(\lambda x\ SOME(WOMAN)(\lambda y\ DTR(x, y))$, presupposes that d is the one and only daughter of a woman $\lambda d\ d'$. Notice that this does not only require uniqueness relative to the contributed witness d', but also uniqueness of the mother. We could easily relax this condition, of course, but for the present purposes it will do.

Let us briefly inspect some sentences. It can readily be seen that, for instance:

(11) Mary walks.
$MARY(WALK)$

presupposes a witness m for Mary and asserts that m walks. With an indefinite:

9. But notice the difference with the interpretation of pronouns in *PLA*. Here, and not in *PLA*, pronouns and proper names do contribute their witness as a new value to the sequence of witnesses. As a matter of fact, all *PTPQ* noun phrases contribute a referent.

(12) Mary teased some dude.
$MARY(\lambda x\ SOME(DUDE)(\lambda y\ TEASExy))$

a witness m for Mary is presupposed, a dude d is contributed, and it is asserted that m teased d. We can follow up on this, with:

(13) She$_i$ was annoyed by a song he$_2$ sang.
$SHE_1(\lambda x\ SOME(SONG\text{-}SUNG\text{-}BY\text{-}HE_2)(\lambda y\ ANNOYyx))$

which presupposes a witness n identical to m, and a witness b identical to d, which contributes a song s sung by b, and which asserts that s annoyed n. Under a straightforward translation ϕ' of ϕ into *PLA* we find that:

Observation 5 (PTPQ and PLA)

- $[\![JOHN(\lambda x\psi)]\!]_{M,g,dce} = 1$ iff $M, g, dce \models \exists x(x = j \wedge \psi')$
  $[\![HE_i(\lambda x\psi)]\!]_{M,g,dce} = 1$ iff $M, g, dce \models \exists x(x = e_i \wedge \psi')$
  $[\![SOME(\lambda x\phi)(\lambda x\psi)]\!]_{M,g,dace} = 1$ iff $M, g, dace \models \exists x(\phi' \wedge \psi')$

The interpretation of proper names, pronouns and indefinites (and definites) thus is one independently argued for elsewhere, but it is more fine-grained, something which we will cash upon in the next section. We may have to add here that the conditions figuring in the presupposition, contribution, and assertion of the terms may vacilate between the three dimensions. For reasons to be made more clear in the next two sections, the contribution of an indefinite can be turned into a presupposition, the presupposition of a definite into a contribution, and the contributions of both into an assertion, etc. For the moment the most important thing is that that we have *some* distribution of semantic material over the three dimensions, and that the conjunction of the distributed conditions equals their standard interpretation.

Let us now turn to quantified constructions. Genuinely quantifying noun phrases are not interpreted relative to possibly intended referents d and sequences of witnesses, but to referent sets D and sequences of witness functions:

Definition 4 (PTPQ Interpretation of Quantified Constructions)

- $[\![DET(\pi)]\!]^p_{M,g,Dfh} = \{Q \mid \emptyset \neq D = [\![!\pi]\!]_{M,g,fh} \subseteq Q\}$
  $[\![DET(\pi)]\!]^c_{M,g,Dfh} = \{Q \mid D \subseteq Q\}$
  $[\![DET(\pi)]\!]^a_{M,g,Dfh} = \{Q \mid [DET](D)(Q) = 1\}$

A few observations are in order. With the above definition we have explicitly encoded the idea that determiners "presuppose their domain" in the sense that this (non-empty) set should be under discussion, contextually given, or what have you. Furthermore, all elements in the witness set are presupposed to satisfy the presuppositions of an associated verb phrase (Q, which is abstracted over), and they also must allow a contribution from Q. The assertional contribution of a determiner is the standard one. This is significant, because it shows, in contrast with what has been suggested in the literature on discourse

representation and dynamic semantics, that we do not have to tamper with the well-established findings from generalized quantifier theory. Finally, two further amendations may have to be made. First, a quantified structure (not downward monotonic) can be taken to contribute a witness set which consists of the intersection of the presupposed domain with the set denoted by the verb phrase. Second, downward monotonic quantifiers must be assumed to quantify away (existentially bind) the contribution of the terms they combine with.

By means of the use of witness functions we can account for donkey-type dependencies, as we find in (14), as well as for subsequent (functional) anaphoric take-up, as in (15) (after an example from Gabriel Sandu):

(14) Every farmer who owns a donkey beats it.

(15) Every boy has a gun, but hardly any boy ever uses it.

Let us inspect an example in detail. Consider:

(16) Most men who sent a present to Curt sent a different$_2$ present to Amelia.

This sentence has the form $MOST(\pi)(\rho)$ with:

- $\pi := \lambda x\ MANx \wedge CURT(\lambda y\ SOME(\lambda z\ PRESz)(\lambda z\ SENDxyz))$
- $\rho := \lambda x\ AMEL(\lambda y\ SOME(\lambda z\ z \neq \mathtt{p}_2 \wedge PRESz)(\lambda z\ SENDxyz))$

These two expressions are interpreted as follows:

- $[\![\pi]\!]^p_{M,g,cp} = \{d \mid c = [c]_{M,g,e}\}$
  $[\![\pi]\!]^c_{M,g,cp} = \{d \mid p(d) \in M(PRES)\}$
  $[\![\pi]\!]^a_{M,g,cp} = \{d \mid d \in M(MAN)\ \&\ \langle d, c, p(d)\rangle \in M(SEND)\}$
- $[\![\rho]\!]^p_{M,g,aqe} = \{d \mid a = [a]_{M,g,e}\}$
  $[\![\rho]\!]^c_{M,g,aqe} = \{d \mid q(d) \neq e_2(d)\ \&\ q(d) \in M(PRES)\}$
  $[\![\rho]\!]^a_{M,g,aqe} = \{d \mid \langle d, a, q(d)\rangle \in M(SEND)\}$

and the whole structure has the following satisfaction conditions:

- $M, g, Daqcp \models^x MOST(\pi)(\rho)$ iff $[\![\rho]\!]^x_{M,g,aqcp} \in [\![MOST(\pi)]\!]^x_{M,g,Dcp}$

Inspecting the above definition the reader may verify that this presupposes that:

- $\emptyset \neq D = [\![!\pi]\!]_{M,g,cp} \subseteq [\![\rho]\!]^p_{aqcp}$

which is to say that c is Curt, a is Amelia, D is the non-empty set of men d who sent a present to c, and if any man d sent any present to c then $p(d)$ is that present. It is contributed that:

- $D \subseteq [\![\rho]\!]^c_{aqcp}$

which is to say that $q(d)$ is a present different from $p(d)$ (for all $d \in D$). Notice that the given presupposition and contribution are independent of the determiner chosen. Of course, the assertion is not independent:

- $[MOST](D)([\![\rho]\!]^a_{aqcp})$

Which is to say that for most $d \in D$: d sent $q(d)$ to a.

We conclude this section with two more observation. First, the witness functions contributed by quantified structures can be taken up by anaphoric pronouns (as we see in, e.g., 15), that is, provided that the pronouns themselves are functionally dependent. Thus, the second sentence of (15) may come to mean that hardly any boy d uses $g(d)$, a/the gun he owns. And after an utterance of the first sentence of (15) we can even make sense of:

(17) Sue uses it to chase foxes.

provided our witness s is a boy named Sue.[10] Second, we have managed to keep our definitions relatively transparent by means of the uniqueness presupposition on witnesses contributed by a quantifier's restriction. Indeed, in order to account for all types of donkey sentences found in the literature, this presupposition may be too strong (see, e.g., Heim 1989; Heim 1990). However, although, of course, the presupposition can easily be relaxed, according to one's taste, it might not be wise to do so. In (van Rooy 1997b; Geurts 2002a) both empirical and theoretical arguments are given in favour of a uniqueness presupposition. Discussing some experimental data concerning so-called 'strong' and 'weak' interpretations of donkey sentences, Geurts convincingly argues that what seem to be different readings are not different readings after all. What Geurts calls the "unwary" informant's interpretation of these sentences is indeed built on a uniqueness presupposition like the one proposed here. In case the presupposition is evidently violated, the informant faces what Geurts calls an "interpretative crisis", which she has to resolve by additional means.[11]

4 Multiplying Dimensions in stead of Truth Values

In the preceding section I have presented a three-dimensional architecture which can be used to model the various kinds of contributions certain expressions may make to interpretation. In a sense it is, at the same time, a semantic implementation of the proposals made by Kamp, van der Sandt, and Geurts, as well as a deconstruction of the notion of meaning endorsed by advocates of Montague grammar, and, we think, an improvement upon both. In this section we will first argue that our architecture, like that of *DRT*, indeed fares better than previous (dynamic) semantic treatments of presupposition. Next, we will argue that its classical semantic set up also improves upon the procedural approach advocated by Kamp and his followers. In the next section we will show how a flexible use of our architecture also allows us to deal successfully with the interpretation of indefinite noun phrases across three dimensions.

Both the linguistic and the philosophical literature on presupposition from the seventies of the previous century contain a number of highlights which are both illuminating and disappointing. A great number of (conceptual) tools and (intuitively motivated) analyses have been offered, which have an almost irrefutable theoretical appeal. Classic is the work of Robert Stalnaker, Lauri Karttunen,

10. The follow-up can also be taken to express that Sue (boy or girl) uses the gun which every boy owns to chase foxes, but this reading is not so likely.

11. Geurts observes that there may be various strategies towards a solution of this crisis, which may depend on the specific examples and on the type of informant, and which may yield different evaluations of the sentences. This indeed explains why our intuitions on the donkey sentences at issue are so 'nebulous' (as (Heim 1982) deemed them), and as Geurts' experiments confirm.

and Gerald Gazdar, and, not so classical, but equally important, that of Stanley Peters. These pioneers have detected some principled ways in which presuppositions may behave in natural language, but they also had to agree that "presupposition", if any general use of the term is viable at all, does not behave that systematically. It is remarkable indeed that, first, Stalnaker had to systematically incorporate "pragmatic" remedies to account for apparent cases of presupposition failure (Stalnaker 1978), second, that Karttunen and Peters ended up writing a "Requiem for Presuppositions" (Karttunen and Peters 1977) and, third, Gazdar had to plea for a benevolent "euthanasia" (Gazdar 1979) on the most important research tradition emerging from that decade, that of Karttunen and Peters. What had gone wrong?

The main conclusion which can be drawn from all of these efforts, we think, is twofold (and not generally accepted by the way). First, the behavior of presuppositions, if any such things exist, is subject to pragmatic principles. This conclusion, it is important to emphasize, sincerely constrains the impact of any semantical or logical theory of presuppositions: if it makes claims about their behavior, it is on the wrong track. Second, presuppositions, as well as other components of meaning, are entities in their own right. For those who know how satisfaction theories of presupposition work, no matter how appealing these theories may be, they simply don't work empirically, as Gazdar, van der Sandt, and Geurts, among many others, have shown in great detail. Willingly or unwillingly, van der Sandt has developed his theory of presupposition in accordance with these two conclusions in the procedural framework of DRT; quite rightly, this theory has gained a lot of empirical and collegial support (Kamp, of course, among many others); but even so, it hasn't answered the question (or never even intended to think of the question at all) what presuppositions are, besides things that have to be handled.[12]

I think the Karttunen and Peters style architecture of interpretation presented above is or can be made consistent with the two previous conclusions, and that it also gives a (qualified) answer to the question what presuppositions are supposed to be in a procedural framework. Our semantic architecture for presupposition does better than previous semantic accounts, because it can treat presupposition and assertion as separate entities in a flexible way. Notwithstanding their initial appeal, rigid satisfaction and update semantic accounts are at odds with both of the previous conclusions and this has serious consequences. Logical and linguistically oriented approaches to presupposition, which revived in many dynamic semantic approaches in the nineties (among many others, Beaver 1995; van Eijck 1994; Heim 1992; Visser 1994; Zeevat 1992), face the dilemma of either assigning (18) a too strict, rigid, interpretation:

(18) Sid didn't invite the president of Trans-Danubia to the exhibition.

12. I realize, I step on some theoretical toes now. Just to make clear: I do not aim to be a nominalist, a mentalist, a platonist, a realist. If the reader feels the need of classifying me anyway, I am a "surplusrealist".

or rendering it (semantically) ambiguous. We don't, and we don't want to, assign this sentence an ambiguous or one unambiguous interpretation. We deem the actual interpretation to be dependent on the context of use.[13] This point is intrinsically related to the debate on speaker's reference and semantic reference, initiated, many think, in (Donnellan 1966), answered, I believe, by (Kripke 1979), and previously denied of interest by (Geach 1962) and basically solved by (Strawson 1964).

Let us inspect a concrete and old example. The following one is from (Kripke 1979):

(19) Jones is raking the leaves.

I agree with almost everybody that this sentence has only one interpretation: that the person named Jones is doing what he is said to do: raking the leaves. But there are some subleties when an utterance of this sentence is actually encountered. The addressee may, for instance, notice it is an assertion about some prominent individual who is not Jones, but Smith, and react:

(20) It is Smith, not Jones, who is raking the leaves.

thereby leaving the assertion that he (Smith) is raking the leaves unchallenged. But the addressee might as well take an utterance of (19) to be about Jones, replying:

(21) If you say so. I only see Smith raking the leaves.

Similar examples can be construed with definite descriptions (as argued by Donnellan)[14], indefinite descriptions, (Kripke) and even generalized quantifiers (Neale). What we take such examples and their possible interpretations to show is that (i) they can be easily handled with an architecture like the one presented above, and (ii) a purely semantic approach cannot account for them without positing ambiguities. For notice that we do not want at all to tamper with the truth conditions of (19), but only want to make some pragmatic structure available for an appropriate reaction. An addressee can, at will, react upon the witness, presupposition, and assertion of an utterance like (19) just as our

13. If in this section we present a somewhat informal sketch of a flexible use of our architecture, be confident that we will be more specific about the details in the next section.

14. Geach discusses an utterance of:

(22) The fat old humbug we saw yesterday has just been made full professor!

Such an utterance can be understood as a claim, even a true one, about a particular person which the addressee need not acknowledge to be a fat old humbug. Thus, (Donnellan 1978, p. 54) suggests the following reply:

(23) I don't think he's fat; he's just large boned. And as for his being a humbug, he seemed quite genuine and aboveboard.

Such a reply may, apparently, serve to express one's disagreement with the description of the individual who is the referent of 'the fat old humbug' as a fat old humbug. But this only makes sense if such an individual has been identified in the first place. Interestingly, Geach himself qualified this kind of 'reference' at issue as "of negligible importance for logic." He mentions it "only to get it out of the way" (Geach 1962, p. 8).

architecture allows.[15]

In this sense our multi-dimensional architecture shares the main benefit of the procedural, mainly *DRT*-based, approaches in that it takes information structure seriously.[16] As a matter of fact, I would love to claim that our architecture actually gives *the* semantics of such a procedural framework. How instructive, and wholesome, such a claim could be, however, it would be slightly misleading. The following, unfortunately rather academic, discussion is intended to display the difference between the two.[17]

This digression can very well begin with a pretty innocent example:

(24) Every politician rode his hobbyhorse.

A pretty basic intuition about an utterance of (24) is that it presupposes that all politicians have a hobby-horse and asserts that they all rode them (their own hobby-horse). As a matter of fact, from a semantic point of view, that's all we would like to get, and it is also something which our architecture predicts, with two qualifications: one in a footnote[18] and this one: an utterance of this sentence is also presupposed to have a possibly restricted domain of politicians under discussion.

Innocent as it may seem, examples like (24) have been the subject of vehement debate. Some recent opinions on an already old debate can be found in (von Fintel 1994; Beaver 1999; Geurts and van der Sandt 1999). Some of the discussion has focused on the following, quite instructive example:

(25) Every team member came to the match in his car.

Basic intuition is again that an utterance of (25) presupposes that every team member has a car, and asserts that they all used it to drive to the match. It so happens, that the specific formulation of Geurts and van der Sandt's binding theory predicts there to be an even more likely reading as to which the sentence simply says that every team member who has a car used it to go to the match. This is the so-called "intermediate accommodation" reading

15. I must mention one previous attempt at providing a two-dimensional semantics, which is totally in the spirit of Stalnaker, that of (van Rooy 2002). Van Rooy as well envisages more than one semantic dimension, and was one of the first to acknowledge the importance of witnesses. His attempt, however, suffers from a too hard split between the two dimensions. Truth (satisfaction) and presupposition (a propositional attitude) are two different things in van Rooy's account, and therefore he renders it consistent to both assert ϕ and presuppose $\neg\phi$ in one and the same utterance. As far as I can see, the only remedy for this is to resort to a three-valued (not n-dimensional) framework which shares with all purely semantic approaches the disadvantage of not being able to make any sense of the reactions to an utterance of (19) without positing ambiguities.

16. With a surplus: real witnesses come for free on our semantic account, whereas they are a pain in the $***$ in any representational framework.

17. The unaffected reader can safely skip the next discussion. If skipping it hurts anybody's career, *that* career is not worth its salt anyway.

18. The really terribly intrigued reader may wonder how the pronoun "his" may come to behave like a bound variable in (24). Her worries or doubts will be answered by even more intriguing insights from Alastair Butler's work on the interface (Butler 2002).

upon which presuppositions float from their triggering context, and end up not in the main context, because they are bound by some quantifier, but in this case in the restriction of the very same quantifier. Von Fintel and Beaver have convincingly argued that this is not at all a sensible reading of (25) in an out of the blue context. Beaver found this claim supported by many native speaker's judgements. Of course, the idea is that this refutes the supposition that presuppositions can float from the nuclear scope of a quantifier (their triggering context) to the quantifier's restriction and I am most sympathetic to that idea.[19]

But things are more subtle. Wolfgang Heydrich (p.c.) acutely observed that an utterance of (25) can easily be used to talk about the team members who came to the match, neglecting the team members who didn't come. That's interesting, because this comes close to the effect, predicted by van der Sandt and Geurts, and refuted by Beaver, that a presupposition trigger ("the match") floats from the nuclear scope of a quantifier (its triggering context) to end up contributing, truth-conditionally, to the quantifier's restriction. So what's going on? We think that Beaver is basically right, but also that material in the nuclear scope of a quantifier may have its truth-conditional impact on the domain of quantification, as argued by (Geurts and van der Sandt 1999), be it not by intermediate accommodation. Here are two more examples which may help to show what is going on:

(26) Almost all tickets were sold at checker 4.

(27) Most boys were rejected because of their length.

Example (26) can of course be used to make a statement about all tickets (presupposing there is some checker 4). However, as Regine Eckardt observed, it can equally well be used to make a statement about the tickets that were sold. Likewise, example (27) (discussed by Petra Hendriks and Helen de Hoop, who attribute it to Marko Bikker) can be used to make a claim about the boys who were rejected.[20] These two examples thus clearly demonstrate that material in the nuclear scope of a quantifier may have a semantic (truth-conditional) impact on the quantifier's restriction. But is this a case of intermediate accommodation? We do not want to jump to that conclusion. If the examples (26)–(27) are understood in the way indicated, we have a strong feeling that they themselves pressuppose a domain of things (tickets) which were sold, or individuals (maybe, but not necessarily the boys) who were rejected. We can easily account for this by assuming that the presupposition from the verb phrase projects into the domain of quantification. That is, the readings which we then get can be paraphrased as "Among those tickets that were sold, almost all were sold at checker 4," and "Among those who were rejected, most boys were rejected because of

19. Not because it doesn't make any intuitive sense, because that's a bad reason. To me, it simply doesn't seem to make any theoretical sense.

20. Once one gets these readings, and starts playing around with intonation, many more interpretations become available.

their length," respectively. It is easily seen that this type of domain restriction has the same truth-conditional effect as intermediate accommodation, for most determiners, that is.[21]

With these observations in the back of our mind, we can now return and see what was going wrong in example (25). For, at first glance, such a sentence can be used to claim, about the team members (all of them, or those who went to the match) how they went to the match, viz, by their car. This is simply the most obvious way of cutting up the verbal pie. But indeed, we can do it differently, if we really need to. Thus, if we watch quite a few (but not all!) of the team members go out and jump in their cars, and I wonder what the hey is going on, you might tell me:

(28) Every team member WENT TO THE MATCH in his car.

For several reasons this might still sound a bit awkward, indeed, but certainly not because it says or presupposes that all team members have a car. If this observation comes close to being correct, then whe do get a reading of (28), a simple variant of (25), as quantifying over team members who have a car and used it. But not by intermediate accommodation, but by contextual (domain) restriction.

5 Indefinites in Three Dimensions

In the previous section we have discussed, rather informally, the flexible ways in which presupposition may make their way in interpretation. In this section we will, in a more formal way, discuss a feature of indefinites which Heim has characterized as "chameleontic" (Heim 1982). We will not, however, focus on the indefinites in the types of constructions Heim has been concerned with, mainly adverbially quantified ones, but on those in even more intriguing types: indefinites in island constructions.

There is a whole range of literature on this subject, starting with (Cooper 1979; Fodor and Sag 1982) and with quite a few recent contributions among which, e.g., (Abusch 1994; Reinhart 1997; Winter 1997; Kratzer 1998; Matthewson 1999). Most of the literature is concerned with the following challenge. In the linguistic canon so-called 'scope islands' have been identified, certain linguistic environments from which quantified expressions and *wh*-phrases cannot 'escape', by raising or movement. Examples of scope islands are for instance relative clauses, *if*-clauses of conditional sentences, and other relative clauses like those headed by "because". Definite and indefinite noun phrases, however, do seem to do what the canon forbids them to do. Sentences with (in-)definite noun phrases in scope islands receive interpretations which can be given an appropriate paraphrase by moving the (in-)definite to the sentence's initial po-

21. That is, for those determiners D for which $D_C(A)(B)$ equals $D(C \cap A)(B)$, where subscripted C indicates the domain of quantification.

sition and filling in its original position with a (bound) pronoun. Consider, for instance:

(29) If every student comes to the party, Max will have a problem.

(30) ?Every student is such that if he comes to the party, Max will have a problem.

Both sentences have a particularly legitimate reading, but (30) is no paraphrase of any reading of (29). (For notice that it is equivalent with "If any student comes to the party, Max will have a problem," which is no reading of (29).) The mentioned 'scope island constraint' accounts for this. But now consider the following example from Reinhart:

(31) If we invite a certain philosopher Max will be offended, but do you remember who?

(32) There is a certain philosopher such that if we invite him, Max will be offended.

The reformulation (32) in which the indefinite gains wide scope seems to be an appropriate paraphrase of a reading of the first sentence of (31), indeed the only sensible reading given the continuation with "do you remember who?". (Fodor and Sag 1982) have solved this problem and saved the scope constraint by postulating an ambiguity. Indefinites can be quantificational, and these indefinites are subject to the scope constraint; but indefinites can also be referential, and since referential expressions are 'scope-less', or 'scopally transparent', the scope island constraint does not apply to them. Fodor and Sag's solution has been challenged, vehemently and repeatdly, on two scores. In the first place it is prima facie suspect to posit ambiguities to solve syntactic-semantic problems, and we as well think that such an aversion against this practice, an aversion which goes back at least to (Grice 1975, "Modified Occam's Razer), is wholesome indeed. In the second place people soon came up with a whole range of examples which show that a two-way ambiguity could never suffice, and which suggest that a completely different account should be given (Farkas 1981; Abusch 1994; Reinhart 1997). The following example is due to Dorit Abusch:

(33) Every one of them moved to Stuttgart because a woman lived there.

There is a most natural interpretation of this example according to which for every person among the intriguing 'them' there was a woman who lived in Stuttgart, and whose living in Stuttgart made up the reason for that person to move to Stuttgart. Notice that, upon this paraphrase, the woman seems to have escaped the 'because'-island, while there is not necessarily only one woman involved. Thus, first, the interpretation given is different from Fodor and Sag's quantificational interpretation, upon which the reason for everybody to move to Stuttgart was that Stuttgart is not for 100% inhabited by males, quite an unlikely reason, by the way; but, second, it is also different from the referential interpretation upon which the reason for everybody to move to Stuttgart was that, e.g., Dorit Abusch herself lived there. (A bad reason as well, because Dorit left.)

Faced with examples like that of Abusch and others, some authors have resorted to the use of a so-called 'choice function' analysis of indefinite noun phrases[22], extended with a free and fancy existential closure over the relevant choice function variables. For reasons which we do not want to go into here, such an analysis faces its own complications and will, if viable at all, at best be redundant. (For some discussion, see (Schlenker 1999; Bende-Farkas and Kamp 2001; Dekker 2002b; Jäger 2002).)

In this paper we therefore want to keep the gist of Fodor and Sag's analysis and save the scope constraint but without postulating any ambiguity. The various interpretations that have been labeled 'referential' or 'wide scope', and those that have been labeled 'intermediate', can be seen to derive from independently motivated pragmatic principles. As a matter of fact, such an approach is not at all new, as it may already have been implicit in Fodor and Sag's own analysis, as it has been anticipated in (Kratzer 1998), and as similar ideas have very recently been advocated by (Bende-Farkas and Kamp 2001; Geurts 2002b; Dekker 2002b; Breheny 2002; Jäger 2002). The ideas laid down in the following paragraphs are most similar to that of (Geurts 2002b), the main difference being that our account is stated in terms of a formal and flexible handling of semantic objects, whereas that of Geurts is the usual procedural one.

The basic idea which we want to pursue is very simple: indefinites, like definites, are presuppositional. As everybody knows, presppositions can swim. So even if syntax and semantics condemn them to live on a scope island, they can simply swim away from there. Basically, and a bit caricaturally, this metaphor fits best in a more procedural setting like that adopted by Geurts. More in the spirit of our own setting, the very same idea is this. Indeed the semantic or assertional contribution of an indefinite noun phrase, a referent or referent set, is bound to the scope islands where they are dropped. But indefinites have access to other dimensions, and there they may freely interact with surface and pragmatic material, with one proviso: if other operators also have access to these other dimensions, the presupposition or contribution of indefinites may get bound or get functionally dependent upon them. In what follows we will spell out this metaphor in formal detail. We will basically concentrate on Abusch' example, trusting that the reader will be able to make the appropriate generalizations required to deal with other examples discussed in the literature.

Let us inspect Abusch' example in a suitably simplified form, this for expository reasons. Consider (34), with its reduced logical form (35):

(34) Everybody came because a woman came.

(35) $ALL(\lambda x\ BEC(SOM(WOM)(CAM))(CAMx))$

We here neglect the question what "everybody" quantifies over—we simply take

22. Dating back to the epsilon operator of Hilbert and Bernays, and also employed, for different reasons, in, e.g., (Meyer Viol 1995; Egli and von Heusinger 1995), among others, in the analysis of indefinites.

it to be a non-empty subset D of the whole domain E—, and we give a rather preposterous, because extensional, analysis of 'because'. (Because we want to focus on the structural aspects of interpretation.) The interpretation of the 'basic' constituents can then be rendered, equally 'basically' as follows:

- $M, g, Dfh \models^x ALL(\rho)$ iff $D \subseteq [\![\rho]\!]^x_{M,g,fh}$
- $M, g, pqace \models^p BEC(\phi)(\psi)$ iff $M, g, ce \models \phi$ and $M, g, ace \models \psi$
  $M, g, paqce \models^c BEC(\phi)(\psi)$ iff $q = [\![\phi]\!]^a_{M,g,ce}$ and $p = [\![\psi]\!]^a_{M,g,ace}$
  $M, g, pqace \models^a BEC(\phi)(\psi)$ iff $\langle p, q\rangle \in M(BEC)$
- $M, g, de \models^p SOM(WOM)(CAM)$
  $M, g, de \models^c SOM(WOM)(CAM)$ iff $d \in M(WOM)$
  $M, g, de \models^a SOM(WOM)(CAM)$ iff $d \in M(CAM)$
- $M, g, de \models^p CAMx$
  $M, g, de \models^c CAMx$
  $M, g, de \models^c CAMx$ iff $g(x) \in M(CAM)$

Clause (36) with 'logical form' (37):

(36) x came because a woman came
(37) $BEC(SOM(WOM)(CAM))(CAMx)$

can now be read in one of two ways. The easiest way to interpret it is to consider the contribution of $SOM(WOM)(CAM)$ to be bound under the BEC-operator, which produces the following result, whereby we suggestively use $[\phi]$ to indicate the 'fact' that ϕ, and $M(WO\text{-}CA)$ for $M(WOM) \cap M(CAM)$:

- $M, g, pqe \models^p (37)$ iff $M(WO\text{-}CA) \neq \emptyset$ and $g(x) \in M(CAM)$
  $M, g, pqe \models^c (37)$ iff $q = [M(WO\text{-}CA) \neq \emptyset]$ and $p = [g(x) \in M(CAM)]$
  $M, g, pqe \models^a (37)$ iff $\langle p, q\rangle \in M(BEC)$

Abstraction over x gives us, relative to propositional functions p' and q', the following sets of individuals as those presupposed, contributed, and asserted by the verb phrase of (34):

- $\{d \mid M(WO\text{-}CA) \neq \emptyset$ and $d \in M(CAM)\}$
  $\{d \mid q'(d) = [M(WO\text{-}CA) \neq \emptyset]$ and $p'(d) = [d \in M(CAM)]\}$
  $\{d \mid \langle p'(d), q'(d)\rangle \in M(BEC)\}$

Combining this with 'all' we get:

- $M, g, Dp'q'h \models^p (35)$ iff $\forall d \in D$: $M(WO\text{-}CA) \neq \emptyset$ and $d \in M(CAM)$
  $M, g, Dp'q'h \models^c (35)$ iff $\forall d \in D$: $q'(d) = [M(WO\text{-}CA) \neq \emptyset]$ and $p'(d) = [d \in M(CAM)]$
  $M, g, Dp'q'h \models^a (35)$ iff $\forall d \in D$: $\langle p'(d), q'(d)\rangle \in M(BEC)$

In more colloquial speech: sentence (34), with logical form (35), and under a bound interpretation of the indefinite, presupposes that at least one woman came and that all individuals in D came; it contributes propositional functions assigning each individual in D the proposition that that individual comes and the proposition that some woman comes, respectively; and it asserts that, for each individual in D, the first proposition was because of the latter. That is, for each individual $d \in D$, the fact that at least one woman came 'caused' him to come as well. Indeed, this corresponds to the interpretation obtained on the

so-called quantificational reading of the indefinite.

Let us now look at the, maybe less easy but more straightforward, interpretation of example (34), to begin with that of clause (36) and its corresponding form (37). If the indefinite is not bound, we get the following interpretation:

- $M, g, pqde \models^p$ (37) iff $d \in M(\textit{WO-CA})$ and $g(x) \in M(\textit{CAM})$
  $M, g, pqde \models^c$ (37) iff $q = [d \in M(\textit{CAM})]$ and $p = [g(x) \in M(\textit{CAM})]$
  $M, g, pqde \models^a$ (37) iff $\langle p, q\rangle \in M(\textit{BEC})$

Abstraction over x gives us, relative to two propositional functions p' and q' and an individual function f, the following sets of individuals as presupposed, contributed, and asserted by the verb phrase of (34):

- $\{d \mid f(d) \in M(\textit{WO-CA})$ and $d \in M(\textit{CAM})\}$
  $\{d \mid q'(d) = [f(d) \in M(\textit{CA})]$ and $p'(d) = [d \in M(\textit{CAM})]\}$
  $\{d \mid \langle p'(d), q'(d)\rangle \in M(\textit{BEC})\}$

Combining this with 'all' we get:

- $M, g, Dp'q'fh \models^p$ (35) iff $\forall d \in D$: $f(d) \in M(\textit{WO-CA})$ and $d \in M(\textit{CAM})$
  $M, g, Dp'q'fh \models^c$ (35) iff $\forall d \in D$: $q'(d) = [f(d) \in M(\textit{CAM})]$ and $p'(d) = [d \in M(\textit{CAM})]$
  $M, g, Dp'q'fh \models^a$ (35) iff $\forall d \in D$: $\langle p'(d), q'(d)\rangle \in M(\textit{BEC})$

In more colloquial speech: sentence (34), with logical form (35), and under a non-bound but dependent interpretation of the indefinite, presupposes an individual function f which assigns each individual in D a woman who comes whereas that individual itself comes as well; it contributes two propositional functions assigning each individual in D the proposition that that individual comes and the proposition that the woman associated with that individual comes, respectively; and it asserts that, for each individual in D, the first proposition was because of the latter. That is, for each individual $d \in D$, there is some woman $f(d)$ such that the fact that $f(d)$ came 'caused' d to come as well. Indeed, this corresponds to the interpretation obtained on the so-called intermediate reading of the indefinite. Notice that the indefinite noun phrase not only retains the position which it was assigned in the logical form in (35) *under BEC*, but also semantically its assertoric force remains under the scope of that operator. For any individual $d \in D$, the indefinite supplies a witness $f(d)$ at the assertoric level, on the scope island, and to the effect that the (presupposed) fact that $f(d)$ came is asserted to have caused d's coming.

Armed with the preceding observations, it is easy to see how a so-called specific interpretation can be obtained. If, in the abstract corresponding to the verb phrase of (34), the witness for the indefinite 'a woman' is a constant function, or an individual itself, we arrive at the folowing interpretation of the sentence:

- $M, g, Dp'q'bh \models^p$ (35) iff $\forall d \in D$: $b \in M(\textit{WO-CA})$ and $d \in M(\textit{CAM})$
  $M, g, Dp'q'bh \models^c$ (35) iff $\forall d \in D$: $q'(d) = [b \in M(\textit{CAM})]$ and $p'(d) = [d \in M(\textit{CAM})]$
  $M, g, Dp'q'bh \models^a$ (35) iff $\forall d \in D$: $\langle p'(d), q'(d)\rangle \in M(\textit{BEC})$

This interpretation of (35) presupposes that b is a woman who came and that

all D came, and it asserts that, for each $d \in D$, the fact $p'(d)$ that d came was because of the fact $q'(d)$ that b came. Again, syntactically, the indefinite has remained in place, and also at the assertoric level it has delivered its assertoric contribution, the witness b, on the scope island. Clearly, the fact that the indefinite has access to other dimensions, and that it may use these to find a witness on the continent, so to speak, does not in any principled way conflict with the scope island constraint.

A lot of dust has been raised about the deemed escapist behaviour of indefinites on scope islands. We hope the preceding discussion has served to sooth matters a bit. For one thing, indefinite noun phrases behave the same, there, like other terms, such as proper names and definites noun phrases. The case for changing our intuitive understanding of this category of terms, indefinite noun phrases, could not be worse, it seems. Yet it is. For, for another thing, indefinite noun phrases behave like all other noun phrases do on scope islands.

We have argued that indefinites deliver their assertoric contribution, a witness, to the interpretation of the scope island which syntax and semantics has condemned them to live on. The fact that they have access to other dimensions of interpretation, where they may chase their witnesses, does not contradict this hard, syntactic constraint. But very much the same can be said about genuinely quantified noun phrases. In section (3) we have proposed that binary determiners assert a relation between sets, and this is indeed something which cannot be lifted from scope islands. But determiners, as well, have their own dimensions of interpretation. It does not take any great effort to see that their domain presuppositions don't get constrained by any island configurations. Consider:

(38) If a boy goes to a party because he thinks most girls in his class come too, he is disappointed, of course, when they don't show up.

It doesn't matter, here, whether 'they' stands for the girls in a boy's class, or for most of them. What matters is that they are dependent on a boy, or on what class he is in, and that this dependence is not asserted but contributed by the construction 'most girls in his class' on the island under 'because'. Thus, although we do not want to deny that the assertoric contribution of 'most' is tied to the clause headed by 'because', its presupposition is not bound in that way, and in this sense the quantified noun phrase 'most girls in his class' behaves just like terms do. Its assertive value is island bound, but its contribution or presupposition, of course, is not.

In sum, acknowledging various dimensions of interpretation is wholesome in two respects. First, it allows us keep to the scope island constraint, without any modifications. Second, it allows us to do away with all putative counterexamples to that constraint, without postulating any ambiguities, and without any need to invent an ad hoc semantics for a category of terms which allow scope island constraint violating paraphrases. Upon reflection, these terms don't violate any scope island constraints, and they pattern well with all other noun phrases. Their cross-dimensional interpretation is independently and cross-categorially

motivated.

Conclusion

In this paper we have sketched and motivated an architecture for a flexible treatment of anaphora, presupposition and quantification. Although we have drawn from many results from the recent literature, the baseline has been, and has remained, rather classical. On the issues of presupposition and quantification we have been extremely conservative, and tried to implement the insights of the seventies of the last century. Our treatment of anaphoric relationships is of a more recent date, but equally conservative. It involves a proper, and minimal, extension of classical systems of interpretation. In no respect do we require, assume, or envisage a change in the standard concept of meaning. Or so we think.

Even so, at least two principled questions raise their head. In the previous sections we have seen that our satisfaction semantics can and should be adjusted to contextual needs, certainly when we consider the interpretation of combinatorial constructions like conjunctions, implications, but also (binary) quantified constructions. The binding and projection of presuppositions can be handled in various alternative ways and this is as it should be, since this phenomenon seems to be constrained by pragmatic principles and world knowledge, as had already been argued by (Gazdar 1979; Karttunen and Peters 1979; van der Sandt 1992) and recently (Beaver 1999). Does this mean that pragmatic principles infect the semantics? The answer to this question is not entirely obvious. It is not inappropriate to say that recent work in (radical) pragmatics, optimality and game theory involves cleaning up the proverbial pragmatic bin, infamous from the seventies of the previous century. But if this is all that is going on, this work leaves the traditional division of labour unaffected. Indeed, the bin was and still is very dirty, and it is both theoretically and empirically quite rewarding to see some cleaning up, but the lazy semanticist may remain comfortably unaffected.

Thus, with some ironic grains of salt, one might say that where, e.g., (Cooper 1979; Rooth 1992) succeeded in giving a transparent, indeed almost trivial, semantics of pronouns and focus sensitive "only", by means of free variables, basically, they thereby relegated all serious problems to pragmatics. And where people nowadays make pragmatic sense of these free variables, and, for instance, know how to determine the relevant order of alternatives over which these variables range, they, arguably, thereby do no more than cleaning up the bin, and the lazy semanticists may reward them with a sympathetic but supercilious, because platonic, smile.[23] Where do we stand in this respect?

23. Even the both philosophically and linguistically most instructive pragmatic work on beliefs in (Aloni 2001) might elicit, from a true fundamentalist, nothing more than the acknowledgment of "another free variable, which we had not previously been aware of".

Reflecting upon the state of the art in presupposition theory it seems a semanticist cannot really say anything more definitive about the projection or resolution of presuppositions than that they must be related to the context.[24] And indeed, as a semanticist, I am satisfied with that. Consider an utterance of:

(39) Mark did not invite the president of Trans-Danubia.

From a semantic perspective we better be silent about what the presuppositions of such an utterance should be.[25] We need an architecture to represent presuppositions, and the possible ways in which they can be projected or resolved, and this is what we have offered in this paper, but we must leave it to pragmatics, or decision theory, to determine exactly how that works out.

There is another principled question that needs to be addressed: why not *DRT*? I have got only one answer, a counterquestion: why not indeed?[26] Despite some formal and notational deviations (which are not trivial though) we have offered a semantic architecture for modeling presupposition and quantification which has already been rendered, quite adequately, in the representational framework of *DRT*. What is more, the gist of our three-dimensional approach can be rendered maybe even more transparently within that framework as well. Thus, for instance, a three-dimensional interpretation of (40) can be most perspicuously rendered by means of (41):

(40) George chased a husky.

(41)

x	y	
george(x)	husky(y)	chase(x, y)

Naturally, such a *DRS* should be interpreted 3D. Its embedding requires two individuals as witnesses for x and y such that the first is presupposed to be George, such that the second is contributed as a husky, and such that the first is asserted to chase the second. Indeed, a three-dimensional representation is not only most transparent, but it would also facilitate the discussion about how 3D *DRS* can be merged, and their presuppositions and contributions can be projected, resolved and bound. So what do we gain from our semantic architecture if a representational one can be made to do all the work?

First, and foremeost, our exercise shows that a representational formulation need not come without a proper interpretation. Representational computations are shown to correspond to semantic operations, and, thus, to be meaningful. This is more or less a philosophical point, which may not appeal to every reader, but it is not trivial and such an enterprise can be revealing. We already mentioned (Groenendijk and Stokhof 1991, in manuscript available

24. "Presuppositions are related to and licensed by the context in which they appear, and not by some unique individual in the context." is the way in which Joakim Nivre (p.c.) reformulated one of the 'fundamental' conclusions of the corpus findings in (Spenader 2002).

25. See (Strawson 1964) for some initial discussion.

26. In proper Dutch, which I am unable to translate, "Waarom ook niet?"

around 1987) in the introduction as a prime example showing that a procedural treatment of anaphoric relationships does not presuppose a representational theory of meaning. Progress has been made with (Zeevat 1989)'s compositional interpretation of *DRT*, and (Dekker 2002a) has next shown that *DRS*s indeed are the logical normal forms of natural language discourse, compositionally interpreted. Our architecture for pressupposition and assertion is also revealing in this respect. If anything, it shows that what has become known as 'intermediate accommodation' is not just a (much disputed) artefact of the representational format, but also completely superfluous.

Second, and more practically, our exercise shows once more that up to date results can be achieved without a breach in tradition. Our treatment of quantifiers is that of Montague, Keenan, Barwise and Cooper, and the only thing we have added is another dimension. This is significant, because a shift to a different semantic framework, be it representational, situation theoretic, or dynamic, has often invoked (asked for, or inspired) an idiosyncratic concept of quantification. With our enterprise, we have not felt any need to change the general concept of quantification. So even if it is formulated in the representational format of *DRT*, quantification, anaphora and presupposition still fit in the schemes of interpretation as developed in the golden age of Montagovian semantics.

```
This is where the manuscript ends.
It seems the author wanted to talk more about
```

Bibliography

Abusch, D.: 1994, The scope of indefinites, *Natural Language Semantics* 2, 83–135

Aloni, M.: 2001, *Quantification under Conceptual Covers*, Ph.D. thesis, ILLC/Department of Philosophy, University of Amsterdam, Amsterdam

Beaver, D.: 1995, *Presupposition and Assertion in Dynamic Semantics*, Ph.D. thesis, CCS, Edinburgh, Published in 2001 by CSLI Publications, Stanford.

Beaver, D.: 1999, Presupposition: a plea for common sense, in L. S. Moss, J. Ginzburg, and M. de Rijke (eds.), *Logic, Language and Computation, vol.2*, pp 21–44, CSLI, Stanford

Bende-Farkas and Kamp, H.: 2001, *Indefinites and Binding: from Specificity to Incorporation*, Technical report, IMS, Stuttgart

Breheny, R.: 2002, *Exceptional-scope Indefinites and Domain Restriction*, Talk given at Sinn und Bedeutung VII, Konstanz

Butler, A.: 2002, *Barriers and Usage*, Unpublished manuscript, ILLC/University of Amsterdam

Cooper, R.: 1979, The interpretation of pronouns, in F. Heny and H. Schnelle (eds.), *Syntax and Semantics 10*, Academic Press, New York

Dekker, P.: 1998, Speaker's reference, descriptions and information structure, *Journal of Semantics* 15(4), 301–330

Dekker, P.: 2002a, Meaning and use of indefinite expressions, *Journal of Logic, Language and Information* 11, 141–194, In print

Dekker, P.: 2002b, A pragmatic view upon indefinites, in R. K. Klaus von Heusinger and W. Meyer-Viol (eds.), *Proceedings of the Workshop "Choice Functions and Natural Language Semantics"*, pp 17–34, Arbeitspapier 110: FB Sprachwissenschaft. Universität Konstanz, Konstanz

Dekker, P.: 200x, Grounding dynamic semantics, in A. Bezuidenhout and M. Reimer (eds.), *Descriptions and Beyond: An Interdisciplinary Collection of Essays on Definite and Indefinite Descriptions and other Related Phenomena*, Oxford University Press, Oxford, Under review

Donnellan, K.: 1966, Reference and definite descriptions, *Philosophical Review* 75, 281–304

Donnellan, K.: 1978, Speaker reference, descriptions and anaphora, in P. Cole (ed.), *Syntax and Semantics, Vol 9. Pragmatics*, pp 47–68, Academic Press, New York

Egli, U. and von Heusinger, K.: 1995, The epsilon-operator and e-type pronouns, in U. E. et al. (ed.), *Lexical Knowledge in the Organization of Language*, pp 121–141, Benjamins, Amsterdam

Farkas, D.: 1981, Quantifier scope and syntactic islands, in R. A. Hendrick, C. S. Massek, and M. F. Miller (eds.), *Papers from the Seventeenth Regional Meeting Chicago Linguistics Society*, pp 59–66, University of Chicago

Fodor, J. and Sag, I.: 1982, Referential and quantificational indefinites, *Linguistics and Philosophy* 5(3), 355–398

Gazdar, G.: 1979, *Pragmatics. Implicature, Presupposition, and Logical Form*, Academic Press, New York

Geach, P. T.: 1962, *Reference and Generality. An Examination of Some Medieval and Modern Theories*, Cornell University Press, Ithaca

Geurts, B.: 2002a, Donkey business, *Linguistics and Philosophy* 25(2), 129–156

Geurts, B.: 2002b, Specific indefinites, presupposition and scope, in R. Bäuerle, U. Reyle, and E. Zimmermann (eds.), *Presuppositions and Discourse*, Elsevier, Oxford

Geurts, B. and van der Sandt, R.: 1999, Domain restriction, in P. Bosch and R. van der Sandt (eds.), *Focus: Linguistic, Cognitive, and Computational Perspectives*, pp 268–292, Cambridge University Press, Cambridge

Grice, H.: 1975, Logic and conversation, in P. Cole and J. L. Morgan (eds.), *Syntax and Semantics, Vol III: Speech Acts*, pp 41–58, Academic Press, New York

Groenendijk, J. and Stokhof, M.: 1991, Dynamic predicate logic, *Linguistics and Philosophy* 14(1), 39–100

Heim, I.: 1982, *The Semantics of Definite and Indefinite Noun Phrases*, Ph.D. thesis, University of Massachusetts, Amherst, Published in 1988 by Garland, New York.

Heim, I.: 1989, *The Semantics of Definite and Indefinite Noun Phrases*, Garland, Ithaca

Heim, I.: 1990, E-type pronouns and donkey anaphora, *Linguistics and Philosophy* 13(2), 137–78

Heim, I.: 1992, Presupposition projection and the semantics of attitude verbs, *Journal of Semantics* 9, 183–221

Jäger, G.: 2002, *Specific Indefinites: Presupposition Accommodation by Existential Closure*, Talk given at Sinn und Bedeutung VII, Konstanz

Kamp, H.: 1990, Prolegomena to a structural account of belief and other attitudes, in C. A. Anderson and J. Owens (eds.), *Propositional Attitudes*, pp 27–90, CSLI, Stanford

Kamp, H. and Reyle, U.: 1993, *From Discourse to Logic*, Kluwer, Dordrecht

Karttunen, L. and Peters, S.: 1975, Conventional implicature in montague grammar, in C. Cogen, H. Thompson, G. Turgood, K. Whistler, and J. Wright (eds.), *Proceedings of the First Annual Meeting of the Berkeley Linguistics Society*, pp 266–278, University of California

Karttunen, L. and Peters, S.: 1977, Requiem for presupposition, in K. Whistler, R. D. van Valin jr, chris Chiarello, J. J. Jaeger, M. Petruck, H. Thompson, R. Javkin, and A. Woodbury (eds.), *Proceedings of the Third Annual Meeting of the Berkeley Linguistics Society*, pp 360–371, University of California

Karttunen, L. and Peters, S.: 1979, Conventional implicature, in C.-K. Oh and D. A. Dinneen (eds.), *Syntax and Semantics 11 – Presupposition*, pp 1–56, Academic Press, New York

Kratzer, A.: 1989, An investigation of the lumps of thought, *Linguistics and Philosophy* 12(5), 607–653

Kratzer, A.: 1998, Scope or pseudoscope? Are there wide-scope indefinites?, in S. Rothstein (ed.), *Events in Grammar*, pp 163–196, Kluwer, Dordrecht

Kripke, S.: 1979, Speaker's reference and semantic reference, in P. A. French, T. E. Uehling, and H. K. Wettstein (eds.), *Contemporary Perspectives in the Philosophy of Language*, Chapt. 6–27, University of Minnesota Press, Minneapolis

Matthewson, L.: 1999, On the interpretation of wide-scope indefinites, *Natural Language Semantics* 7, 79–134

Meyer Viol, W.: 1995, *Instantial Logic*, Ph.D. thesis, OTS, Utrecht, ILLC Dissertation Series no. 1995–11

Reinhart, T.: 1997, Quantifier scope: How labor is divided between QR and choice functions, *Linguistics and Philosophy* 20, 335–397

Rooth, M.: 1992, A theory of focus interpretation, *Natural Language Semantics* 1(1), 75–116

Schlenker, P.: 1999, *A Note on Skolem Functions and the Scope of Indefinites*, Typoscript

Spenader, J.: 2002, *Presuppositions in Spoken Discourse*, Ph.D. thesis, Department of Linguistics, Stockholm University, Stockholm

Stalnaker, R.: 1978, Assertion, in P. Cole (ed.), *Syntax and Semantics 9* –

Pragmatics, pp 315–332, Academic Press, New York

Stalnaker, R.: 1998, On the representation of context, *Journal of Logic, Language and Information* 7, 3–19

Strawson, P. F.: 1964, Identifying reference and truth-values, *Theoria* 30, 96–118

van der Sandt, R. A.: 1992, Presupposition projection as anaphora resolution, *Journal of Semantics* 9, 333–377

van Eijck, J.: 1994, Presupposition failure: A comedy of errors, in *Formal Aspects of Computing*, pp 766–787

van Rooy, R.: 1997a, *Attitudes and Changing Contexts*, Ph.D. thesis, IMS, Stuttgart

van Rooy, R.: 1997b, Descriptive pronouns in dynamic semantics, in P. Dekker, M. Stokhof, and Y. Venema (eds.), *Proceedings of the Eleventh Amsterdam Colloquium*, pp 265–270, ILLC, University of Amsterdam, Amsterdam

van Rooy, R.: 2002, Presupposition: An (un)common attitude?, in R. Bäuerle, U. Reyle, and E. Zimmermann (eds.), *Presuppositions and Discourse*, Elsevier, Oxford

Visser, A.: 1994, Actions under presuppositions, in J. van Eijck and A. Visser (eds.), *Logic and Information Flow*, MIT Press, Cambridge, Mass.

von Fintel, K.: 1994, *Restrictions on Quantifier Domains*, Ph.D. thesis, University of Massachusetts, Amherst

Winter, Y.: 1997, Choice functions and the scopal semantics of indefinites, *Linguistics and Philosophy* 20, 399–467

Zeevat, H.: 1989, A compositional approach to discourse representation theory, *Linguistics and Philosophy* 12, 95–131

Zeevat, H.: 1992, Presupposition and accommodation in update semantics, *Journal of Semantics* 9(4), 379–412