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Presupposition Computation and Presupposition Justification: One Aspect of the Interpretation of Multi-Sentence Discourse

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1 Introduction

As a rule discourse meanings are more than plain conjunctions of sentence meanings[1]. And this "more" is often the effect of interpretation principles that are an integral part of linguistic knowledge, and thus legitimate objects of linguistic study. This observation has been the main

[1]The substance of this paper goes back several years. I have used the example with which the paper is exclusively concerned repeatedly in oral presentations, going back as far as 1996, as a simple illustration of the inferential effects of presupposition justification, and of the interaction between different presuppositions triggered within one and the same sentence. I know that over the years I have benefitted from feedback of more people than I now recall. On pain of offending some who ought to be mentioned here, I would like to thank some of them by name: Peter Krause, Uwe Reyle, Antje Rossdeutscher and Michael Schiehlen have helped me not just to understand better the details of the example in question, but also to arrive at the general perspective of the role of presupposition in discourse of which the treatment proposed in this paper is a single illustrative instance. I am grateful also for the recommendations of an anonymous referee, which I have found very helpful and with which I have tried to comply to the best of my ability. Thanks, finally, to Peter and Antje for seizing this opportunity to wean me (almost) of Word 5.1 and throw me into the deep end of LaTeX.

driving force behind dynamic theories of discourse semantics such as Discourse Representation Theory (DRT) and its extensions S(egmented) DRT and U(nderspecified) DRT.

Our understanding of the mechanisms for computing discourse interpretations is still quite limited. But there has been significant progress, and one thing which has become much clearer in recent years is the role played by presupposition. Most natural language sentences come with presuppositions of one kind or another. These presuppositions must be justified in the context in which the sentence is used. In ongoing discourse or text, the relevant context is often the 'discourse context' established by the sentences or utterances preceding the one whose presuppositions are in question. In such cases presupposition justification is justification in the discourse context.

Often presupposition justification takes the uneventful form of finding the given presupposition or presuppositions satisfied in the given context. But not always. In many other cases the context does, as it stands, not quite measure up to the verification task. It doesn't verify the presuppositions as is, but needs adjustment — by 'accommodation', as linguistic parlance has it — to fit the requirements that the presuppositions impose. This doesn't mean, however, that whenever direct verification fails, the unverified presuppositions get accommodated lock, stock and barrel. There are many instances where the context, while failing to verify the presuppositions at issue, nevertheless contains much of what is needed for their verification; just a small bit of information is missing to make verification complete. In such cases it is not only possible to achieve accommodation by accommodating just this little bit; as a rule, when such a limited accommodation suffices, that accommodation is highly preferred or even mandatory: Even if other, more comprehensive accommodations are possible which also transform the given context into one in which the presuppositons are also satisfied, the rules of interpetation require the smaller, 'less costly' accommodation. As a consequence, the bit of information that gets accommodated will be perceived as one of the discourse's entailments[2].

An example of the effect that presupposition justification can have on discourse meaning is the following discourse:

(1) I gave the workers a generous tip. One thanked me. The other one left without saying a word.

[2]To my knowledge the fact that presupposition justification often takes the form of exploiting as much of the information that is part of the context as given, while accommodating only those bits which are needed to make verification complete, and the importance of this fact for discourse interpretation, were first stressed explicitly in Kamp and Roßdeutscher (5). The term 'presupposition justification' was introduced in that paper as a cover term which subsumes (i) the cases of straightforward presupposition verification (including cases of 'anaphoric binding',van der Sandt (11), (ii) the cases of whole-sale accommodation and (iii) the cases which can be seen as a mixture of verification and accommodation. More about this in Section 6.

Anyone who reads this little text is led to conclude that the number of workers mentioned in the first sentence was two. It is clear that this conclusion is available only after all three sentences have been processed.

It is not hard to see that this conclusion crucially depends on the interpretation of the subject NP *The other one* of the third sentence. In the following sections I will argue that it is the need to justify the different presuppositions triggered by this phrase in the context provided by the first two sentences of (1) which is responsible for it, and then I will analyse in detail how the justification process gives rise to it.

(1) also illustrates another aspect of presupposition justification. The inference that there were exactly two workers who got a tip depends on the interaction between several presuppositions. (In this case the relevant presuppositions are all triggered by different components of the NP *the other one*: the word *one*, the word *other*, the definite article *the* and the number feature *singular*). It is the requirement that the package consisting of these different presuppositions be satisfied as a whole that accounts for the inference. In fact, it is easy to see how closely this conclusion depends on the exact form of the subject NP of the third sentence: As we will see in Section 6, 'small' changes in this NP, such as from *the* to *a* or from singular to plural, yield different conclusions about the size of the set of workers.

2 General Assumptions about the Syntax-Semantics Interface. Construction of the Preliminary Representation of the First Sentence

In my reconstruction of (1) I will assume syntactic analyses of the individual sentences as given. The analyses of which I will make use conform (to the best of my knowledge) to assumptions made within generative linguistics, in particular those associated with the Theory of Government and Binding. However, I do not wish to make a definitive commitment to this or any competing theory of syntax[3]. On the semantic side, the representations I will be using are based on

[3] This paper is not intended as a contribution to the syntax-semantics interface in the strict sense of the word — where the concern is to combine a specific, fully articulated syntactic theory with a systematic account of how semantic representations are derived from the syntactic structures the syntactic theory proposes. Rather, what I will present is to be seen as an attempt to identify some of the necessary elements that any syntax-semantics interface of the kind alluded to should incorporate. In this context, the syntactic analyses which I will assume should be regarded as incorporating sets of syntactic properties of the analysed sentences which any viable theory of syntax should make available in some form. Of course, this way of proceeding, which is now usually referred to as specifying an "abstract syntax-semantics interface", is meaningful only to the extent that there is agreement among syntacticians

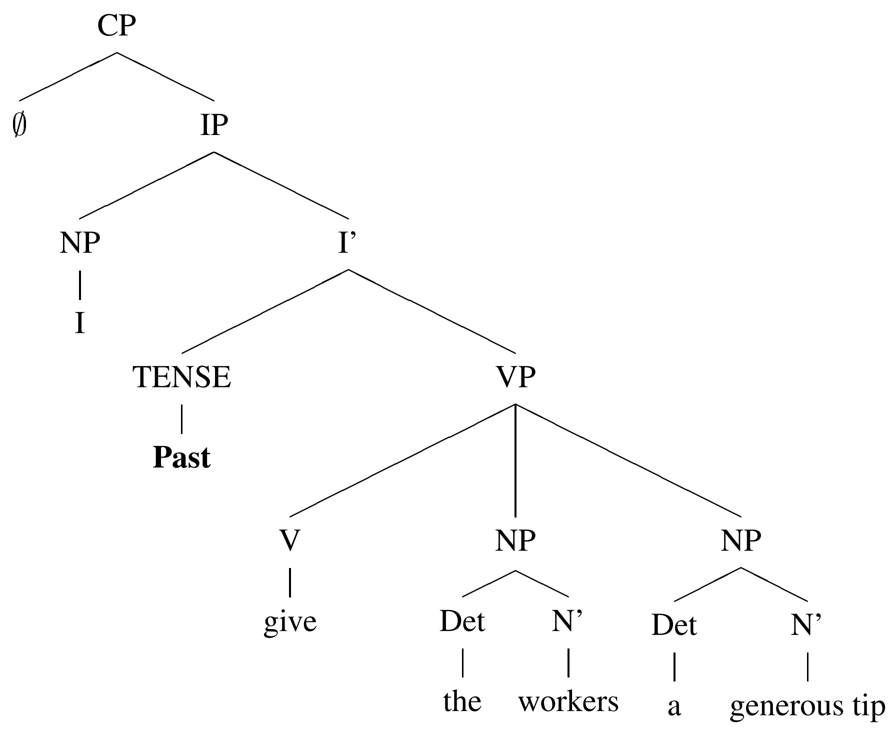
Discourse Representation Theory, more precisely, the representations belong to a DRT-based formalism closely related to that used by Van Der Sandt in his seminal presupposition paper van der Sandt (11). The use of a representation formalism that permits integration of the representation of the current sentence of a discourse or text into the representation of the preceding sentences is, for reasons that should be obvious in the light of what I have said about (1), essential to the kind of analysis the basic outline of which I sketched in section 1. Specifically, we will proceed by and large along the path which Van Der Sandt and others working within a DRT-based framework for the treatment of presuppositions have broken:
(2) Given a representation K of the context provided by the sentences $s_1 \ldots s_{n-1}$ of the given discourse:

(i) construct a *preliminary* representation of sentence s_n in which all the presuppositions generated by presupposition triggers in s_n are explicitly represented;

and then

(ii) integrate this preliminary representation, if possible, into the context representation K, thus transforming K into a new context representation K' for the next sentence.

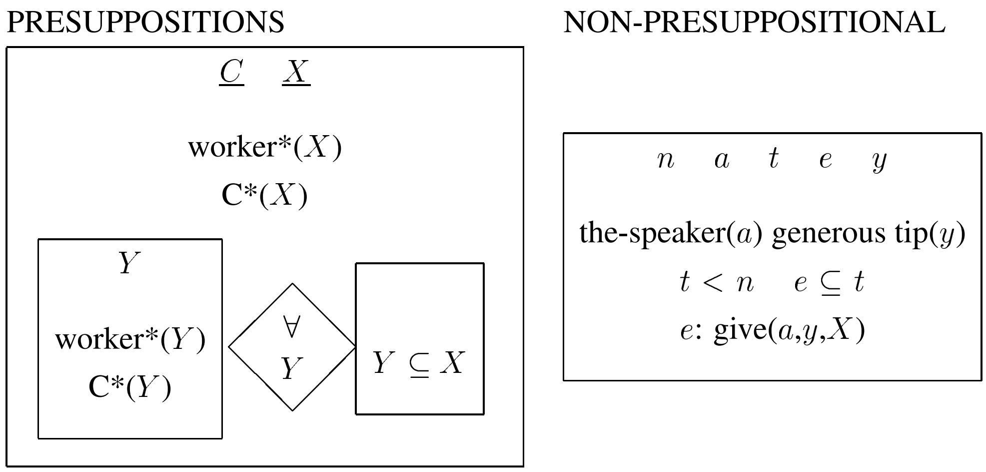
We begin with the first sentence of (1), assuming the syntactic analysis given in (3):
(3)



about the extensions of these syntactic properties, even if there may be substantive differences about the principles which determine these extensions. For more on the syntax-semantics interface see Kamp (3).

The preliminary representation of this sentence which we will be using is that in (4)

(4) Preliminary representation for (1):



Here is a gloss for reading representations like (4).

(i) The representation consists of a non-presuppositional part on the right and a presupposition structure preceding it on the left. (In the present case this structure consists of one presupposition only, but we will later see representations involving sets of presuppositions and even cases of presupposition nesting) The non-presuppositional part of the representation is the one that identifies the actual propositional content of the represented sentence. This part gets added to the context representation once the presuppositions in the presupposition structure have been justified in it.

(ii) Both the non-presuppositional part and the presuppositions in the presupposition structure are given in the form of (one or more) Discourse Representation Structures (DRSs)[4]. Here is a rough indication of how these are to be interpreted. Consider in particular the non-presuppositional part of (4). This is a DRS which, like any other, consists of a DRS *universe* — the set of *variables* (also called "discourse referents") $n, \ldots, y$ at the top of the representation — and a set of *conditions*, entered below them. The variables represent entities of different types — n and t represent times, e an event and a and y ordinary individuals. Their presence in the universe of the DRS signifies that there exist entities of the corresponding types which satisfy the DRS-conditions, in which the variables occur as arguments. n acts as an indexical element; it stands for the utterance time of the represented sentence.

[4]Familiarity with DRT (e.g. with an introduction such asKamp and Reyle (4) will make access to this and later representations much easier, but I hope that the comments given in the text will make it possible to follow what is going on even for those who have little or no knowledge of the theory.

(iii) Most of the conditions of this DRS are self-explanatory. Just to be on the safe sidel:l "e: give(x, y, z)" can be paraphrased as: "e is an event of the type of x giving y to z".

(iv) From these few remarks it should be clear that the non-presuppositional DRS represents a statement to the effect that there is an individual a who is the utterer of the given utterance of (1), a generous tip y and an event e of a giving y to a set X consisting of two or more workers.

(v) The presuppositional part of (4) consists of two underlined variables X and C, which make up the universe of this part, and a number of conditions. The conditions "worker*(X)" and "C*(X)" and the complex condition below them jointly express that X consists of all the individuals that (a) are workers and (b) satisfy the predicate C. (The first two conditions state that X consists of such individuals, and the last condition that X is the largest such set, including all others that satisfy the first two conditions.)

(vi) As regards the details of the presuppositional part:

(a) Capital letters are used for variables whose values are sets of two or more elements. Alternatively, such variables can be taken to range over the non-atomic entities of a mereological universe in the sense of Link (9).

(b) The * in "worker*(X)" and "C*(X)" is an operator which turns a predicate of individuals into a distributively interpreted predicate of sets. For instance, "worker*" is that predicate of sets which is true of a set Y iff each member of Y satisfies the predicate "worker".

(c) The third condition is *complex* in the technical sense of DRT in that it is built from component DRSs with the help of one or more logical operators. In this case the operator is the universal quantifier, which, in the spirit of Generalized Quantifier Theory combines a "restrictor" (the left DRS) with a "scope" (the right DRS). The interpretation of this condition should be intuitively clear: Every possible value of the quantified variable Y which yields a verification of the restictor DRS also allows verification of the scope DRS. In this paper we will be dealing with only one other type of complex condition, in which the logical operator is negation.

(vii) The presupposition of (4) is triggered by the plural definite description *the workers*. The intuition behind this is as follows:

(a) Like other definite NPs, definite descriptions carry the presupposition that their referent can be uniquely identified in the given context. The referent must either satisfy the descriptive content of the description; or, alternatively, it must consist of elements that satisfy that descriptive content. Moreover, the descriptive content may be assumed to identify the referent uniquely, but often it will do so only in conjunction with an additional restriction C which is to be recovered from the context. Thus the description imposes in general a double task of identification-in-context: of the referent itself and, as part of this, of the restricting predicate C. In certain cases the descriptive content will suffice for identification by itself; in such cases C can be identified with the universal predicate.

(b) The underlining of the variables C and X is used as an indication of the requirement that antecedents be found for these variables in context. The paradigmatic example of this kind of underlining is that of the variable introduced by an anaphoric pronoun, for which an anaphoric antecedent has to be found in the discourse context.

(c) Plural descriptions differ from singular ones in that any referent of the former must be a set of cardinality > 1 (or: a non-atomic element of the mereology), whereas any referent of the latter must be an individual (or: an atomic element). Thus, both plural and singular descriptions generate presuppositions of (i) existence of something satisfying the relevant conditions and (ii) maximality vis-a-vis those conditions. Singular and plural, then, add the respective conditions of atomicity and non-atomicitiy. The conjunction of the three conditions existence, maximality and atomicity amounts to unique satisfaction — the classical presupposition associated with singular definite descriptions.

Remark: Arguably the displayed presupposition of (4) is not the only one that is generated by the first sentence of (1). First, there is a pre-state presupposition associated with the verb *give*: In order that an event e of the type "$e : give(x, y, z)$" can take place it is necessary that at the moment when e starts, x has y. In addition, it could be argued that the definite NP *I* carries a presupposition of reference. In practice this presupposition is always satisfied in the context in which *I* is used, insofar as use — that is: utterance — implies that there is someone who does the uttering, and thereby is the referent of that token of *I*. And, finally, the sentence generates several *selectional restriction*. Selectional restrictions are presuppositional constraints associated with the argument positions of verbs and other lexical predicates. They are constraints imposed by the lexical meaning of the predicate, to the effect that the entities occupying these argument positions must be of certain specified ontological types. As none of these other presuppositions has any relevance to the problem about (1) in which we are interested, they have not been explicitly represented. Whenever a presupposition is not explicitly represented, whether in (4) or in the preliminary representations of the next two sentences, the implicit assumption will be that whenever necessary, the presupposition is accommodated.

The principles by which (4) is derived from (3) I won't spell out in full formal detail[5]. But the following tips ought to be sufficient to see how the construction goes:

(a) The representation of the non-presuppositional part of the DRS for (3)

(i) The lexical entry for the main verb contains a characterisation of the type of the eventualities (i.e. events or states) which the verb can be used to describe[6]. Here we make use of a simplified version of the semantic component of the entry for *give*, for which we assume the form given in (5)

(5) e: give(x, y, z)

The contribution made by the occurrence of *give* in the sentence (3) is to introduce an instance of (5) into the semantic representation, where the variables x, y, z are arguments contributed by the corresponding argument phrases of (3) — see under (iii). In addition, the occurrence of *give* leads to a condition of the form "$e \subseteq t$" which says that the event e is located within the temporal interval t.

(ii) The variable t is further constrained by information attached to nodes higher up in the tree. Here we assume that this information is restricted to that provided by the simple past tense (in *gave*), and that this means that t lies entirely before the utterance time n. Moreover, both e and t are exsistentially bound at the level of CP. In the DRT-notation used here this takes the form of introducing these variables into the universe of the representation of the non-presuppositional part of (3).

(iii) Each argument phrase introduces a variable which (a) gets inserted into the relevant argument slot of the semantic representation of the verb; (b) serves as argument to the descriptive content of the argument phrase itself; and (c) gets *bound* according to principles which depend on the form of the argument phrase, in particular on the kind of determiner (in those cases where the phrase has a determiner), as well as on other aspects of the function that the given occurrence of the phrase plays in its sentential environment[7]. Binding, as the term is used here, can take different forms. One of these is the quantificational binding familiar from standard logic. (This is the kind of binding involved in the interpretation of genuinely quantificational NPs, which begin with determiners such as *every* or *most*.) But variables can also be "bound,, by being identified with other designators — the typical case being that of the variables

[5]See (3) for further comments on the construction of preliminary sentence representations.

[6]A lexicon is needed both to support syntactic parsing and for the conversion of the syntactic parse into the preliminary semantic representation; I won't say much about the lexicon in this presentation, leaving the diverse roles it has to play for the most part implicit.

[7]For instance, different uses of definite descriptions involve different binding strategies. The same is true for many other types of definite NPs and also for indefinite noun phrases.

introduced by anaphoric pronouns, which are "bound" by their anaphoric antecedents — or by the default binding familiar from the classical analyses of indefinite NPs of original File Change Semantics and DRT. (The binding of e and t spoken of under (ii) is an example of this third main type.)

(iv) We follow Van Der Sandt in assuming that the binding conditions for variables introduced by definite noun phrases always take the form of presuppositions: The binding condition for any such variable is a constraint on the context in which the NP introducing the variable is used; only when it is possible to find (or accommodate) an "antecedent" for the variable in the given context can interpretation of the sentence in question proceed further.

(v) Precisely how the binding conditions which the different types of NPs impose on their variables are to be dealt with depends in part on the order in which the construction of interpretations of the different constituents specified by the syntactic analysis of the sentence proceeds. The construction algorithm I am assuming in this paper operates on trees like (3) in a bottom-up fashion. This means that in the construction of the representation of an NP both the variable it introduces and the binding condition which it associates with that variable have to be carried upwards jointly with the representation of the NP and of the various larger consituents which contain the NP as a subconstitutent, untilthe point where conversion takes place (either into a proper binding or into a presupposition). In the case of the presuppositional binding conditions associated with definite NPs this means that they are to be carried all the way up to the top node of the syntactic tree, at which point the construction of the preliminary representation of the clause is completed and the binding conditions are turned into genuine presupposition representations, which then get prefixed to the non-presuppositional representation of the clause. In the treatment of (1) presented here we will not go through the successive steps of this "compositional"method of constructing preliminary sentence representations, however, and the additional complications that are connected with this procedure may be ignored.

(b) The representation of the presuppositional part of the DRS for (3)

(i) The construction of the representations of the different presuppositions generated by a given sentence will start at the moment the construction reaches the triggers resposible for them. In (4) the only presupposition is that triggered by the definite NP *the workers*. In (vii) of the gloss of (4) I indicated the intuitive motivation behind this presupposition. As that discusion indicated, we are dealing strictly with three distinct sources of presupposition: (i) the identifiability of the additional predicate C, something which the definite article *the* shares with quantificational determiners like *every*, *most*, *many*, etc.; (ii) the maximality condition, which is the specific contribution made by *the*, and (iii) the condition of non-atomicity connected with the plural. We will simply assume here, without working out the details, that these different lexical and morphological elements introduce their respective presuppositions into the representation via appropriate stipulations attached to their entries in the lexicon.

Warning: The presuppositional part in (4) is an unusually simple example of what presupposition structures of sentences can be like. More often than not sentences generate presupposition structures of much greater complexity. We will encounter a somewhat more complicated case when we come to deal with the third sentence of our example, but it too is quite modest when compared with, for instance, many of the propositions triggered by particles like *too* or *again*.)

It ought to be clear from these remarks that the preliminary representation derived from (3) using the principles outlined is as in (4).

3 From Preliminary Representation to Discoursrepresentation. Presupposition Justification and Accommodation.

Since in (4) we are dealing with the preliminary representation of the first sentence of a new discourse, there is no discourse context which could help us to justify the representation's presupposition. Thus, in this case accommodation is the only available strategy. Since this is always the situation at the start of a discourse, accommodation of the presuppositions of the first sentence tends to be the accepted thing. Wholesale accommodation, which the interpreter is wont to resort to in such a situation, has the effect of incorporating first the presupposition(s) into the (as yet non-existent) context, and then adding the non-presuppositional content to that.

The result of whole-sale accommodation in the case of (4) can be represented as in (6)

(6)

$C \quad X \quad n \quad a \quad t \quad e \quad y$
worker*(X) the-speaker(a) generous tip(y)
C*(X) $t < n$ $e \subseteq t$
e: give(a,y,X)
[Y / worker*(Y) C*(Y)] $\langle \forall$ Y $\rangle$ [$Y \subseteq X$]

Since the accommodated predicate C has no other function than that of constraining the set of workers X, we obtain a simpler, logically equivalent representation if we eliminate all reference to C. The new representation is given in (7)

(7)

$X \quad n \quad a \quad t \quad e \quad y$
worker*(X) the-speaker(a) generous tip(y)
$t < n$ $e \subseteq t$
e: give(a,y,X)

4 THE SECOND SENTENCE

We now turn to the second sentence of (1), repeated as (8)

(8) One thanked me.

The part of (8) that requires our attention is the subject phrase *one*. The English word *one* has a number of different uses. In particular, there are different possibilities for the interpretation of the word when it occurs as the sole constituent of a noun phrase, as it does in (8). To be precise, there are, by my counting, three distinct interpretations of NPs of the form *one*: (i) as proper name of the first positive integer; (ii) as the impersonal pronoun (like French *on* or German *man*); and (iii) as a "dummy indefinite" NP, with a meaning that would be more transparently rendered by the archaic expression *a one*, where *one* acts as the stand-in for some common noun phrase, while *a* does its usual duty as indefinite article.

One problem which the interpreter of an instance of the NP *one* has to solve is which of these three different possibilities he is dealing with. It is intuitively clear that in (8) we are dealing with an instance of the third possibility. But how is it that the other two possibilities are eliminated? The answer is quite different for each of the two possibilities (i) and (ii). (i) can be eliminated immediately because of the selectional restrictions associated with the subject argument of the verb *thank*: Numbers do not thank — not even in any readily conceivable metaphorical sense.

But the second possibility, according to which *one* would refer to a set of "relevant individuals", is not so easily dismissed. In the present context the "relevant individuals" would presumably be the workers mentioned in the first sentence, given that the interpretation of *thank* requires finding a subject that has something to thank the speaker for. In the context set by the first sentence only the workers mentioned in it seem to qualify as satisfying this condition. That the occurrence of *one* in (8) is nevertheless not to be assigned this interpretation has to do with the way in which the discourse continues. If *one* were to refer to the set of workers, rather than to one of them, then there would be no basis for interpreting the subject of the third sentence. For now I will set aside this additional complication. I will return to it in Section 7.

Once possibility (iii) has been chosen, the next problem is to interpret *one* according to the rules associated with that possibility. As noted, according to (iii) *one* is an indefinite NP with a dummy noun. Thus, its interpretation must involve the introduction of a new variable representing its referent, together with an identification of the nominal predicate that the dummy noun *one* stands for. The rule for finding this nominal predicate appears to be simply that of finding a common noun phrase from the antecedent discourse that is salient at the point where *one* is to be interpreted, with recency an important one among the factors by which the salience ranking is determined[8].

[8] As in most other cases where salience appears to play a role, it is not easy to say exactly how the relevant salience ordering is determined. But that some sort of salience enters into the question how the common noun phrase is chosen is shown by examples where there seems to be an unresolvable tie between candidates which renders the use of *one* infelicitous. Thus in (9) neither taking the nominal antecedent to be *boy* nor taking it to be *girl* seems to make for a completely satasfactory interpretation:

(9) ? There were three boys and three girls in the room. One was asleep.

Probably (9) should not be regarded as really ungrammatical. Indeed, for all I know, some speakers seem to accept it, with the interpretation that there was one member of the set of three boys and three girls in the room that was asleep. But personally I cannot get this reading for (9).

N.B. Fully acceptable for me is a variant of (9) in which the subject of the second sentence is not *One* but *One of them*. But the interpretation of *one of them* is a quite different story. Here the plural pronoun *them* can be understood as referring to the set of the three boys and three girls introduced by the subject of the first sentence. Moreover, occurrences of *one* in explicitly partitive constructions such as *one of them* can be interpreted as referring to some member of the set referred to by the embedded partitive NP.

As far as I can judge, the NP *one* cannot very well be used to pick an element from a previously introduced set if that set has not been given as the (contextually restricted) extension of a nominal predicate used in the antecedent discourse. Thus I cannot easily get *one* in (10)

(10) Fred, Carl and Lucy had arrived. One had brought a bottle of wine.

to mean "one of Fred, Carl and Lucy". I have a clear preference in such cases of *one of them* over the simple *one* (cf. fn. 8). However, if the set is given as the extension of some noun N, then *one* can be understood as referring to a member of that set, and not just to something or other falling under the noun generally. Thus one natural interpretation of *one* in (11.i) would seem to be that according to which one of the boys who had arrived lived in Reutlingen. But the less constrained interpretation, according to which *one* is short for "one boy" simpliciter, certainly exists too, as shown by (11.ii)

(11.i) Three boys had arrived. One lived in Reutlingen.

(11.ii) Three boys had arrived. One was still missing.

The interpretation of *one* in (8) that we want is of the type illustrated by the first interpretation of (11.i): The referent of *one* is one of the workers mentioned in the first sentence. The alternative, according to which *one* is understood as standing for some worker or other, but not necessarily one of those mentioned in the first sentence, is problematic because of the constraints imposed by the interpretation of the third sentence. We return to this question in Section 7.

(12) summarises the reflections of the last two paragraphs on the possibility of interpreting *one* as an indefinite NP with dummy noun.

(12) (Interpretation of *one* as a 1-word indefinite NP)

1. "Pure N" interpretation

   A. (Addition to the presuppositional part of the representation)

   Add to the presupposition structure:

   (i) a presupposition expressing the requirement of finding in the discourse context a salient common noun phrase N

   B. (Addition ot the non-presuppositional part of the representation)

   Add to the non-presuppositional part:

   (i) a new (not previously used) variable u

   (ii) the condition "$N(u)$".

2. "Set of Ns" interpretation

A. (Addition to the presuppositional part of the representation)

Add to the presupposition structure:

(i) a presupposition expressing the requirement of finding in the discourse context a salient representation U of a set of two or more individuals for which the context contains a characterisation as the set of all N or as the set of all N which satisfy some further conditions, where N is a common noun phrase.

B. (Addition to the non-presuppositional part of the representation)

Add to the non-presuppositional part:

(i) a new (not previously used) variable u

(ii) the condition "$u \in U$".

It is the second of the two options offered by (12) which we want in our preliminary representation of (8). Even though we have not spelled out the instructions of (12.2) in full formal detail, it should be clear that with this option the presuppositional part of the preliminary representation can be represented as in (13)

(13)

PRESUPPOSITIONS NON-PRESUPPOSITIONAL

$$
\begin{array}{|c|}
\hline
\underline{N} \quad \underline{U} \\
\\
\text{N*}(U) \\
\hline
\end{array}
\qquad
\begin{array}{|c|}
\hline
a \quad t' \quad e' \quad u \\
\\
\text{the-speaker}(a) \quad u \in U \\
t' < n \quad e' \subseteq t' \\
e'\text{: thank}(u,a) \\
\hline
\end{array}
$$

As regards the non-presuppositional part of (13): The inclusion of u in the DRS-Universe and the condition "$u \in U$" among its conditions has already been accounted for in (12.2). For the other conditions, concerning the speaker a, the event e' described by the main verb and its temporal location in the past of n, see the comments on (4).

The context for (8) that is provided by (6) provides only one viable solution for the presuppositional task which (13) identifies: Identify N with *worker* and U with X. The result of this justification and the subsequent merge of (13) with (6) is given in (14)[9]:

[9] No account has yet been given for the condition "$e < e'$". This condition has a somewhat different status than

(14)

$X \quad n \quad a \quad t \quad e \quad y \quad t' \quad e' \quad u$
worker*(X) the-speaker(a) generous tip(y) $u \epsilon X$
$t < n \quad e \subseteq t$
e: give(a,y,X)
$t' < n \quad e' \subseteq t'$
$(e < e')$
e': thank(u,a)

(14) is the context for the interpretation of the third sentence of (1), to which we now turn.

5 THE THIRD SENTENCE

We recall the third sentence of (1):
(15) The other one left without saying a word.

As we noted in our informaldiscussion of (1) in Section 1, the crux of the example is the interpretation of the subject NP of (15). The various elements of this NP each introduce their own presuppositional constraints and it is the joint resolution of these constraints in the context (14) which yields the result for which we are aiming: the conclusion that there were two workers. We list once more the relevant elements of the subject phrase and the associated presuppositions:
(16) (Presuppposition-carrying elements of *the other one*)

(i) The definite article *the*.

Presupposition: the referent of the NP is the maximal mereological element satisfying the conjunction of

(a) the descriptive content of the description; and

all others we have so far encountered, which is the reason I have placed it within parentheses — by way of a warning that the condition falls outside the scope of what is explicitly discussed in this paper.

The basis for the condition "$e < e'$ " is the rhetorical structure of the discourse (1) — or, more precisely, of the initial segment of (1) which consists of its first two sentences. It is a typical (though not invariable) property of two successive event sentences in the simple past that the event reported in the second sentence is understood as coming after the event reported in the first sentence. It is this assumption of temporal odering between the two events which the parenthesised condition of (14) expresses. The general mechanisms which yield such conditions belong to a dimension of discourse interpretation that is not considered in this paper. For discussions see Kamp (2), Kamp and Reyle (4) and especially Lascarides and Asher (8).

(b) (possibly) an additional contextual constraint

(ii) The value "singular" of the NP's number feature

Presupposition: the referent of the NP is an individual (atomic element of the mereology).

(iii) The dummy noun *one*.

Presupposition: Much as for the dummy noun *one* of the second sentence (8). For details see below.

(iv) *other*

Presupposition: See below for details.

First the case of *one*. As indicated under (16.iii), this is an occurrence of *one* that is similar to the one in the second sentence. But there are also differences. In (15) we are dealing not with a 1-word NP, but with an NP consisting of a determiner, an adjective and what appears to be a clear case of a dummy noun (and nothing more). In this case the presuppositional condition connected with *one* is limited to the requirement of finding an antecedent for this dummy noun. Once more, however, we are confronted with the question what form this antecedent may take. I confess to being not entirely certain whether the facts are the same for this case as I have taken them to be for the NP *one*in the second sentence, but it seems likely to me that they are. So, formulated in the same format as we used in (12) to summarise our discussion of the contributions made by *one* to the interpretation of the second sentence, we get for the contribution made by *one* to the preliminary representation of (15):
(17) (Interpretation of *one* as a dummy common noun)

1. "Pure N" interpretation

   A. (Addition to the presuppositional part of the representation)

   Add to the presupposition structure:

   a presupposition expressing the requirement of finding in the discourse context a salient common noun phrase N.

   B. (Addition to the non-presuppositional part of the representation)

   Add to the non-presuppositional part:

   the condition "$N(\eta)$", where η is the discourse referent introduced for the NP of which *one* is the nominal head.

2. "Set of Ns" interpretation

A. (Addition to the presuppositional part of the representation)

Add to the presupposition structure:

a presupposition expressing the requirement of finding in the discourse context a salient representation U of a set of two or more individuals for which the context contains a characterisation as the set of all N or as the set of all N which satisfy some further conditions, where N is a common noun phrase.

B. (Addition to the non-presuppositional part of the representation)

Add to the non-presuppositional part:

the condition "$\eta \preceq U$"[10], where η is the discourse referent introduced for the NP of which *one* is the nominal head.

Somewhat more complex is the presuppositional condition connected with *other*. Intuitively the semantic contribution that a prenominal occurrence of *other* makes to the interpretation of the NP γ to which it belongs involves implicit reference to something or some things from which the referent of γ must be disjoint. Moreover, the referent of γ and this something (or some things) must be of the same "kind". More precisely, that from which the referent is said to be distinct must fall under the concept denoted by the common noun phrase to which *other* is prenominal. I use the phrase "fall under the concept denoted by the common noun phrase ..." advertently, instead of the simpler "satisfy the common noun phrase". For while this concept is sometimes just the one expressed by the common noun phrase as it stands (in which case the simpler formulation would do), in other cases it may be more restricted, e.g. the concept of belonging to a certain set of things to which the common noun phrase applies. It is this last case with which we are dealing in our example: Like the *one* of the second sentence that of the third setence will end up being interpreted as the set X of workers introduced by the first sentence and the concept in question will thus be that of belonging to that set.

Using once more the format of (12), we get for the contribution of *other*:

(18) (Interpretation of *other* as a prenominal adjective)

Let C be the concept denoted by the common noun phrase to which *other* is prenominal, and η the discourse referent representing the referent of the NP of which this CNP is the head[11].

A. (Addition to the presuppositional part of the representation)

Add to the presupposition structure:

[10]for an explanation of $\preceq$ see fn. 12

[11]As in Kamp and Reyle (4) I am using Greek letters for variables whose range subsumes both the atomic and the non-atomic part of the mereology (or, in other words, which can take as values both individuals and sets). The need for using such "neutral" variables here will become more apparent as we go along.

a presupposition expressing the requirement of finding in the discourse context an individual or set ζ, such that C(ζ).

B. (Addition ot the non-presuppositional part of the representation)

Add to the non-presuppositional part:

the condition "$\eta\#\zeta$".[12]

As I said earlier, the presupposition package of the third sentence is more complex than those connected with the first two sentences of (1). Not only are we now dealing with several presuppositions at once. These presuppositions stand moreover in a kind of subordination relation. The definite article *the* gives rise to a "main" presupposition, which introduces a discourse referent η (representing the referent of the subject NP), for which an antecedent must be found in the context. The referent must satisfy the condition of being maximal with respect to the descriptive content of the NP. This content is given by the words *other* and *one*. The presuppositions which these words introduce in their turn have to be prefixed to the Condition part of the presupposition-DRS introduced by *the*, the universe of which consists of the discourse referent η . In this way we get a nested presupposition structure. While this structure is more complex than those we encountered earlier, it is still quite simple when compared to what is found in other cases. (For examples see e.g. (3).)

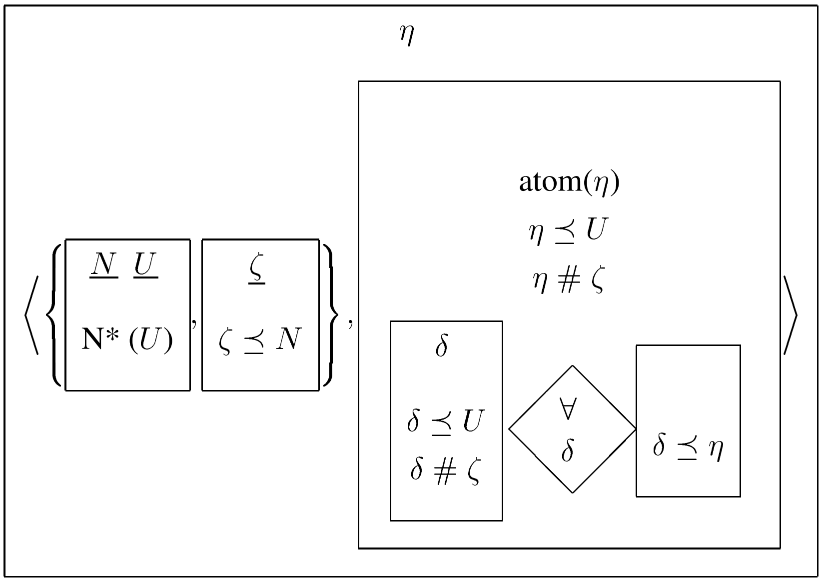
In the presentation of the preliminary representation of (15) given in (19) below I have only represented the presuppositions connected with the subject NP[13]:

[12] The sign "$\#$" is used to express disjointness between two elements of the mereological universe. Thus, when both elements are non-atomic, then "$\#$" signifies disjointness in the familiar set-theoretical sense, if one is atomic and the other not, then $\#$ means that the first is not a member of the second, and if both elements are atomic, "#" simply means difference.

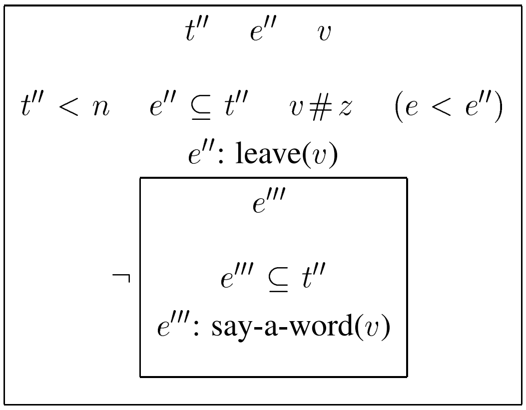
[13] $\delta \preceq \zeta$ means that δ and ζ stand in the mereological "part of"-relation. When both δ and ζ stand for sets, this amounts to inclusion, when one of them is atomic, it amounts to membership.

(19)

PRESUPPOSITION STRUCTURE



NON-PRESUPPOSITIONAL



After what has already been said about the presuppositional part of (19), this part should require no further comment. As regards the non-presuppositional part, note the complex condition in the lower right corner, consisting of the DRS whose universe is $\{e'''\}$ and which is prefixed by the negation operator $\neg$. This is our second example of a complex condition. The semantic significance of this condition ought to be intuitively clear: The condition is satisfied if there is no way of satisfying the embedded DRS — that is: no way of assigning an event to e''' such that the conditions of the DRS are fulfilled[14].

[14]There is the further question how this condition arises. In the present case it represents the *without*-phrase *without saying a word*. The representation rules for this and other non-finite constructions constitute a problem which needs careful attention. I have nothing to say about this problem here.

What remains is the justification of the different presuppositions of (19) in the context given by (14). To a considerable extent this is a combinatorial problem: How can the anaphoric elements of the presuppositional part of (19) be identified with suitable elements of (14) so that the conditions in the presuppositional part are met? But as we have seen, the problem is actually more complicated than that, for no identification will meet the presuppositional constraints as things are. There is one possible combination of identifications, however, which comes close to this. It is stated in (20):

(20) N $\Rightarrow$ worker*; U $\Rightarrow$ X; $\zeta \Rightarrow$ u; $\eta \Rightarrow$ X $\setminus$ { u }.

It is not difficult to see that given these identifications (14) satisfies all the presuppositional conditions of (19) except for the atomicity condition "atom(η)". (In particular, identifying η with $X \setminus \{ u\}$ has the effect of satisfying both the disjointness condition "$\eta \# \zeta$" and the maximality conditions of the presupposition associated with *the*.) In order that the remaining condition be satisfied, we have to assume that $|X \setminus \{ u \}| = 1$, i.e. that $|X| = 2$. Thus, insofar as (20) constitutes the only nearly complete solution to the justification problem that (19) poses, accommodation of this last condition seems the best the interpreter can do to construct a coherent interpretation of the sentence. Hence the conclusion that the number of workers was equal to two.

To conclude this section, (21) gives the representation of (1) which results from resolving the presuppositions of (19) as indicated in (20), accommodating the condition $|X| = 2$ and then merging the non-presuppositional part of (19) with (14)

(21)[15]

$$
\begin{array}{|c|}
\hline
X \quad n \quad a \quad t \quad e \quad y \quad t' \quad e' \quad u \quad t'' \quad e'' \quad v \\
\\
\text{worker*}(X) \quad \text{the-speaker}(a) \quad \text{generous-tip}(y) \\
u \in X \quad |X| = 2 \quad t < n \quad e \subseteq t \\
e\text{: give}(a,y,X) \\
t' < n \\
e' \subseteq t' \quad v\#u \\
\\
\begin{array}{|c|}\hline w \\ \\ w \in X \\ \hline\end{array} \; \left\langle \begin{array}{c} \forall \\ w \end{array} \right\rangle \; \begin{array}{|c|}\hline \\ \\ w = v \\ \hline\end{array} \\
\\
t'' < n \quad e'' \subseteq t'' \quad (e < e'') \\
e''\text{: leave}(v) \\
\\
\neg \begin{array}{|c|}\hline e''' \\ \\ e''' \subseteq t'' \\ e'''\text{: say-a-word}(v) \\ \hline\end{array} \\
\\
\hline
\end{array}
$$

6 Reflection: General Principles of Presupposition Justification

I am fairly convinced that this reconstruction of the interpretation of (1) is basically correct. Further evidence for this is provided by the way in which the conclusion licensed by (1) changes as a function of small textual changes. In (22) I have listed a few of these, together with conclusions about the set X which apparently follow from them. It should not be difficult, especially after the analysis of the preceding sections, to see how these different inferences are the results of changes in presuppositions that come with the modifications that turn (1) into these different variants.

[15]The condition “$e < e''$ ” is like “$e < e'$” the result of processing the rhetorical structure of (1), an aspect of discourse interpetation not considered here.

(22)

(i) I gave the workers a generous tip. One thanked me. Another one left without saying a word.

Conclusion: $|X| > 2$

(ii) I gave the workers a generous tip. Two thanked me. The other one left without saying a word.

Conclusion: $|X| = 3$

(iii) I gave the workers a generous tip. One thanked me. The other two left without saying a word.

Conclusion: $|X| = 3$

(iv) I gave the workers a generous tip. The first one thanked me. The second one left without saying a word.

Conclusion: $|X| \geq 2$

(v) I gave the workers a generous tip. One thanked me. Two others left without saying a word.

Conclusion: $|X| > 3$

(vi) I gave the workers a generous tip. One thanked me. The others left without saying a word.

Conclusion: $|X| \geq 3$

(Exercise: Adapt the analysis of (1) presented in the preceding sections to each of the examples (22.i) — (22.vi).)

In all examples of (22) the conclusion is perceived to be entailed by the text — in this respect the examples are all like (1). That presupposition justification can produce such apparently firm entailments is something of which Antje Rossdeutscher became aware in the early nineties, albeit in connection with presuppositions of a different type (triggered by the word *again*). As we have seen for example (1), these entailments rest in part on a kind of "economy" principle, according to which presupposition justification must make use of as much contextual information as it can get hold of, thereby minimising what remains to be supplied by accommodation.In the absence of a definition of what counts as more and less, however, terms such as "economy" and "minimise" are little more than idle metaphor. In Kamp and Roßdeutscher (5), in which we drew attention to the existence of presupposition-based entailments, Roßdeutscher and I noted that in presupposition justification there is a special premium on the accommodation of new discourse referents; such accommmodation should be avoided if at all possible. But we pretty much left things there.

Here is a proposal for an explicit characterisation of when one accommodation is more economical than another. Suppose that the presupposition structure K_P must be justified in the context DRS K_C. Note that since accommodation involves adding either new discourse referents or new DRS conditions or both, the material that gets added to K_C can itself be regarded as forming a DRS. (In general this DRS will be an improper DRS, as the discourse referents occurring in its conditions need not occur in its universe.) Now let K_1 and K_2 be two possible accommodation DRSs which each verify K_P when added to K_C. Let, for $i \in \{1,2\}$, $K_i = \langle U_i, Con_i \rangle$, and $U_i = X_i \cup Y_i$, where $X_i \subseteq U_{K_C}$ and $Y_i \cap U_{K_C} = \emptyset$. Then we say that *there is a reason for preferring* K_1 *over* K_2 iff there is a partial function f from Y_2 into $X_1 \cup Y_1$ such that (i) $Y_1 \subseteq f(Y_2) \cup Y_2'$ (where $Y_2' = Y_2 \setminus Dom(f)$ and (ii) $f(K_2) \models K_1$. (Intuitively this means that K_2 involves at least as many new discourse referents as K_1 — where f serves to identify certain discourse referents in K_2 with discourse referents in K_1 that can be seen as playing the same argument roles — and that, given this identification, the conditions of K_2 entail those of K_1.) And we say that K_1 *is preferred over* K_2 iff there is a reason for preferring K_1 over K_2 but not for preferring K_2 over K_1.

This definition seems to make the right predictions for the case of (1) and those listed in (22) and also for the cases considered in Kamp and Roßdeutscher (5). But how well it will stand up when applied to a wider range of examples I do not dare to say at present.

The question of accommodating discourse referents is important also in a somewhat different connection, where the issue is not that of comparing possible justification solutions in the sense of economy, but rather what forms of justification are permissible at all. There is compelling evidence that presuppositions vary with regard to the moves which are permitted to bring their justification about. This is particularly plain on a liberal view of what counts as presupposition (such as I have taken in this paper), which assumes that presupposition covers, among other things, the various forms of nominal anaphora, and treats all definite noun phrases as presupppositon triggers, including pronouns and definite descriptions. For it is part of the traditional wisdom about these last two NP types that the justification rules for pronouns are quite different from those governing the presuppositions of definite descriptions, and also that this difference is first and foremost a matter of when accommodation of new discourse referents is allowed. The familiar theories of pronouns assert that interpreting a pronoun requires finding in the context either an entity which can be taken as the pronoun's referent (or a representation of such an entity. In particular, it is assumed that the interpretation of a pronoun in a text requires finding an entity representation in the discourse context which can serve as the pronoun's anaphoric antecedent.

In contrast, the classical presupposition-based account of definite descriptions has it that a description imposes upon the context in which it is used a propositional constraint to the effect that there is one and only one thing satisfying its descriptive content. If the context entails this proposition, then the description's presupposition is justified and the description can be interpreted as referring to what the context determines as the unique satisfier. In DRT terms this means that descriptions are capable of introducing new discourse referents to represent their denotations, whereas pronouns must rely on old discourse referents.Of course, it has been known for many years that descriptions usually do not conform to this account in a literal sense and that their behaviour often resembles that of pronouns quite closely. But it remains true nonetheless that at there are least some occurrences of definite descriptons that do fit the classical account, and at this point that is all we need. For the mere fact that such cases exist implies that there are two different types of presuppositons — the "entity-oriented" presupposition of anaphoric pronouns) and the purely presuppositions triggered by the "classical" cases of descriptions —which involve clearly distinct justification rules.

In the representations we have used in the present paper the distinction between these two types has been indicated by underlining those discourse referents in the universes of presupposition representations for which the context must supply an actual discourse referent as antecedent[16]. This simple distinction between underlined and non-underlined discourse referents suggests a corresponding binary distinction at the level of justification. By and large this is what I have been assuming in the present paper: Presuppositions without underlined discourse referents are treated as "purely propositional", i.e. as representations of propositions that the context must entail. In contrast, presuppositions with underlined discourse referents count as verified only if these underlined discourse referents are identified with discourse referents that already belong to the given context and the context entails the propositional representation into which this identification turns the original presupposition representation.

What if no antecedents for the underlined discourse referents of such a presuposition can be found? One of the conceivable possibilities would be that accommmodation of antecedents for underlined discourse referents is simply prohibited in such cases. This would mean that the interpretation aborts and the discourse is judged as ill-formed. We have already seen, however, that interpretation isn't always as inflexible as that. Presupposiitons generated by discourse-initial sentences tend to get accommodated as a matter of course, and as example (1) showed, this includes presuppositions with underlined discourse referents. There are also other facts which

[16]The first two ecamples of this in the paper are the underlined discourse referents $\underline{X}$ and $\underline{C}$ in the presupposition DRS of (4). The reason for underlining X is that the NP *the workers* is a definite description that cannot be interpreted in a purely descriptive manner and thus must find an antecedent in the context The decision to underline C is similarly motivated: The context must contain a salient predicate with which the predicate variable C can be identified. However, the details of this second case are a little different as they have to do with the treatment of discourse referents for entities of higher type (i.e. other than atomic and non-atomic entities of the type of individuals); and this is a matter that it would take us too far to go into here.

indicate that accommodation of antecedents for underlined discourse referents is sometimes allowed which have also been known for a considerable amount of time. Let me mention just two. First, as discussed at length in Kamp and Reyle (4), Ch. 4, there are intriguing differences between the presuppositonal requirements connected with singular pronouns and those connected with plural pronouns. If an antecedent for a plural pronoun is missing from the context, it can sometimes be "accommodated", but only in the sense of being constructed from material that the context DRS already contains by applying to it a quite limited set of logical operations. A second type of example is given by "bridging descriptions" — definite descriptions that are interpreted as referring to an entity that stands in some functional or quasi-functional relation to some other entity, which is part of the context as given. The principles which govern bridging (i. e. those principles which permit the introduction of an antecedent for the description) are also subject to special restrictions, though these are, if I am not mistaken, not as well understood as those which govern the intepretation of plural pronouns.

All these cases — and I suspect that by looking closely we will find others — show that the simple dichotomy between presuppositions which permit the accommodation of discourse referents and those which do not is a serious oversimplification. What we need is a much finer classification of presupposition types, together with, for each of them, an exact specification of the justification strategies it allows. At the present moment I have only a rough idea of what such a refined theory of presupposition justification might be like. But I am convinced that such a theory is badly needed, and also that it constitutes one of the major remaining challenges for a comprehensive account of presupposition

7 REMAINING LOOSE ENDS CONCERNING THE SUBJECT *one* OF THE SECOND SENTENCE

In this section we return to a couple of loose ends which I left dangling earlier on, with the promise that they would be tied up eventually. Both have to do with the interpretation of the word *one* in the second sentence of (1). We noted in Section 4 that this one-word NP has, in addition to the interpretation which we pursued there, two further interpretations, which we provisionally set aside. The first of these is the 'impersonal pronoun' interpretation, according to which *one* stands for something like 'the relevant individuals'. According to the second interpretation *one* is construed as a dummy common noun and the NP's referent may be any individual that falls under some common noun phrase which the dummy is taken to represent. We'll take these options one at a time.

First the 'impersonal pronoun' interpretation. It is intuitively clear why the third sentence of (1) eliminates this option. For what could 'the relevant individuals' mean in the context in which *one* appears here? Relevant individuals, it would seem, should be individuals who had something for which to thank the speaker. The context offers some such individuals, viz. the workers mentioned in the first sentence, and indeed these are the only available candidates. Since all of the workers mentioned in the first sentence are equally relevant, the referent of *one* we get is the set consisting of all these workers. If this is what the subject NP of the second sentence refers to, however, then there is no good way of resolving the presupposition package of the third sentence. In particular, the presupposition generated by *other* will now be incapable of justification. For that, we have seen, requires from the context a pair $\langle X, \upsilon \rangle$, consisting of (i) a set X of two or more elements and (ii) an element or proper subset υ of this set. If the subject of the second sentence is interpreted as referring to the set X itself, then the context in which the presuppositions of the third sentence are to be justified will contain no such pair.

Giving a precise formal account of this interpetation option is not easy, since it would require giving a operational meaning to the vague notion of 'relevant individuals'. I have no clear idea how this might be done[17].

The second alternative we mentioned in connection with the subject NP of the second sentence would identify its referent as some individual satisfying the common noun phrase which is chosen as antecedent for the anaphoric common noun. It is clear that the context provided by the first sentence of (1) offers no other antecedents of the type 'Common Noun Phrase' than the noun *worker*. So the present option boils down to interpreting the subject of the second sentence as referring to some worker u or other, who might but need not be a member of the set X. It is not entirely clear what should be said about this option in relation to the requirements imposed by the presuppositions of the third sentence. One conceivable possibility is that in this case the difference set $X \setminus \{\upsilon\}$ cannot be formed, since it is not known whether $\upsilon \preceq X$. If this were so, then justification of the *other*-presupposition would fail, and with it the interpretation of the discourse as a whole. An alternative possibility might by that forming $\upsilon \preceq X$ is permissible, but only after the missing condition " $\upsilon \preceq X$" has been accommodated. The end effect of this would be the same over-all interpretation of (1) as we obtained in (21). At this point I see no way of deciding between these last two possibilities, though I am inclined to think that the accommodation option is available. If this is so, then (1) allows for two converging interpretations, based on different interpretations for the second sentence.

[17]For the purpose of the example at hand it would suffice if our formalisation of the concept of 'relevant individuals' would be such as to entail that in cases where a set of relevant individuals are provided by the context, but there are no salient conditions which allow for a partition of this set into two or more smaller subsets, then only the set as a whole is available as a possible referent for *one*. Some definition of 'relevant' that carries this entailment could no doubt be concocted without too much trouble. But such solution would be ad hoc and likely to run into trouble when we turn to other examples.

8 Concluding Remarks

This paper has been concerned with the analysis of one single example. I hope that the story which has been told about this example — how the meaning of the mini-discourse (1) is computed and in what way presupposition justification contributes to that — is reasonably convincing. However, the paper's real aims, which prompted the particular case study I have presented, are more general and more ambitious. The case study was not just meant as a possibly outlandish example of one of the various possible ways in which presupposition justification can affect discourse interpretation. It was chosen in the belief of its being truly representative — that the mechanisms by which presupposition justification increments discourse meaning in this example are often found in discourse, and that the analysis which I have proposed will carry over to a substantial number of other cases, including 'real life' ones, wich are encountered in actual NLP applications. To what extent this belief is justified may not be decidable at present, but only as our experience with discourse interpretation expands.[18]

Another question that the paper leaves unanswered concerns the possibility of t urning the semi-formal analysis I have given into one that is fully explicit or even into a working implementation. In reflecting on this question it is necessary to distinguish between formalisations or implementations which stick with the given example without making a serious attempt to generalise beyond it and those which deal with an open class of cases in which (1) is only one among a significant variety of others. Of course, any formalisation or implementation worth its salt must aim at some form of generalisation, however modest; and in relation to the example discussed in this paper covering the small family consisting of minor variations of (1) which we get when we replace the subject NP *the other one* of the third sentence by NPs like *another one*, *others*, *the*

[18]Here is one example from "'real life". In Samuel Butler's "Erewhon", Ch. 9 (p 66, 2nd paragraph, of the Wordthworth Classics Paperback Edition) we find the following: "Mr Nosbibor took me through several spacious rooms till we reached a boudoir where there were his wife and daughters, of whom I had heard from an interpreter. Mrs Nosbibor was about forty years old, and still handsome, but she had grown very stout; here daughters were in the prime of youth and exquisitely beautiful. I gave the preference almost immediately to the younger, whose name was Arowhena;...". In English the combination of the comparative adjective form with the definite article presupposes that the referent is to be understood as a member of a set of two elements. In the given passage (in which the wife and daughters of Mr Nosbibor are mentioned for the very first time) this rule applies to the NP *the younger*. The missing noun from this definite description carries another, "anaphoric", presupposition, to the effect that a Common Noun Phrase must be found in the given context (just as we saw this to be the case for the word *one* in the subject NP *the other one* of our example). If we resolve this anaphoric constraint by choosing as CNP *(Mr Nosbibor's) daughter*, then the first presupposition leads us to conclude that the set of Mr Nosbibor's daughters consists of two elements. This conclusion gets confirmed almost immediately when in the next sentence of the text we find a reference to *the elder sister*. Evidently such an example does not show that the phenomenon that has been discussed in this paper is one we are likely to run into incessantly when dealing with actual texts. But at the very least it shows that the example is not wholly artificial.

others, *two others*, etc.(as illustrated in Section 6) should be considered a minimal requirement for any credible formalisation or implementation of the analysis this paper has outlined. But if dealing even with this very restricted class will prove non-trivial, generalising to larger classes can be expected to be very much harder, if only because it will require additional lexical entries for presupposition-carrying morphemes or words. The development of a semantic lexicon that can be used effectively by formal or automated interpretation systems is a daunting task that formal and computational linguistics are facing generally. It is a daunting task not just because of the sheer size of the vocabularies of most natural languages, but also because there is so much that is connected with the meanings of particular lexical items and their representation which is poorly understood and for which a proper theoretical foundation is largely missing. The representation of the presuppositional aspects of individual words and morphemes is among those ill-understood aspects of the lexicon. A formalisation or implementation which is to deal with a larger class of presuppositions than has been considered here, will have to have access to entries for the (lexical) triggers of those presuppositions which contain the necessary instructions for how those presuppositions are computed and how they are to be justified. (I am assuming that, with few exceptions, presuppositions are triggered lexically.) This alone will add substantially to the over-all effort that such a broader formalisation or implementation would involve.

In connection with the question of implementation there is also another distinction that is important. Formalising or implementing the analysis presented in Sections 2-6, which relied on a kind of oracle to select the intended interpretation of the subject *one* of the second sentence may be a non-trivial task as it is. But doing without such an oracle, while building into the formalisation/implementation the considerations of Section 7 instead, is much harder. The extra difficulties that have to be overcome when the implementation is to compute an actual resolution of this ambiguity rather than adopting the resolution by fiat deserve special emphasis. As we saw in Section 7, the ambiguity of *one* in the second sentence cannnot be resolved until we get to the third sentence. Thus the context which the first two sentences of (1) offer towards the interpretation of the third sentence is itself three-ways ambiguous (corresponding to the three possible interpretations of *one*). In Section 7 it was implicitly assumed that each of these three possible contexts is used as starting point for an interpretation of the third sentence, that the results of these three interpretation attempts are then compared and that on the basis of this comparison an interpretation is selected which gets away with the most economical justification of the third sentence's presuppositions.

An implementation which follows this recipe to the letter is no doubt possible in principle. But experience has taught that where ambiguity is an issue, operating on fully expanded disjunctions (such as the disjunction of the three representations of the context established by the first two sentences of (1) which result from the three different possible interpretations of *one* in the second sentence) tends to be inefficient, and the inefficiency quickly becomes prohibitive for larger discourses where potential ambiguities multiply. Computational tractability requires that ambiguities be kept as local as possible, for instance along the lines of U(nderspecified) DRT. To get a better sense of the computational complexities that are involved when ambiguity interacts with presupposition-driven interpretation in the way illustrated in (1), a UDRT-based treatment of this one example would seem a natural first step. But even this is something that has yet to be tried, and until it has been, there is no good way of estimating how much more complex the problems of this paper become when ambiguity is paid its proper due.

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