

Shifting, failure to Extrapose, and Topicalization (43-44), but also the hell- Insertion, and the construction Ross called Sluicing, as in (3) and (4) as opposed to (5) and (6).

- 3a. I wonder/don't know/never knew who the hell did it.
 3b. {No one will tell the dean } who the hell did it.
 {Everyone's asking }
 4a. Someone left it here and I would like to know/wonder/never found out who.
 4b. Someone left it here, and {only I know } who.
 {no one will say }
 {the deans want to know }
 5. {#I know } who the hell is to blame.
 {#Everyone realizes }
 {#I remember telling Bill }
 6. #Someone called, and {everyone knows } who.
 {soon you'll realize }

The cases in (43) and (44) involve question complements in initial position; the additional cases above (and in footnote 13) involve question constructions in object complement position, or without indication of syntactic context in their own clause. Thus, the explanation would not seem to lie in the superficial form of the question complement simulating that of a direct question, as it does in the data supporting (42). As Horn speculates, the explanation is more likely to lie in the focussing effects of the various syntactic and morphological structures. Still, it is unclear what the question-emphasizing effect of the hell and if anything, and the focussing effect of initial position, have in common with Sluicing's effect of merely alluding to a question, such that it would make epistemic insecurity a natural correlate of these constructions.

FOOTNOTE

1. The passage actually reads:

The dates might not track Boom-Boom's menstrual cycle, but maybe they indicated some other periodic occurrence. (Deadlock, p. 97. New York: Ballantine Books, 1984.)

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 CONFLICTING PRESUPPOSITIONS AND MODAL SUBORDINATION

Fred Landman
 Brown University

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1. Introduction

There is a ready analogue between the structure of the information that we assume in conversation and the way statements made modify that information, and the structure of proofs in natural deduction systems or semantic tableaux for logical languages. Many people have noticed this analogue for informational theories like Robert Stalnaker's theory of assertion, Jaakko Hintikka's game theoretic semantics, and Hans Kamp and Irene Heim's discourse representation theory; some even have fruitfully exploited it to explain certain linguistic phenomena. Under the examples of the latter I would count Stalnaker [1974]'s analysis of presuppositions, and Roberts [1985]'s analysis of modal subordination. In the present paper, I will argue that these two phenomena are not unrelated, in particular, I will argue that an analysis of presuppositions can be given that is very much in the spirit of Stalnaker, and that the most recalcitrant counterexamples—cases of conflicting presuppositions—can be explained with the help of modal subordination.

2. Presuppositions of conditionals

In what follows, I will at various places unjustly equate a whole tradition of dealing with presuppositions (starting with Karttunen and Stalnaker, including Karttunen and Peters 1979, and—more recently—Heim 1982) with Stalnaker [1974]'s analysis. I will be more concerned with the spirit of that proposal, however, than with its details, so I will allow myself to jump from one proposal to others.

A proof can be regarded as a one-person conversation in which the formulas entered at different steps are the assertions made there. Crucial in a proofsystem are the rules that relate the conversational operation of asserting a complex formula to other conversational operations regarding its parts. In this way, the assertion of the complex formula $\neg\varphi$ is reduced to the *denial* of φ . This introduces structure in the proof if you take the denial of φ to be a subproof showing that the assertion of φ leads to trouble. In proofs the two basic conversational operations are assertion and supposition. You can either enter formulas at the main level of assertion, then indeed they are asserted in their own right; or you can enter them as or under suppositions: you can follow side-paths, subordinated trains of thought, that is, make certain assumptions which are not entered as assertions to the main proof, and follow these for some time, exploring their consequences, and then in the end draw the moral for the main proof.

One of the main insights of Stalnaker [1974] is that it is fruitful to take the same perspective on how complex sentences that are uttered in a conversation are added to the context that the participants share (or assume to share). So the assertion of a logically simple sentence has the consequence that that sentence (or its informational content) is simply added to the context. Complex sentences are

not only added to the context as complex sentences, but they introduce subordinated contexts in which their parts are asserted. This leads to the following very simple view on the conversational role of the sentences we are interested in here, conditionals and disjunctions. *The assertion of a conditional sentence $\varphi \rightarrow \psi$ is the assertion of the consequent ψ under the supposition of the antecedent φ . The assertion of a disjunction $\varphi \vee \psi$ is the assertion of φ under the supposition that $\neg\psi$ and the assertion of ψ under the supposition that $\neg\varphi$.* For the conditional, this will mean that not just the conditional as a whole is added to the context, but a new context is introduced, consisting of the old context with the antecedent added to it as a supposition; that means, it is added temporarily, and the consequent is to be regarded as an assertion relative to this new context. A similar story can be told for disjunction.

Why is this analysis of complex assertions relevant to presuppositions? Quite straightforwardly. Certain assertions require certain presuppositions to be satisfied in the context in which they are asserted in order to be interpreted correctly. If I say *the president is furious*, I presuppose that there is a president and assert that he is furious. (Actually, as Lewis [1979] argues, using a definite description I either refer to a previously introduced person, or assume that it is in this particular case a simple and not demanding task for my hearers (to whom this person is new) to pretend that this person was introduced before and accommodate in this way their information before they interpret my assertion.) Certain assertions require a presupposition to be satisfied in the context. Let ψ be sentence which, if asserted, presupposes ψ' . Now suppose ψ is the consequent of a conditional sentence $\varphi \rightarrow \psi$. What presuppositions does the assertion of the conditional sentence have?

Well, the assertion of the conditional $\varphi \rightarrow \psi$ is the assertion of the consequent ψ under the supposition of the antecedent φ . If the assertion of ψ requires ψ' to be satisfied, then the assertion of $\varphi \rightarrow \psi$ requires ψ' to be satisfied under the supposition of the antecedent φ as well; that is, the assertion of the whole conditional presupposes $\varphi \rightarrow \psi'$.

Here are some standard examples. The consequent of (1) presupposes (2), but the conditional (1) itself presupposes (3) rather than (2).

- (1) If there is a depression, even the boss will be fired
- (2) Others, besides the boss, will be fired
- (3) If there is a depression, others, besides the boss, will be fired

Similarly, if the presupposition of the consequent is satisfied by the antecedent, the whole conditional has only a trivial presupposition: Though the consequent of (4) presupposes (5), (4) itself only presupposes (6).

- (4) If there is a king, the king is the one who opens parliament each year
- (5) There is a king
- (6) If there is a king, there is a king

The analysis may seem problematic for cases like (7), where the theory only gives you (9) as a presupposition, while (8) is what you want.

- (7) If it is September, the queen opens parliament
- (8) There is a queen
- (9) If it is September, there is a queen

Karttunen and Peters [1979] provide a Gricean argument, showing why in normal cases (9) reduces to (8) (and why, in abnormal cases, it shouldn't). There can be three reasons why (9) is accepted as true in the context (i.e. why (9) is presupposed). Either its antecedent is already accepted as false, or its consequent is already accepted as true, or both are regarded still as open questions, but the truth of the conditional depends on a connection between antecedent and consequent, the antecedent is relevant for the consequent. If the conditional (7) is uttered in agreement with the Gricean maxims, then the speaker believes it to be true, and the speaker regards its antecedent and consequent as open questions. Since (7) and (9) have the same antecedent, this excludes the first reason for taking the presupposition to be true. Further, in normal contexts, it is very implausible that (9) would be accepted in the context because of some connection between antecedent and consequent: there being a queen usually does not depend on it being September (usually, that is). This excludes in normal context the third reason, and only the second reason is left: (9) is accepted in the context because its consequent, (8), is.

It has been claimed (e.g. Gazdar 1979) that this Gricean explanation is an ad hoc trick to save a hopeless analysis. I do not believe that. In the first place, as far as presuppositions of consequents of conditionals are concerned, I believe that this analysis is very successful and insightful: Gazdar's counterexamples have been convincingly unmasked by Soames [1982]. Secondly, there is nothing ad hoc about this explanation. Quite the contrary, exactly the same argument has been invoked to successfully explain other phenomena involving conditionals, like the rhetoric use of conditionals (10) and (12) to convey (11) and (13) respectively (see Veltman 1984).

- (10) I payed you back that five, if you remember
- (11) I payed you back that five
- (12) There is coffee in the pot, if you want some
- (13) There is coffee in the pot

To summarize the discussion: we have a very simple analysis of how presuppositions of consequents are inherited in the assertion of a conditional; the analysis has a strong intuitive motivation in a theory of discourse, that is inspired by the analogy to proofs; and finally it fits in quite nicely with the general Gricean theory of conversational correctness.

Turning now to presuppositions of antecedents of conditionals, we should remark that the analogy with proofs does not as strongly impose a view on those as it does for presuppositions of consequents. Karttunen and Peters [1979] assume that the presuppositions of the antecedent of the conditionals are inherited by the assertion of the conditional: what is presupposed by the assertion of the antecedent, is presupposed by the assertion of the conditional itself. They discuss alternatives for this, but mainly they are not convinced by counterexamples like:

- (14) If the queen opened parliament today, then (at least) there is a queen
- (15) There is a queen

(14) should not presuppose (15), but if presuppositions of antecedents are inherited, it does. I will come back to examples like this, but first let me give a more convincing example that Karttunen and Peters' analysis of presuppositions of

antecedents is untenable. I will use the example of conflicting presuppositions for that. Suppose that we know that Bessarabia either is a monarchy or a republic. The following sentence seems to be quite normal:

(16) If Suzan did not meet the king of Bessarabia, she met the president

It is also quite clear what this sentence conveys: Suzan met the head of state of Bessarabia. Now, the antecedent of (16) presupposes (17):

(17) There is a king of Bessarabia

If presuppositions of antecedents are inherited by the assertion of the conditional, then (16) itself presupposes (17), which is obviously wrong.

As we will see later this is not the only problem with this example, but at least *this* is something we want to avoid in our general theory of presuppositions. To shed some light on the issue, consider again example (14).

Though not all examples discussed in the literature are of this sort, there is an obvious observation to be made concerning this particular example, namely, that it is a tautology. What is the use of stating a tautology? The Gricean maxims tell you that as assertions they can never be correct, because they will always violate the maxim of quantity: do not say what you believe to be common knowledge. But of course, people often *do* say what is common knowledge, and they have reasons to do so. If Socrates in a Platonic dialogue asks his opponent: 'Is it not true, my dear ..., that And would you not conclude from that that ...' his purpose is not to provide his opponent with new information, but rather to *make explicit* the information that is already there. Precisely this is the situation where the above tautology can be useful. Its function in conversation is not to provide new information, but to make explicit what we already know, to remind the others of some, perhaps trivial, piece of information that can be useful at this part of the conversation. Making old information explicit may be regarded as a secondary function of making assertions, but certainly this secondary function exists.

Generalizing this to conditionals in general, we can say that Stalnaker's analysis (the assertion of a conditional is the assertion of the consequent under the assumption of the antecedent) corresponds to the primary function of conditionals, but that there is a secondary function as well, that of making certain things explicit. *In particular, the conditional can be used to make explicit what the consequences of asserting the antecedent are.* If the assertion of a conditional can have this secondary use of making something explicit about the antecedent, then one of the obvious things that can be made explicit about an antecedent is what presuppositions it has. Now it is quite clear that if a conditional is used in this secondary way, if it is used to assert what presuppositions the assertion of the antecedent would have, then the assertion of the conditional as a whole does not itself have that same presupposition: it is precisely the function of the secondary use as described here to say something about, and hence without that presupposition. If the whole conditional would have that presupposition, then there is no sense of using it to make the presupposition of the antecedent explicit.

In the case of presuppositions we can characterize the kind of situation in which the conditional has to be understood in a secondary way more precisely. If the presupposition of the antecedent already provides an answer to the question

whether the consequent of the conditional is true, then the conditional cannot be taken on its primary function (that of asserting the consequent under the supposition of the antecedent) because in that case asserting or denying the presupposition itself is always a better Gricean option than asserting the conditional. So if the presupposition of the antecedent already answers the question whether the consequent is true, the conditional has to be understood on its secondary reading, and hence it does not have that presupposition itself. The other way around, if a conditional is used on its secondary function (or partly on its secondary function), but it makes something explicit about the antecedent that is independent of the presupposition (i.e. that is not already answered by the presupposition), it seems that even on its secondary use, the whole conditional does have that presupposition. An example of this is the following tautology:

(18) If the king wants eggs for dinner, then the king wants eggs for dinner, and you have to provide them

So the conditional does not have the presupposition of the antecedent if it is used on its secondary function to make something explicit and the presupposition plays an essential role in that. In other words: the conditional does not have the presupposition of the antecedent if that presupposition already answers the question whether the consequent is true.

Summarizing this discussion we can say that *if φ presupposes φ' then the assertion of $\varphi \rightarrow \psi$ presupposes φ' unless φ' already provides an answer to the question whether the consequent ψ is true.*

Some consequences of this analysis are the following. The presupposition that there is a queen is cancelled in (19) and (20) but not in (21).

(19) If the queen did not open parliament today, there is a queen

(20) If the queen did not open parliament today, there is no queen

(21) If the queen did not open parliament today, the queen was represented by the prime minister

To give another example, the presupposition of (22), *it snows heavily* excludes one of the possible answers to the question whether the consequent is true (it excludes 'no'), but in (22), the presupposition *it snows* does not exclude either one of the answers. Hence the presupposition is cancelled in (22) but not in (23):

(22) If John regrets that it snows heavily, then at least it snows

(23) If John regrets that it snows, then it must snow heavily

Finally, to return to example (16), the presupposition of *Suzan did not meet the king of Bessarabia*, that there is a king, excludes the possible answer to the question whether the consequent is true that indeed she met the president, so (16) does not have that presupposition.

Let me summarize the whole analysis. Let φ presuppose φ' and let ψ presuppose ψ' . Then $\varphi \rightarrow \psi$ presupposes $\varphi \rightarrow \psi'$, and φ' if φ' does not answer the question whether ψ is true. For lack of space, I will only introduce and not discuss the disjunction: $\varphi \vee \psi$ presupposes $\neg\psi \rightarrow \varphi'$ and $\neg\varphi \rightarrow \psi'$ (the presuppositions of the first and second disjunct, respectively).

It can be observed that in my analysis of the way presuppositions of antecedents are inherited, I have absorbed part of Gazdar [1979]'s analysis of presupposition

inheritance. For Gazdar, presuppositions of constituents of conditionals are inherited, if they are not incompatible with some conversational implicature that is previously added to the context. Since the conversational implicatures of the conditional itself, that the speaker does not already have an opinion about the truth of antecedent and of the consequent, are added to the context before the presuppositions of the conditional are, a presupposition of the antecedent that is incompatible with one of the implicatures of the conditional is cancelled. But of course, a presupposition that already answers the question whether the consequent is true, is a presupposition that is incompatible with the conversational implicature that the speaker does not have an opinion on the truth of the consequent.

There are some comments to be made here. In the first place, note that we have an independent motivation, the secondary use of conditionals, why in this particular case presuppositions that are incompatible with a conversational implicature of the consequent are cancelled. That is, this particular case of cancelling falls within the general conversational theory that I am pursuing here. Secondly, there is no good explanation of why Gazdar's general principle 'conversational implicatures cancel presuppositions' should hold (except that it works). It is generally agreed that (at least various kinds of) presuppositions form an aspect of the conventional meaning of expressions, whether or not we are willing to call this semantic or not. Conversational implicatures only arise out of more general rules of conversation, and hence form far less an integrated part of the meaning of expressions. If that is so, then at first sight one should expect things to work the other way around: presuppositions, being conventional, should cancel conversational implicatures. Just saying 'well, apparently that is not the way things work' does not help here. At least we want to understand why our first guess is so wrong. So, though I think there is a good reason to adopt the particular instance of Gazdar's principle, I am reluctant to adopt it in its full generality. Even more so, because I think that in general the principle is *false*: in general, conversational implicatures do not cancel presuppositions (i.e. in general, only explicit denial cancels them). Take the following example.

(24) If there is a president of Bessarabia, he lives in the palace.

The king did not come out of the palace yesterday to make his speech

This discourse, I think, clearly presupposes that there is a king. However, the conditional has as a conversational implicature that there may very well be a president, which is inconsistent with the presupposition that there is a king. On Gazdar's view, consequently the presupposition is cancelled. And this is not so. On hearing the second sentence, the hearer will ask herself what the first meant, and she will try to reanalyze it, but she will not do what she should do on Gazdar's view: simply cancel the presupposition.

So where are we now in the discussion? We have provided an analysis of presuppositions which is in all its aspects intuitively motivated within Stalnaker's general theory of information and information extension. It deals quite well with presuppositions of consequents and of antecedents, except for one case:

3. The Case of Conflicting Presuppositions

The examples we will be concerned with here are implications where antecedent

and consequent have incompatible presuppositions, like (16):

(16) If Suzan did not meet the king of Bessarabia, she met the president
and disjunctions where the disjuncts have incompatible presuppositions, like (25):

(25) Suzan either met the king or the president of Bessarabia

We will assume the situation to be the following. It is already clear in the context that Bessarabia has a head of state, and that he is either a king or a president. Examples (16) and (25), as asserted in this context are meant to convey that Suzan met him. That is, what is added to the information by the assertion of examples (16) or (25) is the new information that Suzan met this head of state (leaving it unspecified whether he is a king or a president).

For shortness, I will only discuss the disjunction (25) here. The case of the conditional (16) is completely analogous to it.

The problem of conflicting presuppositions is a well known problem for the theory of Karttunen and Peters (see Gazdar 1979). The versions of the theory to which the counterexamples have been proposed in the literature did not give an account of the anaphoric nature of the definite descriptions. We may believe that an analysis that is more subtle in these respects, like the one proposed in Heim [1982], can deal with the problems. That is why I prefer here to rephrase the problem in Heim's theory, taking the anaphoric nature of definites into account: in order to show that unfortunately this is not so: the problem of conflicting presuppositions remains in that theory.

For my purposes here, I need not explain very much about the semantics of discourse representation theory, because the problems mainly have to do with the discourse structure. Let me sketch the theory (in Kamp's format for expository reasons only). In a conversation the participants build up a discourse representation structure which represents the information that is assumed and accepted. A discourse representation structure contains discourse markers (or discourse referents) the 'objects' that the conversation talks about; basic predicates: the properties that are ascribed to these objects; and structure, subordinated discourse representation structures introduced by certain logical operations (like if ... then ...). Discourse representation structures get a semantics through a recursive definition of how such structures can be embedded in the world, in the model. As Roberts [1985] observes, it is the structure of subordinated discourse that corresponds closely to the structure of a proof. Hence, an assertion, if accepted, is added to the toplevel, the non-subordinated level of the discourse.

The basic idea of Heim [1982] is that asserting a sentence with a definite or indefinite term in it, like *the man walks* and *a man walks*, is reflected at the level of the discourse representation structure, by adding a discourse marker *a* to the structure with conditions *man(a)* and *walk(a)*. The difference between the indefinite and the definite term is reflected in the condition that the indefinite term has to introduce a new discourse marker, while the definite term introduces conditions about a marker that already occurs in the structure. The conditional introduces a structure consisting of two subordinated structures: an antecedent structure and a consequent structure, which the semantics will relate to each other through universal quantification (\rightarrow). I will use a flat, 'logical' notation for discourse representation structures, with brackets indicating subordinated

structure.

I will not discuss the semantics of disjunction here. I will simply assume that a disjunction is entered into the discourse as:

$$(26) \langle \varphi \rangle \vee \langle \psi \rangle$$

introducing subordinated discourses. If you want, you can also enter it like:

$$(27) \langle \neg\varphi \rangle \rightarrow \langle \psi \rangle, \langle \neg\psi \rangle \rightarrow \langle \varphi \rangle$$

I will assume anyway that the embedding conditions will give (26) and (27) the same interpretation. I will also apply handwaving to the embedding conditions for negation and only make the relatively moderate claim that \neg and \rightarrow interact (at least for the cases at hand) in such a way that their embedding conditions respect contraposition. Similarly, I will assume that the embedding conditions of \rightarrow respect modus ponens, etc.

For ease of notation, I will introduce exclusive disjunction $\langle \varphi \rangle \bowtie \langle \psi \rangle$ as short for $\langle \langle \varphi \rangle \vee \langle \psi \rangle \rangle, \langle \neg \langle \varphi, \psi \rangle \rangle$

Let us see what the initial information about the Bessarabia case is. We assumed it to be common knowledge that there is a head of state and that he is either a king or a president. so, the starting discourse is:

$$(28) \langle a, head(a), \langle king(a) \rangle \bowtie \langle pres(a) \rangle \rangle$$

The top level, the assertion level of this discourse, hence contains a , the condition that a is head of state and a disjunctive condition.

Let us consider what happens if, in this context we assert the disjunction (25). Its discourse structure is:

$$(29) \langle met(s, a), king(a) \rangle \vee \langle met(s, a), pres(a) \rangle$$

and its presupposition is (30):

$$(30) \langle \langle \neg \langle met(s, a), king(a) \rangle \rangle \rightarrow \langle pres(a) \rangle, \langle \neg \langle met(s, a), pres(a) \rangle \rangle \rightarrow \langle king(a) \rangle \rangle$$

Let us write both conditionals here in contraposed form:

$$(31) \langle \langle \neg pres(a) \rangle \rightarrow \langle met(s, a), king(a) \rangle, \langle \neg king(a) \rangle \rightarrow \langle met(s, a), pres(a) \rangle \rangle$$

Now obviously, the presuppositions have to be satisfied at the level where the assertion is added, so either they have to be present in the discourse already, or they have to be added to it through accommodation. The latter happens in this case. So (31) is added to the assertion level, and because it is a presupposition, we assume that it is added *before* the assertion itself, to make the assertion correct. If we do that we get (32):

$$(32) \langle a, head(a), \langle king(a) \rangle \bowtie \langle pres(a) \rangle, \langle \neg pres(a) \rangle \rightarrow \langle met(s, a), king(a) \rangle, \langle \neg king(a) \rangle \rightarrow \langle met(s, a), pres(a) \rangle \rangle$$

We can apply some logical principles to prune this discourse. We observe the following pattern in the discourse: $\varphi \bowtie \psi, \neg\varphi \rightarrow \xi_1, \neg\psi \rightarrow \xi_2$, hence we can simply conclude: $\xi_1 \vee \xi_2$. So the discourse reduces to:

$$(33) \langle a, head(a), \langle king(a) \rangle \bowtie \langle pres(a) \rangle, \langle met(s, a), king(a) \rangle \vee \langle met(s, a), pres(a) \rangle \rangle$$

Again, we see a logical pattern: $(\varphi \wedge \psi) \vee (\varphi \wedge \xi)$ and we can reduce this to $\varphi \wedge (\psi \vee \xi)$. But since $\psi \bowtie \xi$ was already in the discourse, this only adds φ to it:

$$(34) \langle a, head(a), \langle king(a) \rangle \bowtie \langle pres(a) \rangle, met(s, a) \rangle$$

But this is ridiculous. because the discourse structure that satisfies the presupposition of the assertion, is precisely the structure we want to end up with. Before we can make the statement that Suzan either met the king or the president, we have to assume that the context already contains the information that she met him. The assertion cannot provide new information: it is its own presupposition.

This is obviously wrong. Intuitively, what the assertion of the disjunction does is to bring you from discourse structure (28) to discourse structure (34): it provides and does not presuppose the information that Suzan met the head of state.

So either we are stuck with a nice but hopelessly wrong theory of presuppositions, or we have to argue that something else is going on in this example, that there is a different way of bringing you from (28) to (34) that avoids these problems. It is the latter route that I will pursue in the next section.

4. Modal subordination

Discourse representation theory incorporates the insight that normally an anaphor can only be interpreted felicitously if it refers back to a discourse marker at a level that is accessible for it (in general, a higher level). So the following (standard) examples are uninterpretable (on a *de dicto* reading), because the antecedent is at a subordinated (modal) level:

(35) If Mary has a car, she will lend it to me. *It was standing in the rain yesterday

(36) You must write a letter to your parents. * They are expecting it

(37) Mary wants to buy a knife. *It is sharp

On the other hand, it has often been observed that related sentences like (38)–(40) can be interpreted felicitously:

(38) If Mary has a car, she will lend it to me. I will drive home in it to impress my parents

(39) You must send a letter to your parents. It has to be sent by airmail in order to arrive there in time

(40) Mary wants to buy a knife. It must be a sharp one

In all these cases, the antecedent of the pronoun in the second sentence is introduced at a subordinated level of discourse, and is inaccessible for the pronoun if the second sentence is added to the assertion level of the discourse.

Roberts [1985] argues that all these cases fall under a principle of discourse extension that she calls *modal subordination*. Like a proof, a discourse contains various subordinated levels. Normally a new utterance is regarded as an assertion, and added to the assertion level, therewith adding a new thought to the discourse; under certain conditions, however, a new utterance can be regarded as a continuation of subordinated lines of thought, pursuing certain suppositions; that is, not as an assertion, but as an assertion under certain assumptions, available at subordinated levels of the discourse. Of course, it has to be clear in the discourse that that is what is happening: it is not a coincidence that in examples (38)–(40) both parts of the discourse have a similar mood.

What is a continuation of a subordinated discourse? At first sight, we could think that (under the right conditions) modal subordination just infixes the discourse corresponding to the second utterance at some subordinated level in the discourse that corresponds to the first utterance. However, as Roberts shows, this is too simple. Discourse (41) is not interpreted as (42), but rather as (43):

(41) A wolf may come in. It would eat you first

(42) Maybe a wolf comes in and eats you first

(43) Maybe a wolf comes in. And if it does, it would eat you first

So what happens if a sentence is added to the discourse by modal subordination, is that some piece of information (in this case that a wolf comes in) which is available at some subordinated level of the discourse can serve as a supposition under which the new sentence is asserted: *modal subordination is an operation which extends the discourse representation structure by adding the discourse structure corresponding to the new assertion, under the assumption of some piece of information which is available in the discourse.* So in a conversation we have made various assumptions at various embedded levels. If we want to pursue these assumptions rather than make a new assertion, we need not explicitly indicate what the assumptions are under which the new sentence is asserted: we can just state the new sentence, use devices like sameness of mood to indicate at what level of the discourse the assumptions under which it is asserted have to be found, and assume that the hearers will add the sentence with modal subordination to the discourse. I refer to Roberts [1985] for the details of the analysis of examples like the ones given above.

It is not difficult to find examples of modal subordination with disjunction as well. I will here draw the attention to a particular kind of modal subordination, that I will call *modal splitting*.

If in the discourse there are two subordinated lines of thought that are distinguished as competitive alternatives, and we utter a new sentence that also distinguishes two competitive alternatives, and the discourse contains enough indications (like sameness of mood, relevance, etc.) that the asserted alternatives are continuations of the already present ones, then, instead of just adding this new sentence to the assertion level of the discourse, you can and often have to *split* it in its alternatives, and add the one alternative with modal subordination to one of the already present alternatives, and the other to the other present alternative.

That is, instead of extending (44) to (45), you extend it to (46):

(44) $\langle\langle \varphi \rangle \vee \langle \psi \rangle \rangle$

(45) $\langle\langle \varphi \rangle \vee \langle \psi \rangle, \langle\langle \chi \rangle \vee \langle \xi \rangle \rangle$

(46) $\langle\langle \varphi \rangle \vee \langle \psi \rangle, \langle \varphi \rangle \rightarrow \langle \chi \rangle, \langle \psi \rangle \rightarrow \langle \xi \rangle \rangle$

If the conditions under which modal splitting is possible are satisfied by the discourse, modal splitting is a simpler operation than assertion because it brings you more directly to the required discourse. So even in cases where you are not forced to use modal splitting, it is an important shortcut. Here is an example.

Suppose you are already familiar with the following facts. Someone cannot both be in Boston and in Amsterdam. Logan Airport is in Boston, Schiphol Airport is in Amsterdam. Now someone says:

(47) John is at the moment in Boston or in Amsterdam. He arrived this morning at Logan Airport or at Schiphol Airport

The discourse after the first sentence is as in (45) above. In principle, you can simply add the second sentence to the discourse and get a structure as in (46). But then you have to perform the following two operations: work the disjunction inside, to get the equivalent:

(48) $\langle\langle \varphi, \chi \rangle \vee \langle \varphi, \xi \rangle \vee \langle \psi, \chi \rangle \vee \langle \psi, \xi \rangle \rangle$

and then use the fact that you already know which airport is where to eliminate the two middle disjuncts:

(49) $\langle\langle \varphi, \chi \rangle \vee \langle \psi, \xi \rangle \rangle$

The above description of the situation is one where the conditions for modal splitting are satisfied: the first introduces two clearly competitive alternatives, and so does the second. It is similarly clear from the start that we can regard the second alternatives as continuations of the first ones. With modal splitting, we can skip the calculations and directly split $\chi \vee \xi$ over φ and ψ to get the equivalent (under the given circumstances) discourse:

(47) $\langle\langle \varphi \rangle \vee \langle \psi \rangle, \langle \varphi \rangle \rightarrow \langle \chi \rangle, \langle \psi \rangle \rightarrow \langle \xi \rangle \rangle$

Modal splitting is the only possibility if the added sentence contains anaphors that have to be bound in the alternatives:

(50) You will stay unmarried, or you will marry a tramp. You'll become a nun, or the tramp will beat you regularly. Either way you'll have a miserable life.

Somewhat more difficult are cases where two anaphors have to be bound at the same time. Still, example (51) can be interpreted and only with modal splitting:

(51) Call this number. The phone will be answered by either a doctor or a secretary. The doctor can tell you right away what's the matter with you, or the nurse can make an appointment for you.

With modal splitting the second disjunction will be split: its first disjunct will be regarded as a continuation of the first disjunct of the first disjunction, similarly, the second disjuncts will team up: in words, the whole discourse will be:

(52) A doctor or a secretary will answer. If a doctor answers he can tell you what is wrong. If a secretary answers, she can make an appointment.

The anaphors are regularly bound by the existential terms in the antecedent clauses.

Modal splitting, as I said, occurs when alternatives are added to alternatives. Besides disjunction, other kinds of expressions like *on the other hand* (and conjunctions as well) can express such alternatives. Here also we find several examples where we have to assume that the sentence is added with modal splitting to make sense of it:

(53) Mary and Sue are playing poker. The winner will get \$1000. Mary will spend it on a new stereo. Sue, on the other hand, will use it for her trip to Bessarabia.

Here we have to assume that by accommodation the second sentence introduces a disjunction in the discourse: either Mary will win and get \$1000 or Sue will win and get \$1000. Here it is out of the question that the third sentence, or the

fourth, can be simply added as assertions to the discourse. Modal splitting gives the correct result, and gives it in a simple way.

Summarizing, we assume that often when disjunctive information is added to disjunctive information, the first will not be added to the assertion level of the discourse, but its disjuncts will be added under the assumption of the respective disjuncts that were already in the information.

Let us now ask what this will mean for the case of conflicting presuppositions. If the assertion of a sentence has a certain presupposition and that sentence is not entered at the top level, but is asserted, through modal subordination, under some assumption stemming from a subordinated level, then it is clear that its presupposition should be satisfied *under that assumption*.

Let us return to our example (25). The situation before asserting (25) is as described in (28). If we add (29) directly to this discourse we come into problems with the presuppositions. Suppose now that we add (29) with modal splitting to the discourse. This means that *Suzan met the king* will be added under the supposition that *there is a king* and that *Suzan met the president* similarly will be added under the supposition that *there is a president*. We have seen that the disjunction has two presuppositions: namely, that if Suzan did not meet the president, there is a king, and if Suzan did not meet the king, there is a president (see 30). If we split the assertion, also the presuppositions will split, and we can conclude that the first presupposition has to be satisfied under the assumption that there is a king, and the second one under the assumption that there is a president. This means that we extend (28) to (54):

- (54) $\langle a, \text{head}(a), \langle \text{king}(a) \rangle \bowtie \langle \text{pres}(a) \rangle,$
 $\langle \text{king}(a) \rangle \rightarrow \langle \neg \langle \text{pres}(a), \text{met}(s, a) \rangle \rangle \rightarrow \langle \text{king}(a) \rangle \rangle \rangle,$
 $\langle \text{pres}(a) \rangle \rightarrow \langle \neg \langle \text{king}(a), \text{met}(s, a) \rangle \rangle \rightarrow \langle \text{pres}(a) \rangle \rangle \rangle$

The latter two conditionals are obviously tautologies, so indeed under modal subordination the presuppositions are satisfied, without the disastrous conclusion that (34) itself already has to hold. At the contrary: adding the presuppositions to the discourse does not change the discourse at all; after pruning, (54) is again (28).

Here, we can add the disjunction itself to the discourse with modal splitting, and we get:

- (55) $\langle a, \text{head}(a), \langle \text{king}(a) \rangle \bowtie \langle \text{pres}(a) \rangle,$
 $\langle \text{king}(a) \rangle \rightarrow \langle \text{king}(a), \text{met}(s, a) \rangle,$
 $\langle \text{pres}(a) \rangle \rightarrow \langle \text{pres}(a), \text{met}(s, a) \rangle \rangle$

This reduces to:

- (56) $\langle a, \text{head}(a), \langle \text{king}(a) \rangle \bowtie \langle \text{pres}(a) \rangle,$
 $\langle \text{king}(a) \rangle \rightarrow \langle \text{met}(s, a) \rangle,$
 $\langle \text{pres}(a) \rangle \rightarrow \langle \text{met}(s, a) \rangle \rangle$

Now, we have two conditionals $\varphi \rightarrow \chi$ and $\psi \rightarrow \chi$. That is, of course, nothing but: $(\varphi \vee \psi) \rightarrow \chi$. Since, the discourse also contains $\varphi \bowtie \psi$ we can conclude χ with modus ponens. So, the resulting discourse indeed is:

- (34) $\langle a, \text{head}(a), \langle \text{king}(a) \rangle \bowtie \langle \text{pres}(a) \rangle, \text{met}(s, a) \rangle$

Modal subordination will also provide the right result for the conditional with conflicting presuppositions.

In conclusion, we can say the following. We have given a simple analysis of presuppositions that is well motivated within a general theory of assertion and discourse. In fact, by and large it is the analysis of presuppositions as it is given in Stalnaker [1974] and related papers. Apart from being intuitive and simple, this analysis deals with practically all the notorious problems of presuppositions. To solve the remaining problem of conflicting presuppositions, we have to appeal to modal subordination, a well motivated and also simple principle of discourse extension, that we need in our theory anyway. It was shown that splitting a disjunction and its conflicting presuppositions, by regarding them as continuations of disjunctive assumptions in the discourse, is well motivated and leads to the correct results. The simple idea that discourse structure resembles proof structure naturally guides you in the direction of an analysis for presuppositions and for modal subordination. We only need to observe that the two are interrelated to solve the projection problem.

Note

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