ANGELIKA KRATZER

PARTITION AND REVISION: THE SEMANTICS OF COUNTERFACTUALS

I. A STRAIGHTFORWARD ANALYSIS SEEMS TO FAIL

What is for me the most intuitive analysis of counterfactuals goes as follows:

> The truth of counterfactuals depends on everything which is the case in the world under consideration: in assessing them, we have to consider all the possibilities of adding as many facts to the antecedent as consistency permits. If the consequent follows from every such possibility, then (and only then), the whole counterfactual is true.

I want to express this idea within the framework of possible-worlds semantics.

The Analysis

> Let W be the set of possible worlds. A proposition is then a subset of W. If p is any proposition, p is true in a world w of W if and only if w is a member of p. The notions of consistency, logical compatibility and consequence are defined in the usual way.

Suppose now I utter a sentence of the form

(1) If it were the case that α, then it would be the case that β.

where q and r are the propositions expressed by α and β respectively. We have to specify how the proposition expressed by the utterance of the whole sentence depends on q and r. Let p be this proposition. And let f be that function from W which assigns to every world the set of all those propositions which 'are the case' in it. Then p is the set of exactly those worlds w of W which meet the following condition:

Journal of Philosophical Logic **10** (1981) 201–216. 0022–3611/81/0102–0201$01.60

> If $A_w(q)$ is the set of all consistent subsets of $f(w) \cup \{q\}$ which contain q, then every set X in $A_w(q)$ has a superset Y in $A_w(q)$ such that $\bigcap Y \subseteq r$.[1]

If we don't have to worry about the existence of maximal sets, we can express the same condition in the following way:

> The proposition r follows from every maximal set in $A_w(q)$. (A set is maximal in B iff it has no proper superset in B.)

Surprisingly, this analysis seems to endow p with the following truth-conditions:

The Critical Truth-Conditions

(i) If q is true, then p is true if and only if r is true (in the world under consideration).

(ii) If q is false, then p is true (in the world under consideration), if and only if r follows from q (i.e., $q \subseteq r$).

The reader may be curious to see how this result is obtained. The proof is as follows.[2]

The Critical Argument

1. We assume – and this seems natural enough – that 'what is the case' in w is to be identified with the set of propositions true in w.

2. Suppose q is true in w; this means that $q \in f(w)$. Thus $f(w)$ is a superset of every subset of $f(w) \cup \{q\} = f(w)$; and clearly $r \in f(w)$ iff $\bigcap f(w) \subseteq r$. (In fact, $\bigcap f(w) = \{w\}$.) So p is true in w iff $r \in f(w)$.

3. Suppose q is false in w, and let $w^* \in q$. Then $\{w^*\} = \bigcap\{-q \cup \{w^*\}, q\}$, so $\{-q \cup \{w^*\}, q\}$ is consistent. And clearly $\{-q \cup \{w^*\}, q\} \subseteq f(w) \cup \{q\}$. Thus $\{-q \cup \{w^*\}, q\} \in A_w(q)$ and hence if $w \in p$ then $\bigcap\{-q \cup \{w^*\}, q\} \subseteq r$. Hence $w^* \in r$, supposing that $w \in p$. Since this holds for arbitrary w^*, we have $q \subseteq r$. On the other hand, if $q \subseteq r$ clearly $p = W$ and so in particular $w \in p$.

Obviously, I have run into a dilemma. I presented an analysis of counterfactuals which I think to be very plausible. And then I presented an argument which seems to prove that this very same analysis has rather implausible consequences.

However, it is not the case that both clauses of the Critical Truth-Conditions are implausible. Clause (i), at least, is what we want. A counterfactual whose antecedent happens to be true should be true if and only if its consequent is true as well. What we don't want is clause (ii). Suppose I utter a sentence like

(2) If I were sleeping right now, I wouldn't be writing.

No doubt, what I just said is true. At the moment, I am not sleeping. But if I were, the fact that I wasn't writing wouldn't be a logical consequence of this.

I have now two possibilities for avoiding the dilemma: I can give up the analysis or check the argument again. I prefer the second option.

II. ESCAPING THROUGH ATOMISM

There is nothing to be done about parts 2 and 3 of the Critical Argument. Perhaps, though, something can be done about the assumption made in part 1. What is the case in a world could indeed be taken to be something other than the set of all propositions true in that world, and in fact the logical atomists have taken it to be something else. For Wittgenstein, the world is characterized by its *atomic* facts. Consider "The world is everything which is the case" (*Tractatus,* 1) in connection with "What is the case, the fact, is the existence of atomic facts" (*Tractatus,* 2).

Taking an atomistic view of what is the case would undercut part 3 of the proof, for if it is an atomic fact that I am tired, it is certainly not an atomic fact that I am tired or toads are able to drive cars, although the latter proposition follows from the former. It is these 'parasitic' facts, which are deadly for our analysis. They may suddenly play an important role if we dare make the counterfactual assumption that I am not tired. In this case, the two propositions that I am not tired and that I am tired or toads are able to drive cars, would form a consistent set from which it follows that toads are able to drive cars.

Wittgenstein's view of what is the case would save our analysis. But can we adopt such a view, and what are atomic facts? Furthermore, is a world determined by its atomic facts, and do atomic facts play a crucial part in determining the truth of counterfactuals? These questions take us into the middle of John Pollock's account of subjunctive reasoning.[3]

Formally, Pollock's analysis is similar to mine,[4] but in this paper I want to concentrate on its intuitive motivation. Pollock defends atomic propositions (*'simple propositions'*), but not on metaphysical grounds. He thinks that the only way you could justify this notion is to take it as basically epistemological: a simple proposition is one whose truth can be known non-inductively without first coming to know the truth of some proposition or propositions which entail it. Pollock doesn't consider simple propositions to be the only ones responsible for the truth or falsity of counterfactuals. Internal negations of simple propositions have to be considered as well as laws of nature (*'strong subjunctive generalizations'*) and actual necessities (*'weak subjunctive generalizations'*). The laws of gravity are examples of strong subjunctive generalizations. That anyone drinking from a particular bottle (hidden in Roderick Chisholm's closet and accidentally containing rat poison) would die, is an example of a weak subjunctive generalization.

But if subjunctive generalizations are used for an analysis of counterfactuals, there is the danger of circularity. Aren't these generalizations counterfactuals themselves? According to Pollock they are something quite different, and he gives them an independent analysis.[5] So he is free to use them for the counterfactual enterprise.

Let me briefly summarize our discussion so far. The truth of a counterfactual depends on what is the case in the world under consideration. But not all propositions which are actually true can be taken into account. We have to make a choice. Among the various ways of accomplishing this, Pollock proposes a refined version of atomism. His justification of this version is epistemological and thus is not open to the kind of criticism put forward against Wittgenstein. Furthermore, Pollock's atomism is not as exclusive as Wittgenstein's: He grants a place to certain kinds of complex propositions.

What I want to do now is to mold Pollock's suggestions into the format of the truth-conditions I presented above. Pollock's actual proposals are much more complicated than my presentation of them is going to be. For example, I shall neglect the important issue of temporal priorities. I believe, however, that these simplifications will not affect the point I wish to make.

A Pollock-like analysis

Again, imagine a sentence of the form (1) being uttered with p, q and r being the propositions expressed by the whole sentence, the antecedent and the consequent respectively. Let f_1 be that function from W which assigns to every world the set of all its true strong subjunctive generalizations. Let f_2 be that function from W which assigns to every world the set of all its true weak subjunctive generalizations. Finally, let f_3 be that function from W which assigns to every world the set of all its true simple propositions and negations of simple propositions. Then p is true in precisely those worlds w of W which fulfill the following condition:

> Let $A^1_w(q)$ be the set of all consistent subsets of $f_1(w) \cup \{q\}$ which contain q, let $A^2_w(q)$ be the set of all consistent subsets of $f_1(w) \cup f_2(w) \cup \{q\}$ which are extensions of a maximal set in $A^1_w(q)$, and let $A^3_w(q)$ be the set of all consistent subsets of $f_1(w) \cup f_2(w) \cup f_3(w) \cup \{q\}$ which are extensions of a maximal set in $A^2_w(q)$. Then for every maximal set X in $A^3_w(q)$, $\cap X \subseteq r$.

We shall need Pollock-like truth-conditions for "might"-counterfactuals as well. These are obtained by replacing the last clause of the preceding condition by the following.

> Then for some maximal set X in $A_w(q)$, $\cap X \cap r \neq \emptyset$.

It would be straightforward though cumbersome to accommodate these two definitions to the more general case, where we don't assume the existence of maximal sets. For our present purposes, the simpler version will do. Note that the definition ensures that in counterfactual reasoning, laws of nature have priority over actual necessities and actual necessities have priority over simple facts.

Although the Critical Argument does not apply to this analysis, there are other objections against it. One of these is that we have lost clause (i) of the Critical Truth-Conditions unless we stipulate that a world is uniquely characterized by all its true simple propositions, negations of simple propositions and subjunctive generalizations; it is unclear to me whether we are entitled to stipulate this. Another objection is more serious. There are quite simple examples which show that Pollock's partitioning of the world can't be the one underlying counterfactual reasoning in general. I shall present some of these examples in the following section.

II. COUNTEREXAMPLES AND AMENDMENTS

Consider the following three examples.

1. Hans and Babette spend the evening together. They go to a restaurant called "Dutchman's Delight", sit down, order, eat and talk, Suppose now, counterfactually, that Babette had gone to a bistro called "Frenchman's Horror" instead. Where would Hans have gone? (I have to add that Hans rather likes this bistro.)

2. Regina and I go on a walk in the bush. We have to pass a hanging bridge. I pass first. Regina is waiting. I am in the middle of the bridge. Suppose now, counterfactually, that I had passed a bit faster and had just left the bridge. Where would Regina be? Would she still be waiting?

3. I am taking dancing lessons at Wander's dancing school. Last Saturday, there were five men to dance with: John, James, Jack, Joseph and Jeremy. I danced with the latter three only. Suppose now, counterfactually, that I had danced with at least four of the men. With whom might I have danced?

I will comment on each problem separately.

Re (1)

I think that – given the circumstances – Hans would have gone to the bistro, too, if Babette had gone there. If this counterfactual is true, it is so mainly in virtue of the fact that Hans and Babette spend the evening together. Spending the evening together is no law of nature nor an actual necessity nor a simple fact. It involves simpler facts like the following:

> Hans picks Babette up. Hans takes the bus number five at five o'clock. Babette takes the bus number five at five o'clock. Babette sits next to Hans in the bus. Hans talks to Babette. Babette talks to Hans. And so on.

Probably, these facts are still not simple facts. That Hans picks Babette up involves in turn simpler facts like:

> Hans enters Babette's house. Hans knocks at the door. And so on.

However small these details may be, they will be listed by f_3.

The counterfactual assumption that Babette had gone to a different restaurant doesn't conflict with our laws of nature or actual necessities. So the conflict arises only in connection with f_3. There will now be several ways of achieving consistency. If we let Hans continue on his way to "Dutchman's Delight", he has to stop talking to Babette, for example. And if we let him continue talking to Babette, he has to go with her. But clearly a Pollock-like analysis wouldn't give priority to the second possibility.

Perhaps we can repair the analysis. Instead of having three kinds of facts, we might need four. Let f_1 and f_2 be as before. Let f_3 be responsible for facts like the one that Hans and Babette spend the (entire) evening together. And let f_4 be as f_3 above. The definitions have to be changed accordingly. They would now imply that Hans would have gone to the bistro, too, if Babette had gone there. But then, how many kinds of facts will we end up with? And how complicated is our system of priorities going to be?

Re (2)

I think that Regina might have started passing over the bridge, if I had just left the bridge. So it is not true that she would still be waiting. She might be, but she wouldn't necessarily be. The supposition that I had just left the bridge affects many actual simple facts but there seems to be no logical reason to remove the fact that Regina is waiting at the beginning of the bridge. There is no law of nature or actual necessity either which would prevent her from doing so. So it is quite likely that Regina's waiting turns out to be what Nicholas Rescher called an "innocent bystander",[6] a proposition which (in terms of our definitions) is contained in every maximal set of $A^3_w(q)$.

Since Regina's waiting is incompatible with her having started passing over the bridge, a Pollock-like analysis would require that it would have to be false that she might have started passing already, if only I had passed a bit faster. Yet this conflicts with our intuitions.

If we wish to repair the analysis, we have to get rid of the fact that Regina is waiting at the beginning of the bridge. In the previous example, we had to get rid of certain facts, too, such as the simple facts connected with the fact that Hans went to "Dutchman's Delight". We were able to knock out these unwelcome facts by giving priority to the more general fact that Hans and Babette spent the entire evening together.

A similar move is not possible here. The difference is this: In the Hans-and-Babette example, a Pollock-like analysis has the effect of making true a "might"-counterfactual only, whereas is is the corresponding "would"-counterfactual that should be true. We give priority to the possibility that Hans spends the evening with Babette. In the bridge example, the situation is reversed: A Pollock-like analysis has the effect of making a "would"-counterfactual true, whereas it is the corresponding "might"-counterfactual only that should be true. We don't give priority to either Regina's waiting or her passing. Both possibilities are equally licensed.

The conclusion seems to be that, sometimes, there are simple facts which cannot enter into the assessment of a counterfactual. Does this mean that we simply have to drop some of these facts? If we did so, we would be in danger of losing clause (i) of the Critical Truth-Conditions once and for all, for we couldn't be sure that the remaining facts would still provide a unique characterization of the world under consideration. We have to compensate for the facts we drop and again the admission of more complex facts will help us out.

Instead of thinking of Regina's waiting and my passing in terms of two separate facts, say p and q, we may consider them to be *one* fact $p \cap q$ (or parts of a single fact involving even more conjuncts). If these two facts are lumped together, they stand or fall together. If we make the counterfactual assumption that I am not on the bridge anymore, Regina's waiting will be removed together with my passing. Since the whole lump of propositions is incompatible with the counterfactual assumption, it doesn't have a chance of becoming a member of any set in $A_w^3(q)$.

Perhaps it will be helpful if I give a short illustration of how an analysis of counterfactuals in terms of maximal consistent sets is responsive to the way propositions are lumped together. Let p, q and r be any propositions such that $\{p, -q, r\}$ is consistent and p doesn't follow from $\{-q, r\}$. Consider now the two inconsistent sets $\{p, q, r, -q\}$ and $\{p \cap q, r, -q\}$. The first set contains p and q as members. However, neither proposition is a member of the second set. This set contains the conjunction (that is the intersection) of the two propositions without containing the single conjuncts.

Let us now examine for both sets the sets, say A and B, of all their consistent subsets which contain $-q$.

$$A = \{\{-q\}, \{p, -q\}, \{r, -q\}, \{p, r, -q\}\}$$

$$B = \{\{-q\}, \{r, -q\}\}$$

The proposition p follows from the only maximal set in A, but it doesn't follow from the only maximal set in B. Thus, lumping p and q together will enable us to knock out p along with q.

Re (3)

If I had danced with at least four of the men, I might have danced with Jeremy, Joseph, Jack and James or else with Jeremy, Joseph, Jack and John. These are the two possibilities permitted by a Pollock-like analysis: We have to keep the three men I actually danced with and we can't add more than one extra man. Our reasoning is not as rigid as this, however; it seems that I might have danced with all five of the men or with *any* combination of four. To account for this without risk of losing clause (i) of the Critical Truth-Conditions, we must take recourse to lumped propositions again: my dancing with Jeremy, Joseph and Jack as well as my not dancing with James and John should be parts of a single fact. If we assume that I had danced with at least four of the men, this lump of facts will be removed as a whole.

The three examples showed that Pollock's tripartition is not a partition of facts which underlies counterfactual reasoning in general. Two amendments seem necessary:

(i) More types of complex facts have to be admitted.

(ii) The system of priorities mentioned in the truth-conditions has to be extended.

We saw that priorities can't always be used for shelving propositions. Sometimes, we need other mechanisms for doing so. Thus lumped facts entered the picture. At this stage, it seems good to reconsider the reasons which made us load our truth-conditions with a weird system of priorities. So let us go back to Hans and Babette: Hans would have gone to the bistro, too, if Babette had gone there. I took this counterfactual to be true in the situation depicted above and I responded as if this judgement forced us to accept the amendments (i) and (ii).

We are not really commited to (ii), however. We might argue that the presence of the more general fact that Hans and Babette spent the evening together has the effect of lumping together other facts: it would then be *one* fact, for example, that Hans and Babette have dinner at "Dutchman's Delight". On such a view, we wouldn't have to extend our system of priorities anymore. If we make the counterfactual assumption that Babette has dinner somewhere else, Hans' activities are removed along with hers. Then there wouldn't be any propositions left which could be competitors for the fact that Hans and Babette spend the evening together.

A similar line of reasoning applies to the original Pollock-like truth-conditions. They stipulate that, in counterfactual reasoning, laws of nature have priority over actual necessities and actual necessities have priority over simple facts. Here too, the evidence originally motivating the introduction of priorities can be interpreted in a different way.

Suppose, for instance, that there is a mirror next door. At the moment, I am not looking into it. But suppose I did. Would I see my face reflected or wouldn't I? I am sure I would. The laws of optics wouldn't change. And there wouldn't be miraculous strokes of fate destroying the mirror or making me blind. What has to give way is the fact that I don't see my face reflected right now. Why is it this fact that has to be given up?

We may present an answer in terms of priorities. But we might just as well present an answer in terms of lumping. We would then assume that my not looking into the mirror and my not seeing my face reflected are facts which are lumped together (along with other facts).

Examples like this suggest that priorities are most likely to be superfluous: the phenomena to be accounted for can be explained by lumping as well. And lumping is a device we need anyway.

If all this is true, we can accept the analysis at the beginning of this paper. But in returning there, we are confronted immediately with the problem of giving a proper account to the notion of 'what is the case'.

IV. BACK TO THE ORIGINAL ANALYSIS

So far, a clear-cut notion of 'what is the case' hasn't emerged from our reflections. A vague notion, however, can be stated: that what is the case in a world is a set of propositions which characterizes it uniquely. I want to call such a set of propositions a *partition* of the respective world. A *partition function* is then a function which assigns to every world a partition of it. Formally, a partition function is a function f on W which assigns to every w in W a set of propositions such that $\bigcap f(w) = \{w\}$. Examples of partition functions are the function which assigns to every world the set of all its true propositions and the function which assigns to every world w the set $\{\{w\}\}$. The notion of a 'fact' would then have to be relativized to a partition function: a proposition p is a *fact* of a world w with respect to a partition function f if and only if p is a member of $f(w)$.

Consequently, our analysis of counterfactuals will have to be relativized to a partition function as well. Which proposition is expressed by an utterance of a sentence of the form (1) will then not only depend on the propositions expressed by the constituent sentences, but also on a partition function contributed by the context of conversation. The function f described in the analysis as "that function which assigns to every world 'what is the case' in it" will then be a parameter and not a constant: different contexts fix the parameter in different ways. In theory, there are many possible partitition functions. But in practice, their range is restricted by our modes of cognition. The human mind doesn't split up the world in any arbitrary way. A further narrowing down of possibilities comes from the context of conversation. Some contexts impose a particular view of the world: Atomistic, holistic, Pollockistic perhaps. Usually, these restrictions are not sufficient to determine a unique partition function for a particular context of conversation. And this is a source of vagueness in conditionals.

Subjunctive conditional sentences are *context-dependent* expressions, since their interpretation depends on a parameter that has to be fixed by the utterance situation. Subjunctive conditional sentences are also *vague* expressions since this parameter is seldom fixed in a determinate way. There are context-dependent expressions which are less vague than subjunctive conditional sentences. Take for example the word "I". A normal utterance of "I" refers to the speaker. There is hardly ever any vagueness about who the speaker is. Or consider "this" and "that" when used to refer to individuals. We mostly fix the individuals to which we want to refer in an unambiguous way. Pointing may help. We succeed because our standards for splitting up the world into individuals are rather rigid. There is comparatively little room for vagueness.

But it is different with "here" and "now". A typical utterance of "here" refers to some indeterminate area around the speaker.[7] And a typical utterance of "now" refers to some indeterminate interval around the utterance time. In general, it remains open which area or which interval this is exactly. Our everyday standards for splitting up space into places or times into intervals are variable and hazy. And so are – I believe – our everyday standards for splitting up the world into facts.

If I am right in assuming that there is such an intimate connection between partition functions and counterfactuals, then we should expect that

(1) The variability and indeterminacy of the partition function determines the variability and vagueness of counterfactuals.

(2) The invariable properties of counterfactuals are determined by the invariable properties of the partition function and the invariable role it plays in the analysis.

And what we know about counterfactuals supports both points.

The first expectation

The analysis I have proposed makes the interpretation of counterfactuals depend on a parameter f. The two functions I mentioned as examples for partition functions represent two extreme ways of fixing this parameter. In both cases, the analysis predicts that a counterfactual will reduce to the corresponding material implication if its antecedent is true and to strict implication if its antecedent is false (in the world under consideration).

The Critical Argument established this for the function that assigns to every world the set of all its true propositions. We will now prove it for the function f which assigns to every world w of W the set $\{\{w\}\}$.

Hegel's Counterfactual

Suppose that a sentence of the form (1) is uttered in a situation which fixes the parameter f so that $f(w) = \{\{w\}\}$ for all w in W. Let p, q and r be the propositions expressed by the utterance of the whole sentence, the antecedent and the consequent respectively.

(i) Assume that q is true in a world w of W. Then $\{\{q\}, \{q, \{w\}\}\}$ is the set of all consistent subsets of $f(w) \cup \{q\}$ which contain q and $\{q, \{w\}\}$ is the only maximal set in this set. Now, obviously, r follows from $\{q, \{w\}\}$ if and only if r is true in w. This means that, if q is true in w, then p is true in w if and only if r is true in w as well.

(ii) Assume that q is false in w. If q is the empty set, then p is true trivially and r follows from q. If q is not the empty set, then the set of all consistent subsets of $f(w) \cup \{q\}$ is simply $\{\{q\}\}$ and $\{q\}$ is the only maximal set in this set. This means that, if q is false in w, then p is true in w, if and only if r follows from q.

The partition function underlying Hegel's counterfactual corresponds to a holistic view of the world: all facts hang together. Our analysis predicts that a holistic view of the world should reduce counterfactuals to strict implications if their antecedents are false (in the world under consideration). But do counterfactuals really oscillate so as to include strict implication as the limiting case?

I think they do. If we adopt a sceptical strategy in a conversation, we can indeed push every counterfactual with false antecedent towards strict implication. We just have to insist again and again that – after all – everything is connected to everything else in our world. Here is an example of such a conversation:

A Holist's Argument

Hans: If I had left five minutes earlier, I would have caught the train.

Anna: Not necessarily. You might have got run over by a car.

Hans: But there weren't any cars around at that time. I saw it from the window.

Anna: But if you had left earlier, someone else might have left earlier, too. He might have taken his car and might have run you over. What would have caused *you* to leave five minutes earlier, might have caused *him* to leave five minutes earlier.

By lumping together fact after fact, Anna will succed in destroying every counterfactual that Hans might think of – with the exception of only those counterfactuals where the proposition expressed by the consequent follows from the one expressed by the antecedent.

In making a counterfactual assumption, we make a kind of revision to the actual world. The extent of this revision depends on the underlying partition. If everything is linked to everything else, the world is a whole. If you change a bit of it, the rest may change as well.

Examples of this kind support our first expectation: the range of variability of counterfactuals seems to correspond to the range of variability of the partition function. But we still need some support for our second expectation.

The second expectation

There are certain principles for counterfactual reasoning which hold independently of a particular utterance situation and on which everyone seems to agree. One of these principles is expressed in clause (i) of the Critical Truth-Conditions. It says that a counterfactual with true antecedent should be true if and only if its consequent is true (in the respective world). While brooding over amendments in the preceding section, we always kept in mind that we should never lose this principle. And indeed, we have saved it.

This can be seen by going back to part 2 of the Critical Argument. The only property of the function f which is really needed for this part of the argument is precisely the property of being a partition function.

Examples of other commonly hold principles which are validated by our semantics, are the following:[8]

If α were the case, then β would be the case.
If α were the case, then γ would be the case.

If α were the case, then β and γ would be the case.

If α were the case, then β would be the case.
If α were the case, then γ would be the case.

If α and β were the case, then γ would be the case.

As usual for counterfactuals, the inference patterns of strengthening the antecedent, transitivity and contraposition are not validated.

John Burgess (1) gave axiomatizations and completeness proofs for a number of conditional logics. Burgess' proofs are based on ordering frames as discussed in Lewis (4). That these proofs include a completeness proof for the semantics of counterfactuals presented here, follows from Lewis' equivalence proofs in the same paper.

This shows that the invariable properties of the partition function and the role it plays in our analysis are indeed strong enough for characterizing a plausible logic of counterfactuals.

CONCLUSION

The last section made it clear that an analysis which at first seems to fail is viable after all. It is viable if we let it depend on a partition function to be provided by the context of conversation. This analysis leaves certain traits of the partition function open. I have tried to show that this should be so. Specifying these traits as Pollock does leads to wrong predictions. And leaving them open endows counterfactuals with just the right amount of variability and vagueness.

Max Planck Institute, Nijmegen

ACKNOWLEDGEMENTS

I want to thank Max and Mary Cresswell for discussions and hospitality in January and February 1979. I am also indebted to the Max Planck Gesellschaft for a travel grant to New Zealand.

A previous version of this paper was read at the 1979 Bielefeld conference on theories of meaning and language use sponsored by the Deutsche Forschungsgemeinschaft.

I profited from written or oral comments by Jonathan Bennet, Ulrich Blau, Franz von Kutschera, David Lewis, Wolfgang Spohn, Frank Veltman and Thomas Zimmermann.

I am also grateful to Lorraine Tyler for checking my English.

NOTES

[1] This treatment of counterfactuals is based on my treatment of inconsistencies in (3). Frank Veltman (7) presents a formally analogous analysis of counterfactuals which relies on beliefs and not on facts, however.

[2] I am indebted to David Lewis for the third part.
[3] Pollock (5).
[4] See Lewis (4).
[5] Pollock (5).
[6] Rescher (6).
[7] Klein (2).
[8] We have to assume, of course, that the partition function contributed by the context of conversation stays the same during the inference.

BIBLIOGRAPHY

Burgess, J. P.: 1979, *Quick Completeness Proofs for Some Logics of Conditionals*, manuscript, Princeton University.

Klein, W.: 1979, *Local Deixis in Route Directions*, to appear in R. J. Jarvella and W. Klein (eds.), *Speech, Place, Action. Studies of Language in Context*, Academic Press.

Kratzer, A.: 1977, 'What 'Must' and 'Can' Must and Can Mean', *Linguistics and Philosophy* 1, 337–355.

Lewis, D. K.: 1981, 'Ordering Semantics and Premise Semantics for Counterfactuals', *Journal of Philosophical Logic*, this issue.

Pollock, J. L.: 1976, *Subjunctive Reasoning*, D. Reidel, Dordrecht.

Rescher, N.: 1973, *The Coherence Theory of Truth*, Clarendon Press, Oxford.

Veltman, F.: 1976, *Prejudices, Presuppositions and the Theory of Conditionals*, Amsterdam Papers in Formal Grammar, 1.