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A THEORY OF CONDITIONALS

I. INTRODUCTION

A conditional sentence expresses a proposition which is a function of two other propositions, yet not one which is a *truth* function of those propositions. I may know the truth values of "Willie Mays played in the American League" and "Willie Mays hit four hundred" without knowing whether or not Mays would have hit four hundred if he had played in the American League. This fact has tended to puzzle, displease, or delight philosophers, and many have felt that it is a fact that calls for some comment or explanation. It has given rise to a number of philosophical problems; I shall discuss three of these.

My principal concern will be with what has been called the *logical problem of conditionals*, a problem that frequently is ignored or dismissed by writers on conditionals and counterfactuals. This is the task of describing the formal properties of the *conditional function*: a function, usually represented in English by the words "if ... then", taking ordered pairs of propositions into propositions. I shall explain informally and defend a solution, presented more rigorously elsewhere, to this problem.[1]

The second issue – the one that has dominated recent discussions of contrary-to-fact conditionals – is the *pragmatic problem of counterfactuals*. This problem derives from the belief, which I share with most philosophers writing about this topic, that the formal properties of the conditional function, together with all of the *facts*, may not be sufficient for determining the truth value of a counterfactual; that is, different truth values of conditional statements may be consistent with a single valuation of all nonconditional statements. The task set by the problem is to find and defend criteria for choosing among these different valuations.

This problem is different from the first issue because these criteria are pragmatic, and not semantic. The distinction between semantic and pragmatic criteria, however, depends on the construction of a semantic theory. The semantic theory that I shall defend will thus help to clarify the second problem by charting the boundary between the semantic and pragmatic components of the concept. The question of this boundary line is precisely what Rescher, for example, avoids by couching his whole discussion in terms of

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conditions for belief, or justified belief, rather than truth conditions. Conditions for justified belief are pragmatic for any concept.[2]

The third issue is an epistemological problem that has bothered empiricist philosophers. It is based on the fact that many counterfactuals seem to be synthetic, and contingent, statements about unrealized possibilities. But contingent statements must be capable of confirmation by empirical evidence, and the investigator can gather evidence only in the actual world. How are conditionals which are both empirical and contrary-to-fact possible at all? How do we learn about possible worlds, and where are the facts (or counterfacts) which make counterfactuals true? Such questions have led philosophers to try to analyze the conditional in non-conditional terms[3] – to show that conditionals merely appears to be about unrealized possibilities. My approach, however, will be to accept the appearance as reality, and to argue that one can sometimes have evidence about nonactual situations.

In Sections II and III of this paper, I shall present and defend a theory of conditionals which has two parts, a formal system with a primitive conditional connective, and a semantical apparatus which provides general truth conditions for statements involving that connective. In Sections IV, V, and VI, I shall discuss in a general way the relation of the theory to the three problems outlined above.

II. THE INTERPRETATION

Eventually, I want to defend a hypothesis about the truth conditions for statements having conditional form, but I shall begin by asking a more practical question: how does one evaluate a conditional statement? How does one decide whether or not he believes it to be true? An answer to this question will not be a set of truth conditions, but it will serve as a heuristic aid in the search for such a set.

To make the question more concrete, consider the following situation: you are faced with a true-false political opinion survey. The statement is, "If the Chinese enter the Vietnam conflict, the United States will use nuclear weapons." How do you deliberate in choosing your response? What considerations of a logical sort are relevant? I shall first discuss two familiar answers to this question, and then defend a third answer which avoids some of the weaknesses of the first two.

The first answer is based on the simplest account of the conditional, the truth functional analysis. According to this account, you should reason as follows in responding to the true-false quiz: you ask yourself, first, will the

Chinese enter the conflict? and second, will the United States use nuclear weapons? If the answer to the first question is no, *or* if the answer to the second is yes, then you should place your X in the 'true' box. But this account is unacceptable since the following piece of reasoning is an obvious *non sequitur*: "I firmly believe that the Chinese will stay out of the conflict; *therefore* I believe that the statement is true." The falsity of the antecedent is never sufficient reason to affirm a conditional, even an indicative conditional.

A second answer is suggested by the shortcomings of the truth-functional account. The material implication analysis fails, critics have said, because it leaves out the idea of *connection* which is implicit in an if-then statement. According to this line of thought, a conditional is to be understood as a statement which affirms that some sort of logical or causal connection holds between the antecedent and the consequent. In responding to the true-false quiz, then, you should look, not at the truth values of the two clauses, but at the relation between the propositions expressed by them. If the 'connection' holds, you check the 'true' box. If not, you answer 'false'.

If the second hypothesis were accepted, then we would face the task of clarifying the idea of 'connection', but there are counter-examples even with this notion left as obscure as it is. Consider the following case: you firmly believe that the use of nuclear weapons by the United States in this war is inevitable because of the arrogance of power, the bellicosity of our president, rising pressure from congressional hawks, or other *domestic* causes. You have no opinion about future Chinese actions, but you do not think they will make much difference one way or another to nuclear escalation. Clearly, you believe the opinion survey statement to be true even though you believe the antecedent and consequent to be logically and causually independent of each other. It seems that the presence of a 'connection' is not a necessary condition for the truth of an if-then statement.

The third answer that I shall consider is based on a suggestion made some time ago by F. P. Ramsey.[4] Consider first the case where you have no opinion about the statement, "The Chinese will enter the Vietnam war." According to the suggestion, your deliberation about the survey statement should consist of a simple thought experiment: add the antecedent (hypothetically) to your stock of knowledge (or beliefs), and then consider whether or not the consequent is true. Your belief about the conditional should be the same as your hypothetical belief, under this condition, about the consequent.

What happens to the idea of connection on this hypothesis? It is sometimes relevant to the evaluation of a conditional, and sometimes not. If you believe that a causal or logical connection exists, then you will add the consequent to your stock of beliefs along with the antecedent, since the rational man accepts the consequences of his beliefs. On the other hand, if you already believe the consequent (and if you also believe it to be causally independent of the antecedent), then it will remain a part of your stock of beliefs when you add the antecedent, since the rational man does not change his beliefs without reason. In either case, you will affirm the conditional. Thus this answer accounts for the relevance of 'connection' when it is relevant without making it a necessary condition of the truth of a conditional.

Ramsey's suggestion covers only the situation in which you have no opinion about the truth value of the antecedent. Can it be generalized? We can of course extend it without problem to the case where you believe or know the antecedent to be true; in this case, no changes need be made in your stock of beliefs. If you already believe that the Chinese will enter the Vietnam conflict, then your belief about the conditional will be just the same as your belief about the statement that the U.S. will use the bomb.

What about the case in which you know or believe the antecedent to be false? In this situation, you cannot simply add it to your stock of beliefs without introducing a contradiction. You must make adjustments by deleting or changing those beliefs which conflict with the antecedent. Here, the familiar difficulties begin, of course, because there will be more than one way to make the required adjustments.[5] These difficulties point to the pragmatic problem of counterfactuals, but if we set them aside for a moment, we shall see a rough but general answer to the question we are asking. This is how to evaluate a conditional:

First, add the antecedent (hypothetically) to your stock of beliefs; second, make whatever adjustments are required to maintain consistency (without modifying the hypothetical belief in the antecedent); finally, consider whether or not the consequent is then true.

It is not particularly important that our answer is approximate – that it skirts the problem of adjustments – since we are using it only as a way of finding truth conditions. It is crucial, however, that the answer may not be restricted to some particular context of belief if it is to be helpful in finding a definition of the conditional function. If the conditional is to be understood as a function of the propositions expressed by its component clauses, then its truth value should not in general be dependent on the attitudes which anyone has toward those propositions.

Now that we have found an answer to the question, "How do we decide whether or not we believe a conditional statement?" the problem is to make the transition from belief conditions to truth conditions; that is, to find a set of truth conditions for statements having conditional form which explains why we use the method we do use to evaluate them. The concept of a *possible world* is just what we need to make this transition, since a possible world is the ontological analogue of a stock of hypothetical beliefs. The following set of truth conditions, using this notion, is a first approximation to the account that I shall propose:

Consider a possible world in which A is true, and which otherwise differs minimally from the actual world. *"If A, then B" is true (false) just in case B is true (false) in that possible world.*

An analysis in terms of possible worlds also has the advantage of providing a ready made apparatus on which to build a formal semantical theory. In making this account of the conditional precise, we use the semantical systems for modal logics developed by Saul Kripke.[6] Following Kripke, we first define a *model structure*. Let M be an ordered triple (K, R, λ). K is to be understood intuitively as the set of all possible worlds; R is the relation of relative possibility which defines the structure. If α and β are possible worlds (members of K), then $\alpha R \beta$ reads "β is possible with respect to α". This means that, where α is the actual world, β is a possible world. R is a reflexive relation; that is, every world is possible with respect to itself. If your modal intuitions so incline you, you may add that R must be transitive, or transitive and symmetrical.[7] The only element that is not a part of the standard modal semantics is λ, a member of K which is to be understood as the *absurd world* – the world in which contradictions and all their consequences are true. It is an isolated element under R; that is, no other world is possible with respect to it, and it is not possible with respect to any other world. The purpose of λ is to allow for an interpretation of "If A, then B" in the case where A is impossible; for this situation one needs an impossible world.

In addition to a model structure, our semantical apparatus includes a *selection function*, f, which takes a proposition and a possible world as arguments and a possible world as its value. The s-function selects, for each antecedent A, a particular possible world in which A is true. The *assertion* which the conditional makes, then, is that the consequent is true in the world selected. A conditional is true in the actual world when its consequent is true in the selected world.

Now we can state the semantical rule for the conditional more formally (using the corner, $>$, as the conditional connective):

$A > B$ is true in α if B is true in $f(A, \alpha)$;
$A > B$ is false in α if B is false in $f(A, \alpha)$.

The interpretation shows conditional logic to be an extension of modal logic. Modal logic provides a way of talking about what is true in the actual world, in all possible worlds, or in at least one, unspecified world. The addition of the selection function to the semantics and the conditional connective to the object language of modal logic provides a way of talking also about what is true in *particular* non-actual possible situations. This is what counterfactuals are: statements about particular counterfactual worlds.

But the world selected cannot be just any world. The *s*-function must meet at least the following conditions. I shall use the following terminology for talking about the arguments and values of *s*-functions: where $f(A, \alpha) = \beta$, A is the *antecedent*, α is the *base world*, and β is the *selected world*.

(1) For all antecedents A and base worlds α, A must be true in $f(A, \alpha)$.

(2) For all antecedents A and base worlds α, $f(A, \alpha) = \lambda$ only if there is no world possible with respect to α in which A is true.

The first condition requires that the antecedent be true in the selected world. This ensures that all statements like "if snow is white, then snow is white" are true. The second condition requires that the absurd world be selected only when the antecedent is impossible. Since everything is true in the absurd world, including contradictions, if the selection function were to choose it for the antecedent A, then "If A, then B and not B" would be true. But one cannot legitimately reach an impossible conclusion from a consistent assumption.

The informal truth conditions that were suggested above required that the world selected *differ minimally* from the actual world. This implies, first, that there are no differences between the actual world and the selected world except those that are required, implicitly or explicitly, by the antecedent. Further, it means that among the alternative ways of making the required changes, one must choose one that does the least violence to the correct description and explanation of the actual world. These are vague conditions which are largely dependent on pragmatic considerations for their application. They suggest, however, that the selection is based on an ordering of possible worlds with respect to their resemblance to the base world. If this is correct, then there are two further formal constraints which must be imposed on the *s*-function.

(3) For all base worlds α and all antecedents A, if A is true in α, then $f(A, \alpha) = \alpha$.

(4) For all base worlds α and all antecedents B and B', if B is true in $f(B', \alpha)$ and B' is true in $f(B, \alpha)$, then $f(B, \alpha) = f(B', \alpha)$.

The third condition requires that the base world be selected if it is among the worlds in which the antecedent is true. Whatever the criteria for evaluating resemblance among possible worlds, there is obviously no other possible world as much like the base world as the base world itself. The fourth condition ensures that the ordering among possible worlds is consistent in the following sense: if any selection established β as prior to β' in the ordering (with respect to a particular base world α), then no other selection (relative to that α) may establish β' as prior to β.[8] Conditions (3) and (4) together ensure that the s-function establishes a total ordering of all selected worlds with respect to each possible world, with the base world preceding all others in the order.

These conditions on the selection function are necessary in order that this account be recognizable as an explication of the conditional, but they are of course far from sufficient to determine the function uniquely. There may be further formal constraints that can plausibly be imposed on the selection principle, but we should not expect to find semantic conditions sufficient to guarantee that there will be a unique s-function for each valuation of non-conditional formulas on a model structure. The questions, "On what basis do we select a selection function from among the acceptable ones?" and "What are the criteria for ordering possible worlds?" are reformulations of the pragmatic problem of counterfactuals, which is a problem in the application of conditional logic. The conditions that I have mentioned above are sufficient, however, to define the semantical notions of validity and consequence for conditional logic.

III. THE FORMAL SYSTEM

The class of valid formulas of conditional logic according to the definitions sketched in the preceding section, is coextensive with the class of theorems of a formal system, C2. The primitive connectives of C2 are the usual $\supset$ and $\sim$ (with v, &, and $\equiv$ defined as usual), as well as a conditional connective, $>$ (called the corner). Other modal and conditional concepts can be defined in terms of the corner as follows:

$$\Box A =_{\mathrm{DF}} \sim A > A$$

$$\Diamond A =_{\mathrm{DF}} \sim(A > \sim A)$$

$$A \gtrless B =_{\mathrm{DF}} (A > B) \,\&\, (B > A)$$

The rules of inference of C2 are *modus ponens* (if A and $A \supset B$ are theorems, then B is a theorem) and the Gödel rule of necessitation (If A is a theorem, then $\Box A$ is a theorem). There are seven axiom schemata:

(a1) Any tautologous wff (well-formed formula) is an axiom.

(a2) $\Box(A \supset B) \supset (\Box A \supset \Box B)$

(a3) $\Box(A \supset B) \supset (A > B)$

(a4) $\Diamond A \supset \cdot (A > B) \supset \sim(A > \sim B)$

(a5) $A > (B \vee C) \supset \cdot (A > B) \vee (A > C)$

(a6) $(A > B) \supset (A \supset B)$

(a7) $A \gtrless B \supset \cdot (A > C) \supset (B > C)$

The conditional connective, as characterized by this formal system, is intermediate between strict implication and the material conditional, in the sense that $\Box(A \supset B)$ entails $A > B$ by (a3) and $A > B$ entails $A \supset B$ by (a6). It cannot, however, be analyzed as a modal operation performed on a material conditional (like Burks's causal implication, for example).[9] The corner lacks certain properties shared by the two traditional implication concepts, and in fact these differences help to explain some peculiarities of counterfactuals. I shall point out three unusual features of the conditional connective.

(1) Unlike both material and strict implication, the conditional corner is a non-transitive connective. That is, from $A > B$ and $B > C$, one cannot infer $A > C$. While this may at first seem surprising, consider the following example: *Premisses*. "If J. Edgar Hoover were today a communist, then he would be a traitor." "If J. Edgar Hoover had been born a Russian, then he would today be a communist." *Conclusion*. "If J. Edgar Hoover had been born a Russian, he would be a traitor." It seems reasonable to affirm these premisses and deny the conclusion.

If this example is not sufficiently compelling, note that the following rule follows from the transitivity rule: From $A > B$ to infer $(A \;\&\; C) > B$. But it is obvious that the former rule is invalid; we cannot always strengthen the antecedent of a true conditional and have it remain true. Consider "If this match were struck, it would light," and "If this match had been soaked in water overnight *and* it were struck, it would light."[10]

(2) According to the formal system, the denial of a conditional is equivalent to a conditional with the same antecedent and opposite consequent (provided

that the antecedent is not impossible). That is, $\Diamond A - \sim(A > B) \equiv (A > \sim B)$. This explains the fact, noted by both Goodman and Chisholm in their early papers on counterfactuals, that the normal way to contradict a counterfactual is to contradict the consequent, keeping the same antecedent. To deny "If Kennedy were alive today, we wouldn't be in this Vietnam mess," we say, "If Kennedy were alive today, we would so be in this Vietnam mess."

(3) The inference of contraposition, valid for both the truth-functional horseshoe and the strict implication hook, is invalid for the conditional corner. $A > B$ may be true while $\sim B > \sim A$ is false. For an example in support of this conclusion, we take another item from the political opinion survey: "If the U.S. halts the bombing, then North Vietnam will not agree to negotiate." A person would believe that this statement is true if he thought that the North Vietnamese were determined to press for a complete withdrawal of U.S. troops. But he would surely deny the contrapositive, "If North Vietnam agrees to negotiate, then the U.S. will not have halted the bombing." He would believe that halt in the bombing, and much more, is required to bring the North Vietnamese to the negotiating table.[11]

Examples of these anomalies have been noted by philosophers in the past. For instance, Goodman pointed out that two counterfactuals with the same antecedent and contradictory consequents are "normally meant" as direct negations of each other. He also remarked that we may sometimes assert a conditional and yet reject its contrapositive. He accounted for these facts by arguing that semifactuals – conditionals with false antecedents and true consequents – are for the most part not to be taken literally. "In practice," he wrote, "full counterfactuals affirm, while semifactuals deny, that a certain connection obtains between antecedent and consequent . . . The practical import of a semifactual is thus different from its literal import."[12] Chisholm also suggested paraphrasing semifactuals before analyzing them. "Even if you were to sleep all morning, you would be tired" is to be read "It is false that if you were to sleep all morning, you would not be tired."[13]

A separate and nonconditional analysis for semifactuals is necessary to save the 'connection' theory of counterfactuals in the face of the anomalies we have discussed, but it is a baldly *ad hoc* manoeuvre. Any analysis can be saved by paraphrasing the counter-examples. The theory presented in Section II avoids this difficulty by denying that the conditional can be said, in general, to assert a connection of any particular kind between antecedent and consequent. It is, of course, the structure of inductive relations and causal connections which make counterfactuals and semifactuals true or false, but they do this by determining the relationships among possible worlds, which in turn determine the truth values of conditionals. By treating the relation between connection and conditionals as an indirect relation in this way, the theory is able to give a unified account of conditionals which explains the variations in their behavior in different contexts.

IV. THE LOGICAL PROBLEM: GENERAL CONSIDERATIONS

The traditional strategy for attacking a problem like the logical problem of conditionals was to find an *analysis*, to show that the unclear or objectionable phrase was dispensable, or replaceable by something clear and harmless. Analysis was viewed by some as an *unpacking* – a making manifest of what was latent in the concept; by others it was seen as the *replacement* of a vague idea by a precise one, adequate to the same purposes as the old expression, but free of its problems. The semantic theory of conditionals can also be viewed either as the construction of a concept to replace an unclear notion of ordinary language, or as an *explanation* of a commonly used concept. I see the theory in the latter way: no recommendation or stipulation is intended. This does not imply, however, that the theory is meant as a description of linguistic usage. What is being explained is not the rules governing the use of an English word, but the structure of a concept. Linguistic facts – what we would say in this or that context, and what sounds odd to the native speaker – are relevant as evidence, since one may presume that concepts are to some extent mirrored in language.

The 'facts', taken singly, need not be decisive. A recalcitrant counterexample may be judged a deviant use or a different sense of the word. We can claim that a paraphrase is necessary, or even that ordinary language is systematically mistaken about the concept we are explaining. There are, of course, different senses and times when 'ordinary language' goes astray, but such *ad hoc* hypotheses and qualifications diminish both the plausibility and the explanatory force of a theory. While we are not irrevocably bound to the linguistic facts, there are no 'don't cares' – contexts of use with which we are not concerned, since any context can be relevant as evidence for or against an analysis. A general interpretation which avoids dividing senses and accounts for the behavior of a concept in many contexts fits the familiar pattern of scientific explanation in which diverse, seemingly unlike surface phenomena are seen as deriving from some common source. For these reasons, I take it as a strong point in favor of the semantic theory that it treats the conditional as a univocal concept.

V. PRAGMATIC AMBIGUITY

I have argued that the conditional connective is semantically unambiguous. It is obvious, however, that the context of utterance, the purpose of the assertion, and the beliefs of the speaker or his community may make a difference to the interpretation of a counterfactual. How do we reconcile the ambiguity of conditional sentences with the univocity of the conditional concept? Let us look more closely at the notion of ambiguity.

A sentence is ambiguous if there is more than one proposition which it may properly be interpreted to express. Ambiguity may be syntactic (if the sentence has more than one grammatical structure, semantic (if one of the words has more than one meaning), or pragmatic (if the interpretation depends directly on the context of use). The first two kinds of ambiguity are perhaps more familiar, but the third kind is probably the most common in natural languages. Any sentence involving pronouns, tensed verbs, articles or quantifiers is pragmatically ambiguous. For example, the proposition expressed by "L'état, c'est moi" depends on who says it; "Do it now" may be good or bad advice depending on when it is said; "Cherchez la femme" is ambiguous since it contains a definite description, and the truth conditions for "All's well that ends well" depends on the domain of discourse. If the theory presented above is correct, then we may add conditional sentences to this list. The truth conditions for "If wishes were horses, then beggers would ride" depend on the specification of an *s*-function.[14]

The grounds for treating the ambiguity of conditional sentences as pragmatic rather than semantic are the same as the grounds for treating the ambiguity of quantified sentences as pragmatic: simplicity and systematic coherence. The truth conditions for quantified statements vary with a change in the domain of discourse, but there is a single structure to these truth conditions which remains constant for every domain. The semantics for classical predicate logic brings out this common structure by giving the universal quantifier a single meaning and making the domain a parameter of the interpretation. In a similar fashion, the semantics for conditional logic brings out the common structure of the truth conditions for conditional statements by giving the connective a single meaning and making the selection function a parameter of the interpretation.

Just as we can communicate effectively using quantified sentences without explicitly specifying a domain, so we can communicate effectively using conditional sentences without explicitly specifying an *s*-function. This suggests that there are further rules beyond those set down in the semantics, governing the use of conditional sentences. Such rules are the subject matter of a *pragmatics* of conditionals. Very little can be said, at this point, about pragmatic rules for the use of conditionals since the logic has not advanced beyond the propositional stage, but I shall make a few speculative remarks about the kinds of research which may provide a framework for treatment of this problem, and related pragmatic problems in the philosophy of science.

(1) If we had a functional logic with a conditional connective, it is likely that $(\forall x)(Fx > Gx)$ would be a plausible candidate for the form of a law of nature. A law of nature says, not just that every actual F is a G, but further that for every possible F, if it were an F, it would be a G. If this is correct, then Hempel's confirmation paradox does not arise, since "All ravens are black" is not logically equivalent to "All non-black things are non-ravens." Also, the relation between counterfactuals and laws becomes clear: laws support counterfactuals because they entail them. "If this dove were a raven, it would be black" is simply an instantiation of "All ravens are black."[15]

(2) Goodman has argued that the pragmatic problem of counterfactuals is one of a cluster of closely related problems concerning induction and confirmation. He locates the source of these difficulties in the general problem of projectability, which can be stated roughly as follows: when can a predicate be validly projected from one set of cases to others? or when is a hypothesis confirmed by its positive instances? Some way of distinguishing between natural predicates and those which are artificially constructed is needed. If a theory of projection such as Goodman envisions were developed, it might find a natural place in a pragmatics of conditionals. Pragmatic criteria for measuring the inductive properties of predicates might provide pragmatic criteria for ordering possible worlds.[16]

(3) There are some striking structural parallels between conditional logic and conditional probability functions, which suggests the possibility of a connection between inductive logic and conditional logic. A probability assignment and an *s*-function are two quite different ways to describe the inductive relations among propositions; a theory which draws a connection between them might be illuminating for both.[17]

VI. CONCLUSION: EMPIRICISM AND POSSIBLE WORLDS

Writers of fiction and fantasy sometimes suggest that imaginary worlds have a life of their own beyond the control of their creators. Pirandello's six characters, for example, rebelled against their author and took the story out of his hands. The skeptic may be inclined to suspect that this suggestion is itself fantasy. He believes that nothing goes into a fictional world, or a possible world, unless it is put there by decision or convention; it is a creature of invention and not discovery. Even the fabulist Tolkien admits that Faërie is a land "full of wonder, but not of information."[18]

For similar reasons, the empiricist may be uncomfortable about a theory which treats counterfactuals as literal statements about non-actual situations. Counterfactuals are often contingent, and contingent statements must be supported by evidence. But evidence can be gathered, by us at least, only in this universe. To satisfy the empiricist, I must show how possible worlds, even if the product of convention, can be subjects of empirical investigation.

There is no mystery to the fact that I can partially define a possible world in such a way that I am ignorant of some of the determinate truths in that world. One way I can do this is to attribute to it features of the actual world which are unknown to me. Thus I can say, "I am thinking of a possible world in which the population of China is just the same, on each day, as it is in the actual world." *I* am making up this world – it is a pure product of my intentions – but there are already things true in it which I shall never know.

Conditionals do implicitly, and by convention, what is done explicitly by stipulation in this example. It is because counterfactuals are generally about possible worlds which are very much like the actual one, and defined in terms of it, that evidence is so often relevant to their truth. When I wonder, for example, what would have happened if I had asked my boss for a raise yesterday, I am wondering about a possible world that I have already roughly picked out. It has the same history, up to yesterday, as the actual world, the same boss with the same dispositions and habits. The main difference is that in that world, yesterday I asked the boss for a raise. Since I do not know everything about the boss's habits and dispositions in the actual world, there is a lot that I do not know about how he acts in the possible world that I have chosen, although I might find out by watching him respond to a similar request from another, or by asking his sectetary about his mood yesterday. These bits of information about the actual world would not be decisive, of course, but they would be relevant, since they tell me more about the non-actual situation that I have selected.

If I make a conditional statement – subjunctive or otherwise – and the antecedent turns out to be true, then whether I know it or not, I have said something about the actual world, namely that the consequent is true in it. If the antecedent is false, then I have said something about a particular counterfactual world, even if I believe the antencedent to be true. The conditional provides a set of conventions for selecting possible situations which have a specified relation to what actually happens. This makes it possible for statements about unrealized possibilities to tell us, not just about the speaker's imagination, but about the world.

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NOTES

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[1] R. C. Stalnaker and R. H. Thomason, 'A Semantic Analysis of Conditional Logic', (*mimeo.*, 1967). In this paper, the formal system, C2, is proved sound and semantically complete with respect to the interpretation sketched in the present paper. That is, it is shown that a formula is a consequence of a class of formulas if and only if it is derivable from the class in the formal system, C2.

[2] N. Rescher, *Hypothetical Reasoning*, Amsterdam, 1964.

[3] Cf. R. Chisholm, 'The Contrary-to-fact Conditional', *Mind* 55 (1946), 289–307, reprinted in *Readings in Philosophical Analysis*, ed. by H. Feigl and W. Sellars, New York, 1949, pp. 482–497. The problem is sometimes posed (as it is here) as the task of analyzing the *subjunctive* conditional into an indicative statement, but I think it is a mistake to base very much on the distinction of mood. As far as I can tell, the mood tends to indicate something about the attitude of the speaker, but in no way effects the propositional content of the statement.

[4] F. P. Ramsey, 'General Propositions and Causality', in Ramsey, *Foundations of Mathematics and other Logical Essays*, New York, 1950, pp. 237–257. The suggestion is made on p. 248. Chisholm, *op. cit.*, p. 489, quotes the suggestion and discusses the limitations of the "connection" thesis which it brings out, but he develops it somewhat differently.

[5] Rescher, *op. cit.*, pp. 11–16, contains a very clear statement and discussion of this problem, which he calls the problem of the ambiguity of belief-contravening hypotheses. He argues that the resolution of this ambiguity depends on pragmatic consideration. Cf, also Goodman's problem of relevant conditions in N. Goodman, *Fact, Fiction, and Forecast*, Cambridge, Mass., 1955, pp. 17–24.

[6] S. Kripke, 'Semantical Analysis of Modal Logics, I', *Zeitschrift für mathematische Logik und Grundlagen der Mathematik* 9 (1963), 67–96.

[7] The different restrictions on the relation R provide interpretations for the different modal systems. The system we build on is von Wright's M. If we add the transitivity requirement, then the underlying modal logic of our system is Lewis's S4, and if we add both the transitivity and symmetry requirements, then the modal logic is S5. Cf. S. Kripke, *op. cit.*

[8] If $f(A, \alpha) = \beta$, then β is established as prior to all worlds possible with respect to α in which A is true.

[9] A. W. Burks, 'The Logic of Causal Propositions', *Mind* 60 (1951), 363–382. The causal implication connective characterized in this article has the same structure as strict implication. For an interesting philosophical defense of this modal interpretation of conditionals, see B. Mayo, 'Conditional Statements', *The Philosophical Review* 66 (1957), 291–303.

[10] Although the transitivity inference fails, a related inference is of course valid. From $A > B$, $B > C$, and A, one can infer C. Also, note that the biconditional connective is transitive. From $A \gtrless B$ and $B \gtrless C$, one can infer $A \gtrless C$. Thus the biconditional is an equivalence relation, since it is also symmetrical and reflexive.

[11] Although contraposition fails, *modus tolens* is valid for the conditional: from $A > B$ and $\sim B$, one can infer $\sim A$.

[12] Goodman, *op. cit.*, pp. 15, 32.

[13] Chisholm, *op, cit.*, p. 492.

[14] I do not wish to pretend that the notions needed to define ambiguity and to make the distinction between pragmatic and semantic ambiguity (e.g., 'proposition', and 'meaning') are precise. They can be made precise only in the context of semantic and pragmatic theories. But even if it is unclear, in general, what pragmatic ambiguity is, it is clear, I hope, that my examples are cases of it.

[15] For a discussion of the relation of laws to counterfactuals, see E. Nagel, *Structure of Science*, New York, 1961, pp. 47–78. For a recent discussion of the paradoxes of confirmation by the man who discovered them, see C. G. Hempel, 'Recent Problems of Induction', in R. G. Colodny (ed.), *Mind and Cosmos*, Pittsburgh, 1966, pp. 112–134.

[16] Goodman, *op. cit.*, especially Ch. IV.

[17] Several philosophers have discussed the relation of conditional propositions to conditional probabilities. See R. C. Jeffrey, 'If', *The Journal of Philosophy* 61 (1964), 702–703; and E. W. Adams, 'Probability and the Logic of Conditionals', in J. Hintikka and P. Suppes (eds.), *Aspects of Inductive Logic*, Amsterdam, 1966, pp. 265–316. I hope to present elsewhere my method of drawing the connection between the two notions, which differs from both of these.

[18] J. R. Tolkien, 'On Fairy Stories', in *The Tolkien Reader*, New York, 1966, p. 3.