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Some questions about Adams' conditionals

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I have liked, since it was first published, Ernest Adams' book on conditionals (Adams, 1975). There is much about his probabilistic approach that is of permanent value. Whatever modifications will be made – and certainly they will be for such an important concept – much will remain of his original ideas and analysis. The present paper is an amplification and extension of comments I made to Ernest Adams' own paper given at the 1987 meetings of the Pacific Division of the American Philosophical Association.

I have organized my questions under three headings: varieties of conditionals, problems of computation, and questions of psychological reality.

1. VARIETIES OF CONDITIONALS

From Adams' various writings on probabilistic conditionals, it is not clear how he wants to treat the widespread use of conditionals in mathematical texts and especially in scientific texts. It seems apparent that he might not want to argue that books or articles on pure mathematics should use a conditional probability concept as the appropriate interpretation of conditionals, but the problem is certainly more complex in the case of scientific texts, especially those reporting the design and analysis of experiments. One can, of course, make the move of using probability 1 to a fare-thee-well, but that often seems awkward in cases of mathematics. In any case, the real point of my question is not this particular instance, which in fact Adams may have analyzed clearly in some place I have forgotten, but to

It is a pleasure to contribute to this *Festschrift* for Ernie Adams, who was my first Ph.D. student. I have learned a great deal from him over the years about a variety of topics, ranging from rational mechanics to the measurement of utility. I have especially benefited from the natural skepticism with which he greets half-baked philosophical ideas proposed by others, including myself.

raise the question whether or not a probabilistic interpretation of conditionals is going to work out well in almost all cases.

In this frame of mind, consider the following two sentences:

If Jones gets an ace, then he will get a face card on the next draw.
If Jones gets an ace, then it is likely that he will get a face card on the next draw.

It is not clear to me how, from a probabilistic interpretation of conditionals, one has anything like a clear qualitative algorithm for distinguishing between these two sample sentences. What is the impact on the probability of the main conditional to add to the consequent the standard phrase “it is likely that”? It would seem that there is a natural “computation” to move from the first sentence to the second, based on the way we think of “likely” as expressing a probability judgment. In a similar way, we can ring the changes on elaboration of the first phrase: *It is very likely, it is not likely, it is not very likely.* It is not that I think the handling of such phrases presents a problem, in principle, for Adams’ conditionals; it is just that I am not clear how we are to think about such extensions, which are certainly needed to give an adequate account of the ordinary use of conditionals.

In a similar vein, I am not clear how to think about imperatives. For example consider this imperative: *If you are cold, close the door!* Similar problems are presented by any standard computer instruction. For example: *If register 6 is empty, jump to exit!* How are imperatives meant to work in relation to indicative conditionals? Still other cases of analysis are required when probabilistic considerations are directly embedded in the content of the antecedent of an imperative:

If it is likely to rain, close the window!
If you think it is likely to rain, close the window!

Again, I am just not sure how all these probabilities, easily embedded in the content of the antecedent or consequent of a conditional, are to interact in a systematic way with the probability of the conditional.

The general way of putting my question about the varieties of conditionals is this: What is Adams’ characterization of the range of his conditional probability thesis for ordinary conditionals?

2. PROBLEMS OF COMPUTATION

Perhaps my most difficult question, at least in my own conception of Adams’ conditionals, concerns problems of computation. For example, we ordinarily think of conditionals as being transitive, following the Law

of Hypothetical Syllogism, but in general this is going to be true for Adams' conditionals only when the probability is 1. But as in the case of transitivity of causes, it is a useful and important topic to investigate when transitivity holds. My question is, What kind of results should be expected here? For a discussion of transitivity of non-Markovian causes, see Suppes (1986).

Of more concern to me than the question of transitivity is the general problem of how to compute. Simple gambling examples are too easy. Is the thesis that there are implicit upper and lower bounds on a collection of heterogeneous conditionals in terms of the conditional probability we can assign to the conclusion, or else how are we to think about the actual results expected from such inferences? Bayesians might offer an answer by sketching how they would put the various probabilities together, but it does not seem to me that Adams would necessarily want to adopt that answer. (I shall return to this point later.) Another possibility that might well be appropriate in his framework is to use a qualitative theory of probability that can, of course, nicely express the qualitative conditional probabilities. Of course, the problem here is that, in general, we do not have good rules for combining qualitative conditional probabilities when we put together an argument or a piece of discourse. To emphasize the fact that we do not is another way of saying how subtle and complicated it is to compute the probability of a conclusion coming out of a piece of discourse. My skepticism is not meant to imply that I think the usual interpretation of conditionals as material conditionals will work. This is an obvious shortcoming of standard logic, which has too little to do with most reasoning that takes place in ordinary talk. I do not mean to suggest by the questions or problems that I raise here that alternative theories are better than Adams', at least not the alternative theories now available to us, but I do want to suggest that there is a problem that needs solving in any theory of conditionals that claims to give a successful account of ordinary reasoning.

There is a reason for being doubtful that the exact numerical values of probability will matter in most ordinary informal reasoning, but then there is also the problem that the theory of qualitative probability is not well set up for combining inferences, except for the Bayesian, who can perhaps do it by brute intuition. Of course, even though I am a sometime Bayesian myself, it is a paradox of Bayesian thinking that it is only in cases of relative frequency data, resulting from nicely designed experiments, that we all move in the same way from a given prior to a good posterior. The reason is simple. Talk about being Bayesian really provides no explicit methods for evaluating conditionals of any complexity. A standard answer is that the Bayesians can do it because they have a joint probability, and all they have to do is conditionalize in terms of the joint probability

distribution. This is, however, a piece of fantasy. We simply do not, in ordinary circumstances, carry around any serious knowledge of a joint probability distribution of all the great variety of events, states, or facts that are referred to in ordinary discourse. Bayesians do not really have a prior that encompasses all these matters; they just have pieces of a prior distribution – a marginal here, a marginal there – but certainly no complicated precise joint distribution.

Another way of putting my question, which is central in many ways to the viability of Adams' conditionals, is one that is very much in the spirit of the question that Adams himself addresses to traditional logic: Can the theory being given escape from the scholastic box into the real world? Much more complicated and realistic examples must be given over a variety of domains before we can wholeheartedly accept an affirmative answer.

As a way of making this general remark more particular, I cannot but be skeptical that Adams' intriguing conditional deficit formula can possibly be computed even approximately in connection with conditionals used in ordinary discourse. Let us remember that the conditional deficit formula is the difference between the probability of the disjunction $\neg A \vee B$ and the probability of the conditional $A \rightarrow B$, which can be translated into the deficit $(1 - P(\neg A \vee B)) \cdot P(\neg A) / P(A)$.

3. PROBLEMS OF PSYCHOLOGICAL REALITY

There is a strong tendency in the current theories of language production and comprehension to postulate that many matters are modular, although exactly how these modules are themselves defined or put together is still a matter of much speculation that obviously will require much further work, both theoretical and empirical. However, in examining a new theory of conditionals, it is natural to ask what kinds of problems would arise in processing, let us say, the production of conditionals if Adams' conditionals were most commonly used. At a glance, this would seem to be an easy question for Bayesians. It would just be the imposition of a joint probability distribution properly conditionalized in the final evaluation of the conditional probability of the uttered conditional. For the reasons stated earlier when the conditional was at all complicated, this story seems to have the elements of a wonderful fairy tale. First we form the complicated joint distribution, and then we go through the complicated process of conditionalizing. Moreover, it would be natural to think of indicating in prosodic features, at least in the case of spoken conditionals, the degree of confidence or belief one had in the conditional, as expressed in the underlying conditional probability. Does, however, such a connection between prosodic feature as a component of a speech act and the probability

assigned to a conditional have any systematic relation that can be observed? Perhaps the right way to think about Adams' conditionals as reflected in this kind of problem is that most of the conditional probabilities are close to 1, and therefore a kind of rough-and-ready computation is not too difficult.

But it seems to me that it is just in ordinary talk that we utter a lot of conditionals that we do not have great confidence in – to use another way of talking about their probable truth. We meander around in our conversations in all sorts of ways, expressing casual opinions and ill-thought-out ideas, and sometimes nothing much at all is to be found in what is said except the mere pleasure of talking. I give a number of examples of this last phenomenon in the section entitled “Grody to the Max” in Suppes (1984, pp. 170–2).

In these common cases perhaps it is right to think in terms of conditional probabilities that are far from 1. But then we have the problem of how seriously we should take them, and whether a numerical view of the probabilities is an appropriate one. It seems to me there is again a thicket of problems that are in all likelihood not insurmountable, but it is certainly not clear how to think through a more detailed formulation of the psychological theory of processing governing Adams' conditionals.

Perhaps the deepest problem of psychological processing for me is that it seems reasonable to suppose in the case of very many of the conditionals we utter that the evidence on which the conditionals are based is only partly summarized in the statement itself. In most practical situations it is too difficult to summarize with great care the complex evidence on which we base an assertion. If we make the assertion in conditional form, then we select certain items of information, but not simply because of their high probability or because they render a high probability for the conclusion, but for many kinds of reasons – ranging from the desire to persuade to the desire to use a popular argument in which we believe but which we think to be not as powerful as the real argument. Moreover, we have no rational scheme for selecting from our complicated network of beliefs exactly those that should be expressed verbally in forming a conditional. Further, as the dynamics of any situation changes, we also do not have rationally formulated mechanisms of attention telling us what we should watch for and what we should record in our network of beliefs. Of course there are obvious things we all notice because of their great saliency, but in ordinary situations, we find that our past history, our current preoccupations, and God knows what else play significant roles in that to which we attend. The conditionals we utter are reflections of such attendance, but no accurate mirror.

When, as in Adams' 1986 article, we restrict ourselves to high probability,

there is another point that puzzles me, a point I made earlier in another context (Suppes, 1966). Consider the following two inference forms involving high probability, the first for material implication and the second for conditional probability:

$$\frac{P(A \rightarrow B) \geq 1 - \varepsilon}{\frac{P(A) \geq 1 - \varepsilon}{P(B) \geq 1 - 2\varepsilon}}$$

$$\frac{P(B|A) \geq 1 - \varepsilon}{\frac{P(A) \geq 1 - \varepsilon}{P(B) \geq (1 - \varepsilon)^2}}$$

For very small ε , $1 - 2\varepsilon$ and $(1 - \varepsilon)^2$ are quite close together. Surely such a small difference in itself cannot have much psychological significance. For Bayesians who assign at best a high probability slightly less than 1 to nearly any statement, the thesis about the probabilistic interpretation of conditionals is easily accepted, but the difference between conditional probability and material implication, as shown earlier, is of little importance. Given Adams' careful and, to my mind, devastating arguments against many ideas put forward in support of counterfactuals, I feel rather confident that he has sound objections to the too-simple analysis I have just given.

4. CONCLUDING REMARKS

I want to emphasize as strongly as I can that the many skeptical questions that I raised about the current status of the theory of Adams' conditionals is not meant to express any strong preference for another theory, because I think that Adams is off to an excellent start and has, moreover, backed it up with a great deal of systematic and technical analysis – see Adams (1986) for an example of the way he has successfully worked out details of the theory, and also the references there to earlier work.

My point is to stress how far I think we are from anything like an adequate theory of how conditionals are used in ordinary talk. There may be some thin version of rationality that would let Adams' theory of conditionals with high probability, as developed in the 1986 article, be seen as adequate, but I am an unreconstructed advocate of a much thicker concept of rationality – in spite of many things I have written myself in the past. We are, in my judgment, still very far from a satisfactory theory of rational talking, let alone rational decision making, once we take into account detailed and realistic concepts of how our attention mechanisms work and how we process information and for what purposes. In the

meantime, I hope that Ernest Adams will continue to march forward and lead the way for the rest of us to follow in the use of probability in developing a more realistic theory of ordinary language.

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