

III. KNOWLEDGE, INFERENCE, AND EXPLANATION

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I. INTRODUCTION

THIS paper examines applications of an *empiricist analysis of knowledge*. Without attempting to defend the analysis, I shall assume that it is roughly correct and shall draw some consequences. I shall argue in particular that it suggests solutions of problems in inductive logic and statistical explanation. These applications support the analysis; but I shall also show that the analysis is not completely adequate, since it does not provide for a "social aspect" of knowledge.

I take an analysis to be any interesting set of necessary and sufficient conditions. Although I shall not offer an analysis of the meaning of "know" (whatever that would be), I shall appeal to your intuitions about hypothetical cases. I shall claim, for example, that a person can come to know something when he is told it, or when he reads it in the newspaper. Although I may seem to appeal to what one would ordinarily say about such cases and for this reason may seem to be doing "linguistic analysis," I am interested in what is true about such cases and not just in what we say about such cases. But, since I want to test the assumption that ordinary judgments about knowledge are usually correct, trust your natural inclinations about the cases I describe. Consider what you would naturally and ordinarily judge, if you were not doing philosophy. Fine distinctions made in ordinary judgments become blurred when these judgments are made in a philosophical context.

A rough statement of the empiricist analysis is that all knowledge is based on inference from data given in immediate experience. My strategy is to suppose the rough statement roughly true, to assume that ordinary judgments about knowledge are, on the whole, correct, and to see what sort of theory this leads to. I depart from the empiricist tradition in (at least) one important respect. I take the analysis as a rough statement of what it is to *come to know*. I do not want to say anything in this

paper about so-called "memory knowledge." For simplicity, furthermore, I shall consider only cases in which a person comes to know something when he comes to believe it. In other words, I shall disregard cases in which a person comes to know something he previously believed for the wrong reasons.

There are many relevant things I cannot discuss. For example, I shall not discuss the objection that there is no such thing as immediate experience. (For the purposes of this paper, fortunately, it may not be very important whether the objection is right.) Another objection is that a person's knowledge cannot be based on inferences he is not aware he makes. This deserves detailed consideration, especially since it has not received the same amount of critical attention as the first objection. But in this paper I must limit myself to some rather brief remarks.

II. HOW BELIEF IS BASED ON INFERENCE

In this paper I often use the expression "based on inference," and similar expressions. I do not say that, strictly speaking, the knower actually reasons (although I say this when I am speaking loosely). I say rather that, strictly speaking, his belief is based on reasoning. What a belief is based on depends upon how the belief came about; but belief can be based on reasoning even if the belief is not the result of conscious reasoning.

Consider how people talk about computers. Computers are said to add, multiply, compute, reason, and make use of data, even though no one means by this that some person literally does these things. When we talk about computers, we use words like "reasoning," "inference," "data," etc., in a wider sense than when we talk about people. I suggest that empiricists use the wider sense of these terms when they describe knowledge as based on reasoning from data in immediate experience. Thus psychologists have come more and more to explain human behavior by thinking

* I have discussed the subject of this paper with a great many people. I am especially grateful to Paul Benacerraf, John Earman, Richard Jeffrey, and Saul Kripke. Earman suggested several of the examples. The form of the argument is my own, as is the responsibility for errors.

of people as if they were in part computers. They speak of psychological mechanisms and psychological models. Many psychologists have said that the first step in any good psychological explanation is a description of a mechanism that can duplicate the behavior to be explained.¹ If we think of a person (or his brain) as a mechanism like a computer, then we can ascribe inference and reasoning to that person, in the sense in which computers infer and reason. The conscious inferences a person makes are in the extended sense of the term only some of the inferences he makes. We can in this way make sense of the notion that (loosely speaking) a person is not always aware of the inferences he makes.

Psychological explanation typically describes a mechanism by means of a program or flow chart rather than its physiological realization. The same automaton can be constructed in various ways, with either tubes or transistors for example. Two computers, made of different materials but programmed in the same way, may be said to be in the same state when they carry out the same part of the program. Putnam and Fodor have persuasively argued that psychological states are more like being at a particular place in the program than like having something or other happening in your transistors.²

Suppose that a psychologist wants to describe a mechanism to account for belief formation. Having a particular belief must correspond to the machine's being in a particular state. For example, belief might correspond to the state in which the sentence believed is stored in a certain part of computer memory. The psychologist must propose an hypothesis about how the mechanism comes to be in various states of belief. He must explain how the computer comes to store particular sentences in its memory.

My empiricist claims that belief is the result of reasoning in the sense in which computers reason. The process by which the mechanism comes to store a sentence in its memory is like a reasoning process. Moreover, if none of its belief states correspond to beliefs that it is going through such a process, the computer will not be "aware" that it is going through this process. This represents unconscious inference. Conscious reasoning is repre-

sented in the mechanism when reasoning produces in memory sentences that describe the reasoning process.

Notice that the computer analogy does not provide a method for determining what reasoning belief is based on. I explain in Sects. IV and VI below how to discover such reasoning by appeal to intuitive judgments about when a person knows something. Ultimate confirmation of this approach awaits the development of an adequate psychological model. Part of the argument of the present paper is that appeal to intuitive judgments about knowledge and to the empiricist analysis of knowledge can help in the construction of such a model. (Cf. the final paragraph of Sect. III below.)

I now want to describe two principles that an empiricist must accept if he is to offer a plausible account of knowledge. The first is that all inductive inference infers the truth of an explanation. The second is the condition that the lemmas be true. I shall begin with a brief account of each of these principles.

III. EXPLANATIONS AND LEMMAS

The first principle is illustrated whenever a person infers from certain evidence to an explanation of that evidence. The detective infers that the butler did it, since that's the only way to explain the fingerprints on the gun. A scientist infers something about unit charges in order to account for the behavior of oil drops in an experiment he has done. Since the reasoner must infer that one explanation is better than competing explanations, I say he makes an *inference to the best explanation*. In my view, all inductive inference takes this form. Even when a person infers a generalization of the evidence, his inference is good only to the extent that the generalization offers (or is entailed by) a better explanation of the evidence than competing hypotheses. (But note, I do not say that the explanation must be the best of *alternative* explanations; I say rather that it must be the best of *competing* explanations.)

The connection between explanation and induction is implicit in recent work in inductive logic and the theory of explanation. Goodman has shown

¹ E.g., J. A. Deusch, *The Structural Basis of Behavior* (Chicago, University of Chicago Press, 1960).

² Hilary Putnam, "Minds and Machines" in Sidney Hook (ed.), *Dimensions of Mind* (New York, New York University Press, 1960); "Robots: Machines or Artificially Created Life?" *The Journal of Philosophy*, vol. 61 (1964), pp. 668-691. Jerry A. Fodor, "Explanations in Psychology" in Max Black (ed.), *Philosophy in America* (New York, Ithaca, Cornell University Press, 1965).

that one can ordinarily infer a generalization of the evidence only if the generalization is lawlike, and Hempel and Oppenheim have pointed out that only lawlike generalizations can explain their instances.³ This provides confirmation of the claim that all inductive inference is inference to the best explanation. More confirmation will be provided later.

The second principle an empiricist must accept, the condition that the lemmas be true, says that a person cannot come to know something by inferring it from something false. In Keith Lehrer's example,⁴ suppose Mary has strong evidence that Mr. Nogot, who is in her office, owns a Ford; but suppose that Mr. Nogot does not in fact own a Ford. Perhaps someone else in her office, Mr. Havit, does own a Ford. Still, Mary cannot come to know that someone in her office owns a Ford by inferring this from the false premiss that Mr. Nogot, who is in her office, owns a Ford.

I speak of "lemmas" because the relevant propositions need not be included in Mary's initial premiss. Her initial premisses may be that she has seen Mr. Nogot driving a new Ford, that she has heard him say he owns a Ford, etc., where all of these initial premisses are true. It is false that Mr. Nogot owns a Ford; but that is not one of her initial premisses. It is, rather, a provisional conclusion reached on the way to the final conclusion. Such a provisional conclusion, that is a premiss for later steps of the argument, is a lemma. The condition that the lemmas be true says that, if Mary is to know something by virtue of an inference on which her belief is based, every premiss and lemma of that inference must be true.

Mary's belief will often be based on several inferences, only one of which needs to satisfy the condition that the lemmas be true. For example, she might also possess evidence that Mr. Havit owns a Ford and infer from that that someone in her office owns a Ford. That one of her inferences fails to satisfy the condition that the lemmas be true does not prevent Mary from obtaining knowledge from her other inference. Furthermore, even when Mary explicitly reasons in one particular way, we may want to say her belief is also based on other unexpressed reasoning. If Mary has evidence that Mr. Havit owns a Ford, we may also

want to ascribe the condition of the above inferences to her even though she consciously formulated only the first. Sect. VI, below, describes how the inferences we shall want to ascribe to a person will depend upon our intuitive judgments about when people know things.

So, inferential knowledge requires two things: inference to the best explanation and the condition that the lemmas be true. I shall now illustrate and support these requirements with some examples.⁵

I shall describe two cases, the *testimony case* and the *lottery case*, and appeal to your natural non-philosophical judgments about these cases. In the testimony case a person comes to know something when he is told about it by an eyewitness or when he reads about it in the newspaper. In the lottery case, a person fails to come to know he will lose a fair lottery, even though he reasons as follows: "Since there are N tickets, the probability of losing is $(N - 1)/N$. This probability is very close to one. Therefore, I shall lose the lottery." A person can know in the testimony case but not in the lottery case, or so we would ordinarily and naturally judge. In the lottery case a person cannot know he will lose no matter how probable this is. The contrast between the two cases may seem paradoxical, since witnesses are sometimes mistaken and newspapers often print things that are false. For some N , the likelihood that a person will lose the lottery is higher than the likelihood that the witness has told the truth or that the newspaper is right. Our ordinary, natural judgments thus seem almost contradictory. How could a person know in the testimony case but not in the lottery case?

At this point many philosophers would reject one of the ordinary judgments no matter how natural the judgment may be. But such rejection would be premature. My strategy is to ask how beliefs are based on reasoning in the two cases. The only relevant reasoning in the lottery case seems to be deductive. From the premiss that the lottery is fair and that there are N tickets, it follows that the probability of any ticket being a loser is $(N - 1)/N$. One can only deduce the probability statement. No deductive inference permits one to detach the probability qualification from the statement that the ticket will lose. I claim moreover that there is no inductive way to detach this

³ Nelson Goodman, *Fact, Fiction, and Forecast* (Cambridge, Mass., Harvard University Press, 1953). C. G. Hempel and Paul Oppenheim, "Studies in the Logic of Explanation," *Philosophy of Science*, vol. 15 (1948), pp. 135-175.

⁴ Keith Lehrer, "Knowledge, Truth, and Evidence," *Analysis*, vol. 25 (1965), pp. 168-175.

⁵ See also Gilbert H. Harman, "The Inference to the Best Explanation," *The Philosophical Review*, vol. 74 (1965), pp. 88-95.

qualification, since inductive inference must take the form of inference to the best explanation and no explanation is involved in the lottery case.

The testimony case is different. No obvious deductive inference leads to a probabilistic conclusion in this case; and acceptance of the testimony can be based on two consecutive inferences to the best explanation. To see this, consider how we would ordinarily explain our evidence, the testimony. First, we would infer that the speaker so testifies because he believes what he says (and not because he has something to gain by so testifying, or because he has gotten confused and has said the opposite of what he means, etc.). Second, we would infer that he believes as he does because in fact he witnessed what he described (and not because he suffered an hallucination, or because his memory deceives him, etc.).

There is, then, an important divergence between the two cases. In the testimony case, the relevant conclusion can be reached by inference to the best explanation. This is not true in the lottery case. It is the appeal to explanation, over and above any appeal to probability, that is important when a person comes to know a nonprobabilistic conclusion.

A person who believes testimony rarely is conscious of reasoning as I have suggested. But, in the ordinary case, such reasoning must be warranted. For suppose that the hearer had good reason to doubt that the speaker has said what he believes, so that the hearer would not be warranted in reasoning in the required way. Then, even if he accepted what the speaker has said and the speaker has spoken truly, the hearer could not be said to know this. The hearer would also fail to gain knowledge if he had good reason to doubt that the speaker's belief is the result of what the speaker witnessed, since again the hearer could not reason in the required way. My analysis of the testimony case would explain why this reason must be warranted if the hearer is to come to know the truth of what he hears. According to that analysis, the hearer's belief is based on the suggested reasoning; and if his belief is to be knowledge, reasoning must be warranted. Therefore, that the this reasoning must be warranted provides some confirmation of my analysis of the testimony case.

Stronger confirmation arises from an application of the condition that the lemmas be true. Suppose that a person who has no reason not to believe a witness does believe him. The hearer cannot

thereby come to know unless *in fact* the testimony is an expression of what the witness believes and unless *in fact* the witness's belief was the result of what he witnessed. If the witness were to say the opposite of what he believes, a listener could not come to know, even if the witness inadvertently spoke the truth. Nor could he come to know if the witness said what is true as a result of remembering the wrong occasion. The witness's knowledge requires the truth of two explanatory claims. We can understand this if we assume that knowledge in the testimony case is based on the reasoning I have already mentioned and if we apply the condition that the lemmas be true. The two explanatory claims appear as lemmas in that reasoning. These lemmas must be true if the hearer is to gain knowledge from the testimony. The empiricist analysis thus permits us to explain things we might not otherwise be able to explain.

We have, then, a rough analysis of knowledge that involves two principles. If we take the analysis as a working hypothesis, we can apply the two principles in order to learn something about knowledge, inference, explanation, and perception. The discussion of the lottery case *versus* the testimony case has provided one example of such an application. I shall now describe other examples.

Notice that to take the analysis as a working hypothesis in this way is to render it immune to a certain sort of counterexample. According to the analysis, knowledge is based on inference to the best explanation; but in order to determine when belief is based on inference and in order to discover what constitutes good inference to the best explanation, one must appeal to the analysis plus intuitions about when people know things. Therefore, the test of the resulting theory cannot be whether or not it conflicts with one's intuitions about when people know things. (This is only partially correct; see the final section of this paper.) Instead, the theory must be judged by whether it can be developed without appeal to *ad hoc* assumptions in a way that sheds light on epistemological and psychological subjects and whether it does this better than competing alternatives. The next three sections of this paper are meant to suggest some of the range and power of this theory.

IV. APPLICATION TO INDUCTIVE LOGIC

We can use the analysis in finding criteria of good inductive inference. Instead of asking directly

whether a particular inference is warranted, we can ask whether a person could come to know by virtue of that inference. If we identify what can be known with what can be inferred, we can discover something important about "detachment" in inductive logic. A principle of detachment would let us "detach" the probability qualification from our conclusion. If there were no rule of detachment, induction would never permit anything more than probabilistic conclusions. But, as inductive logicians have found, it is difficult to state a rule of detachment that does not lead to inconsistency.

Suppose, for example, that detachment were permitted whenever the evidence made a conclusion highly probable. Thus suppose that we could detach a probability qualification whenever our conclusion had a probability (on our total evidence) of at least $(N-1)/N$. Since any ticket in a fair lottery among N tickets has a probability of $(N-1)/N$ of being a loser, the suggested principle of detachment would permit us to conclude for each ticket that it will lose. But we also know that one of these tickets will win, so use of high probability to warrant detachment had led us to inconsistency. Some logicians take this result to show that there should be no principle of detachment in inductive logic.⁶

We can avoid this extreme position if we identify the possibility of detachment with the possibility of knowing a nonprobabilistic conclusion. The testimony case tells us that induction sometimes allows nonprobabilistic conclusions, since in that case a person comes to know such a conclusion. The lottery case shows that the inference to such a conclusion is not determined by the high probability one's premisses give his conclusion, since in the lottery case one can only come to know a probability statement. Detachment is possible in the testimony case but not in the lottery case. I have argued that explanation marks the difference between these cases. In the testimony case a person infers the truth of certain explanations. Not so in the lottery case. The problem of detachment arises through failure to notice the role of explanation in inductive inference. Such inference is not just a matter of probability; one must infer the truth of an explanation. Detachment can and must be justified by inference to the best explanation.

This is not to say that probability, or degree of

confirmation, is irrelevant to inductive inference. We can, in fact, use the empiricist analysis again to discover how induction involves probability. Suppose that John and Sam have tossed a fair coin to determine who will have a new hundred-dollar bill. The new hundreds are easily recognizable, being pink, an innovation of the Treasury Department. An hour later, Peter, who knows about the toss, sees John with a new hundred-dollar bill. Peter realizes that John could have received such a bill in only two ways, the most likely being that he won the toss with Sam. There is also an extremely unlikely way, hardly even worth considering. That morning, as a result of a *Consumer Digest* promotion scheme, some person, chosen at random from the population of the United States, has received the only other pink hundred now in general circulation. The odds are two-hundred million to one that John did not receive the *Digest's* bill. So Peter infers that John won the toss with Sam. He infers that the explanation of John's having the bill is that he won the toss and not that he received the *Digest's* bill. If the explanation is right, an ordinary, natural judgment about the coin toss case would be that Peter knows John won the toss.

If this is correct, it suggests one way in which probability can serve as a guide to the best of several competing explanations. Other things equal, the best one will be the most probable one. If it is sufficiently more probable than the others, then a person may infer the truth of that explanation. If *Consumer Digest* had sent pink hundred-dollar bills to every third person, randomly selected, then Peter could not know John has won the coin toss, since that explanation of John's having the bill would no longer be sufficiently more probable than a competing hypothesis. An important issue is how much more probable the one hypothesis must be if it is to provide knowledge. This question may be pursued by further application of the empiricist analysis; but I shall not do so. I shall instead turn to a different aspect of inductive inference.

A complication must be added to what has been said. The best explanation is more than just a highly probable explanation. It must also make what is to be explained considerably more probable than would the denial of that explanation. That is,

⁶ Cf. Henry E. Kyburg, "Probability, Rationality, and a Rule of Detachment" in Brouwer *et. al.* (eds.), *Proceedings of the 1964 Congress on Logic, Methodology, and the Philosophy of Science* (Amsterdam, North Holland Publishing Co., 1965), and references therein. I shall not discuss Kyburg's own solution, since he retains inductive detachment at the expense of deduction. For him one cannot in general infer deductive consequences of what one accepts.

a weak maximum likelihood principle must be satisfied.⁷

To see this, consider the following case. Terry has received a special certificate if he has won a fair lottery among 1000 people. If Terry hasn't won, then George has given him a duplicate of the winning certificate, since George wants Terry to have such a certificate no matter what. Arthur, knowing all this, sees Terry with a certificate. Why cannot Arthur infer that George gave Terry the certificate? That explanation of Terry's having the certificate is very probable; but Arthur cannot make such an inference, because he cannot come to know by virtue of that inference that Terry didn't win the lottery. The most probable explanation does not make what is to be explained any more probable than the denial of that explanation does. That George has given Terry the certificate would make it certain that Terry has a certificate; but this is just as certain if George has not given it to him, because Terry has then won the lottery. Since Terry would have a certificate in any event, Arthur cannot infer that it came from George, even though this explanation is the most probable.

So two things are necessary if an explanation is to be inferable. First, it must be much more probable on the evidence than its denial. Second, it must make what is to be explained more probable than its denial does. This amounts to a synthesis of two apparently conflicting approaches to statistical inference. The Bayesian approach is reflected in the requirement that the best explanation be more probable on the evidence than its denial. The maximum likelihood approach is reflected in the requirement that the explanation make what is to be explained more probable than its denial does.⁸

More needs to be said about this since even these two conditions are not sufficient; but further investigation would place us in the middle of the theory of confirmation. Enough has been said to show how the analysis may be used to study induction from an unusual point of view.

V. APPLICATION TO THE THEORY OF EXPLANATION

If we exploit the connection between explanations and projectible (or inferable) hypotheses, we

may use the analysis to study explanation. An hypothesis is directly confirmed by evidence only if it explains the evidence. So, an hypothesis is a potential explanation if it is the sort of thing that can be directly inferred; and the legitimacy of an inference can again be determined by the possibility of obtaining knowledge by virtue of that inference.

One can show, for example, that a conjunction does not always explain its conjuncts. Let one conjunct be that this is a ticket in a fair lottery among N tickets. Let the other conjunct be that this ticket loses. It is easy to show that the conjunction (that this is a ticket in a fair lottery among N tickets and will lose) cannot explain its first conjunct (that this is a ticket in a fair lottery among N tickets). The result is perfectly obvious, of course, but I want to show how to use the empiricist analysis to demonstrate such a result.

The argument is simple. If the conjunction provides an explanation, then it sometimes provides the best explanation. But then we ought to be able to know something we cannot know. We ought to be able to know in the lottery case that we have a losing ticket; and we cannot know this. If the conjunction provided the best explanation of our evidence, a person in the lottery case could infer the truth of the conjunction from this evidence. In that way he could come to know that his ticket will lose. Since he can't come to know this, the conjunction does not explain its conjunct.

To prove that the conjunction, if an explanation, sometimes satisfies the requirements on the best explanation, notice that it always satisfies the first requirement. The evidence makes the conjunction more probable than not, since the conjunction has a probability on the evidence of $(N-1)/N$. Furthermore, there will be situations in which the weak maximum likelihood principle is satisfied. Typically, in fact, the falsity of the conjunction would make it very improbable that this is a ticket in an N ticket lottery. So, if the conjunction can explain, it can be the best explanation.

This result is trivial and obvious, but the same method can be applied to less trivial cases. It is especially useful in the study of statistical explanation. Consider, for example, the most basic question, whether there can be such a thing as statistical explanation at all. Use of the empiricist

⁷ An explanation of the maximum likelihood principle with further references appears in Ian Hacking, *Logic of Statistical Inference* (Cambridge, Cambridge University Press, 1965).

⁸ The Bayesian position is forcefully presented in Richard Jeffrey, *The Logic of Decision* (New York, McGraw Hill, 1965). The maximum likelihood principle is defended against the Bayesians in Hacking, *op. cit.*

analysis shows there can be and also shows what sort of explanation it is.

Consider cases in which a person comes to know something by means of statistical sampling methods. Suppose, for example, that there are two batches of widgets such that about 70 percent of the widgets in one batch are defective and only about 1 percent of the widgets in the other batch are defective. Confronted with one of the batches, David must decide whether it is the largely defective batch or the good batch. He randomly selects ten widgets from the batch and discovers that seven out of the ten are defective. He infers correctly that this is the defective batch. In this way he comes to know that this is the defective batch, or so we would naturally judge. To apply the empiricist analysis requires assuming his inference is to the best explanation; and to assume this is to assume that there can be statistical explanation. David must choose between two explanations of the makeup of his sample. Both are statistical. Each explains the sample as the result of a random selection from among the items of one of the batches. The explanation David accepts is much more probable than its denial, given the sample he has drawn and assuming that before he had the sample either batch was equally likely. The same explanation makes David's having drawn such a sample more likely than this is made by the explanation he rejects. Therefore, the explanation he accepts is the best explanation of his evidence, and he can come to know the truth of that explanation. He could not, on the empiricist analysis, make his inference if there were no such thing as statistical explanation.

This kind of statistical explanation does not always make what it explains very probable. It is possible, given David's evidence, that the explanation of the makeup of his sample is that he drew randomly from the good batch and this was one of those times when the unlikely thing happens. Such a possibility contradicts the Hempelian account of statistical explanation,⁹ so I shall elaborate.

I can make my point clearer if I change the example. Suppose Sidney selects one of two similar looking coins, a fair one and a weighted one such that the probability of getting heads on a toss of the fair coin is $1/2$ and the probability of getting heads on a toss of the weighted coin is $9/10$. To discover which coin he has, Sidney tosses it ten

times. The coin comes up heads three times and tails seven times. Sidney correctly concludes the coin must be the fair one. We would ordinarily think that Sidney could in this way come to know he has the fair coin. On the empiricist analysis, this means he has inferred the best explanation of that distribution of heads and tails. But the explanation, that these were random tosses of a fair coin, does not make it probable that the coin comes up heads three times and tails seven times. The probability of this happening with a fair coin is considerably less than $1/2$. If we want to accept the empiricist analysis, we must agree that statistical explanation sometimes makes what is to be explained less probable than its denial. This means one has not explained why three heads have come up rather than some other number of heads. The explanation is of a different sort. One explains, as it were, how it happened that three heads came up, what led to this happening. One does not explain why this happened rather than something else, since the same thing could have led to something else.

Suppose Stuart walks into the casino and sees the roulette wheel stop at red fifty times in a row. The explanation of this may be that the wheel is fixed. It may also be that the wheel is fair and this is one of those times when fifty reds are going to come up. Given a fair wheel one expects that to happen sometime (although not very often). But, if the explanation is that the wheel is fair and this is just one of those times, it says what the sequence of reds is the result of, the "outcome" of. It does not say why fifty reds in a row occurred this time rather than some other time, nor why that particular series occurred rather than any of the $2^{50}-1$ other possible series.

I am inclined to suppose that this is the only sort of statistical explanation. But that is another story. I do not want to pursue the theory of explanation in detail. My point has been that the empiricist analysis can be used in the study of explanation and that it results in conclusions different from those generally accepted.

VI. DISCOVERING INFERENCES BELIEF IS BASED ON

Another way to use the analysis exploits the condition that the lemmas be true in order to discover what reasoning knowledge is based on. I begin with a simple example. Normally, if a hearer

⁹ C. G. Hempel, "Aspects of Scientific Explanation" in *Aspects of Scientific Explanation and Other Essays in the Philosophy of Science* (New York, The Free Press, 1965), esp. pp. 376-412.

is to gain knowledge of what a witness reports, the witness must say what he does because he believes it; and he must believe as he does because of what he saw. Two conditions must thus be satisfied if the hearer is to know. If we wanted to discover the hearer's reasoning, we could use the fact that there are these conditions. We could explain these conditions if we were to assume that they represent lemmas in the hearer's reasoning, since that would make the conditions special cases of the condition that the lemmas be true. Thus we can often account for conditions on knowledge, if we assume that the knowledge is based on relevant reasoning and if we apply the condition that the lemmas be true.

One example worth pursuing, although I shall not say much about it, is knowledge one gets from reading the newspaper. Suppose a misprint changes a false statement into a true one (by, perhaps, substituting the word "not" for the word "now"). In any ordinary case, one cannot come to know by reading that sentence even though the sentence is true. Our method tells us to assume that this fact about misprints represents a lemma in our inference. And it does seem reasonable to assume we infer that the sentence we read is there as a result of the printer correctly forming the sentence that appears in the manuscript. What else do we infer? We ordinarily do not make detailed assumptions about how the reporter got his story, nor about whether the story comes from wire services or from the paper's own reporters. If we are to discover just what we do infer, we must make extensive use of the condition that the lemmas be true. We must discover what has to be true about the way the story gets from reporters to the printer and what has to be true about the way the reporter got his story. We must then associate these conditions with the condition that the lemmas be true, in order to discover what we infer when we come to know by reading the paper. But I shall say nothing more about this problem.

Now consider a case of perceptual knowledge in which a person, as we say, *just sees* that something is true. It is obvious that there are conditions to be satisfied if a case of seeing is to be a case of seeing that something is true. We can account for some of these conditions if we assume that direct perceptual knowledge is based on reasoning. Suppose that Gregory sees a table in the room. As many philosophers have noted, ordinarily, if he is to see *that* there is a table in the room, it must look to him as if there is a table in the room. Further-

more, there must be some causal relationship between the table and its looking to Gregory as if there is a table in the room. It will not do if there is a mirror between Gregory and the table such that he is really seeing the reflection of a different table in a different room. Nor could Gregory see that there is a table if he was hallucinating, even if, by some coincidence he hallucinated a scene exactly like the one in fact before him.

Applying the analysis, we assume that such direct perceptual knowledge is based on inference and attempt to apply the condition that the lemmas be true. This leads us to say that perceptual knowledge is based on inference from data in immediate experience, where such data include how things look, sound, feel, smell, taste, etc. The relevant reasoning infers an explanation of some aspect of immediate experience. In the example, Gregory reasons that it looks as if there is a table because there is a table there and he is looking at it. If he is to reach the conclusion that there is a table, he needs the explanatory statement as a lemma. That is why the truth of the explanatory statement is required if Gregory is to see that there is a table in the room. A similar analysis applies to other cases of direct perceptual knowledge.

I have been purposefully vague about immediate experience, because the empiricist analysis can probably be adapted to any conception. It can apply even if one denies there is any such thing as immediate experience, for one can speak about stimulations of sense organs instead. If Gregory is to see that there is a table in the room, then his eye must be stimulated in a way that depends in part on the table in the room. I can imagine an empiricist who holds that perceptual knowledge is based on inference from immediate stimulation.

Two things must always be remembered. First, an empiricist analysis is not necessarily an analysis of meaning. It is merely an interesting set of necessary and sufficient conditions. It is irrelevant to an empiricist analysis whether the meaning of knowledge claims implies anything about stimulation of sense organs. Second, knowledge can be based on reasoning even when no one actually reasons.

Usually the relevant reasoning will be reasoning only in the sense in which computers reason. The computer analogy is particularly useful if perceptual knowledge is analyzed in terms of stimulations rather than immediate experience, since stimulations are data only in the sense in which a computer can be supplied with data. One might

think here of a computer used to aim antiaircraft missiles in the light of data obtained by radar.

VII. KNOWLEDGE OF THE EXTERNAL WORLD?

Philosophers have wanted to avoid this conception of perceptual knowledge, because they have thought it leads to scepticism. If a person has only his immediate experience to go on, how can he know there is a world of objects surrounding him? How does he know it is not a dream? How does he know it is not the creation of an evil demon?

The problem, if there is one, is not just how one comes to know there is a world of objects, for it arises in any instance of perceptual knowledge. I can see that there is a table in the room only if I can infer an explanation of my immediate experience. How can I legitimately make this inference? How can I rule out the possibility that I may be dreaming? How do I know that a demon psychologist has not attached my brain to a computer that stimulates me as if I were seeing a table? If veridical perception is to provide the best explanation of my experience, that explanation must be more probable than the others. But how can I assume that it is more probable without begging the question? How can I know I have not had many dreams just like this? How can I know I have not had many experiments played on me by the demon psychologist?

Notice that we have no independent way to discover the likelihoods of the various explanations. If one applies the empiricist method for dealing with problems in inductive logic, he may take the fact of perceptual knowledge to show that the hypothesis of veridical perception is highly probable on a person's evidence. The empiricist can in this way avoid the problem of our knowledge of the external world, indeed he can exploit the problem for his own ends in order to argue that there is a predilection for veridical perception built into our confirmation function.

I have tried to show how the empiricist analysis can be used to study induction and explanation and to account for certain requirements on knowledge as special cases of the condition that the lemmas be true. I have described how the analysis can lead one to say that even direct perceptual knowledge is based on inference. In my opinion, the applications of the empiricist analysis show that there must be something to that analysis. I shall

now show that the analysis does not provide the whole story and that it leaves out a "social aspect" of knowledge.

VIII. THE "SOCIAL ASPECT" OF KNOWLEDGE

An empiricist assumes that whether a person knows depends only on the data that person has and not on the data someone else has. There are qualifications, of course. One person may rely indirectly on another's data if he relies on the other person's testimony. The validity of someone else's data may thus be relevant by virtue of the condition that the lemmas be true. But if this condition is satisfied, empiricists assume that the *sufficiency* of a person's data is not affected by information someone else has. In making this assumption, empiricists overlook the social aspect of knowledge.

Suppose that Tom enters a room in which many people are talking excitedly although he cannot understand what they are saying. He sees a copy of the morning paper on a table. The headline and main story reveal that a famous civil-rights leader has been assassinated. On reading the story he comes to believe it; it is true; and the condition that the lemmas be true has been satisfied since a reporter who witnessed the assassination wrote the story that appears under his by-line. According to an empiricist analysis, Tom ought to know the assassination had occurred. It ought to be irrelevant what information other people have, since Tom has no reason to think they have information that would contradict the story in the paper.

But this is a mistake. For, suppose that the assassination has been denied, even by eyewitnesses, the point of the denial being to avoid a racial explosion. The assassinated leader is reported in good health; the bullets are said, falsely, to have missed him and hit someone else. The denials occurred too late to prevent the original and true story from appearing in the paper that Tom has seen; but everyone else in the room has heard about the denials. None of them know what to believe. They all have information that Tom lacks. Would we judge Tom to be the only one who knows that the assassination has actually happened? Could we say that he knows this because he does not yet have the information everyone else has? I do not think so. I believe we would ordinarily judge that Tom does not know.

This reveals the social aspect of knowledge. The

evidence that a person has is not always all the evidence relevant to whether he knows. Someone else's information may also be relevant.¹⁰ But how, exactly, ought the empiricist analysis be changed? Should we count information that any person at all has? Should we combine information possessed in part by several people, even if the information each has does not appear significant taken by itself? Must we take all the information one of these others has, or can we select bits and pieces that may give a misleading impression? And what is it that makes another person's information relevant?

The last question seems easiest to answer. Another person's information is relevant if the original person could not have properly reasoned as he did had he known about this information. If Tom had known about the denials as everyone else in the room knows, then Tom could not properly infer that the newspaper story is true. The other questions I have mentioned are not as easily answered, if we are to avoid the consequence that people rarely know anything. For example, if one could select bits and pieces of someone's information in a misleading way, he might be able to undermine almost any claim to knowledge. A similar result would follow if he could combine the information that several people hold separately,

since he might choose people such that their information combined to give a misleading result. On the other hand, it is not required that one combine the information everyone has, in order to see whether that prevents Tom's inference. That information would support Tom's inference, since it includes the fact that the explanations Tom originally inferred are correct.

The hardest problem is who may have the information that undermines Tom's reasoning. I doubt that we can allow his reasoning to be faulted by *any* one person's information. Otherwise, I would prevent many people from knowing things if I were to fake evidence about various things and show it to you. But I do not know how many people or what sort of people must be taken into account. Perhaps we must even consider people living at a different time, since we think our predecessors were sometimes right for the wrong reasons. It isn't just a matter of numbers. There can be evidence known only to a few that contradicts what the majority believe. This is certainly a subject worth pursuing; but I shall follow it no farther at this time.

In this paper I have tried to show two things. One is that there is something importantly right about the empiricist analysis. The other is that the analysis is not enough.¹¹

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¹⁰ Why "social"? Can there be relevant evidence no one knows, has known, or will know about? I doubt it. In the example it is important that people have heard the denials. If they had been spoken into a dead microphone, I believe Tom would not be deprived of knowledge in the way he is by everyone's knowing about the denials.

¹¹ Apparently the social aspect of knowledge fails to provide a counter-example to the empiricist analysis of knowledge. Suppose we represent that aspect by the claim that the following condition is necessary for knowledge, where the condition is stated quite roughly and where we agree that there are serious problems in giving a precise formulation of the condition.

(1) No further evidence exists that would, if known, cast doubt on one's conclusion.

Ernest Sosa mentions a similar condition in his article, "The Analysis of 'Knowledge That P'," *Analysis* 25.1 (1964), pp. 1-8 (see condition (o)₃). Sosa also mentions another condition (s)₃ which I would express as follows:

(2) One must be justified in not believing that (1) is false.

To account for (2) we need only assume that the inference on which belief is based (if nondeductive) requires (1) as premiss or lemma. Furthermore the social aspect of knowledge then becomes a special case of the condition that the lemmas be true. Therefore, the social aspect of knowledge does not provide a counter-example to the empiricist analysis, indeed it is even to be explained in terms of that analysis along with (2).