A CAUSAL THEORY OF KNOWING *

SINCE Edmund L. Gettier reminded us recently of a certain important inadequacy of the traditional analysis of "S knows that p," several attempts have been made to correct that analysis.[1] In this paper I shall offer still another analysis (or a sketch of an analysis) of "S knows that p," one which will avert Gettier's problem. My concern will be with knowledge of empirical propositions only, since I think that the traditional analysis is adequate for knowledge of nonempirical truths.

Consider an abbreviated version of Gettier's second counterexample to the traditional analysis. Smith believes

(q) Jones owns a Ford

and has very strong evidence for it. Smith's evidence might be that Jones has owned a Ford for many years and that Jones has just offered Smith a ride while driving a Ford. Smith has another friend, Brown, of whose whereabouts he is totally ignorant. Choosing a town quite at random, however, Smith constructs the proposition

(p) Either Jones owns a Ford or Brown is in Barcelona.

Seeing that q entails p, Smith infers that p is true. Since he has adequate evidence for q, he also has adequate evidence for p. But now suppose that Jones does *not* own a Ford (he was driving a rented car when he offered Smith a ride), but, quite by coincidence, Brown hap-

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[1] "Is True Justified Belief Knowledge?" *Analysis*, XXIII.6, ns 96 (June 1963): 121–123. I say "reminded" because essentially the same point was made by Russell in 1912. Cf. *The Problems of Philosophy* (Oxford, 1912), ch. XIII, pp. 132 ff. New analyses have been proposed by Michael Clark, "Knowledge and Grounds: A Comment on Mr. Gettier's Paper," *Analysis*, XXIV.2, ns 98 (December 1963): 46–48; Ernest Sosa, "The Analysis of 'Knowledge that p'," *ibid.*, XXV.1, ns 103 (October 1964): 1–3; and Keith Lehrer, "Knowledge, Truth, and Evidence," *ibid.*, XXV.5, ns 105 (April 1965): 168–175.

pens to be in Barcelona. This means that p is true, that Smith believes p, and that Smith has adequate evidence for p. But Smith does not know p.

A variety of hypotheses might be made to account for Smith's not knowing p. Michael Clark, for example, points to the fact that q is false, and suggests this as the reason why Smith cannot be said to know p. Generalizing from this case, Clark argues that, for S to know a proposition, each of S's grounds for it must be *true*, as well as his grounds for his grounds, etc.[2] I shall make another hypothesis to account for the fact that Smith cannot be said to know p, and I shall generalize this into a new analysis of "S knows that p."

Notice that what *makes* p true is the fact that Brown is in Barcelona, but that this fact has nothing to do with Smith's believing p. That is, there is no *causal* connection between the fact that Brown is in Barcelona and Smith's believing p. If Smith had come to believe p by reading a letter from Brown postmarked in Barcelona, then we might say that Smith knew p. Alternatively, if Jones did own a Ford, and his owning the Ford was manifested by his offer of a ride to Smith, and this in turn resulted in Smith's believing p, then we would say that Smith knew p. Thus, one thing that seems to be missing in this example is a causal connection between the fact that makes p true [or simply: the fact that p] and Smith's belief of p. The requirement of such a *causal connection* is what I wish to add to the traditional analysis.

To see that this requirement is satisfied in all cases of (empirical) knowledge, we must examine a variety of such causal connections. Clearly, only a sketch of the important kinds of cases is possible here.

Perhaps the simplest case of a causal chain connecting some fact p with someone's belief of p is that of *perception*. I wish to espouse a version of the causal theory of perception, in essence that defended by H. P. Grice.[3] Suppose that S sees that there is a vase in front of him. How is this to be analyzed? I shall not attempt a complete analysis of this, but a necessary condition of S's seeing that there is a vase in front of him is that there be a certain kind of causal connection between the presence of the vase and S's believing that a vase is present. I shall not attempt to describe this causal process in detail. Indeed, to a large extent, a description of this process must be regarded as a problem for the special sciences, not for philosophy. But a certain causal process—viz. that which standardly takes place when we say

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2 *Op. cit.* Criticisms of Clark's analysis will be discussed below.

3 "The Causal Theory of Perception," *Proceedings of the Aristotelian Society,* supp. vol. xxxv (1961).

that so-and-so *sees* such-and-such—must occur. That our ordinary concept of sight (i.e., knowledge acquired by sight) includes a causal requirement is shown by the fact that if the relevant causal process is absent we would withhold the assertion that so-and-so *saw* such-and-such. Suppose that, although a vase is directly in front of S, a laser photograph [4] is interposed between it and S, thereby blocking it from S's view. The photograph, however, is one of a vase (a different vase), and when it is illuminated by light waves from a laser, it looks to S exactly like a real vase. When the photograph is illuminated, S forms the belief that there is a vase in front of him. Here we would deny that S *sees* that there is a vase in front of him, for his view of the real vase is completely blocked, so that it has no causal role in the formation of his belief. Of course, S might *know* that there was a vase in front of him even if the photograph is blocking his view. Someone else, in a position to see the vase, might tell S that there is a vase in front of him. Here the presence of the vase might be a causal ancestor of S's belief, but the causal process would not be a (purely) *perceptual* one. S could not be said to *see* that there is a vase in front of him. For this to be true, there must be a causal process, but one of a very special sort, connecting the presence of the vase with S's belief.

I shall here assume that perceptual knowledge of facts is noninferential. This is merely a simplifying procedure, and not essential to my account. Certainly a percipient does not *infer* facts about physical objects from the state of his brain or from the stimulation of his sense organs. He need not know about these goings-on at all. But some epistemologists maintain that we directly perceive only sense data and that we infer physical-object facts from them. This view could be accommodated within my analysis. I could say that physical-object facts cause sense data, that people directly perceive sense data, and that they infer the physical object facts from the sense data. This kind of process would be fully accredited by my analysis, which will allow for knowledge based on inference. But for purposes of exposition it will be convenient to regard perceptual knowledge of external facts as independent of any inference.

Here the question arises about the *scope* of perceptual knowledge. By perception I can know noninferentially that there is a vase in front of me. But can I know noninferentially that the painting I am viewing is a Picasso? It is unnecessary to settle such issues here.

[4] If a laser photograph (hologram) is illuminated by light waves, especially waves from a laser, the effect of the hologram on the viewer is exactly as if the object were being seen. It preserves three-dimensionality completely, and even gives appropriate parallax effects as the viewer moves relative to it. Cf. E. N. Leith and J. Upatnieks, "Photography by Laser," *Scientific American*, ccxii, 6 (June 1965): 24.

Whether the knowledge of such facts is to be classed as inferential or noninferential, my analysis can account for it. So the scope of non-inferential knowledge may be left indeterminate.

I turn next to memory, i.e., knowledge that is based, in part, on memory. Remembering, like perceiving, must be regarded as a causal process. S remembers p at time t only if S's believing p at an earlier time is a cause of his believing p at t. Of course, not every causal connection between an earlier belief and a later one is a case of remembering. As in the case of perception, however, I shall not try to describe this process in detail. This is a job mainly for the scientist. Instead, the kind of causal process in question is to be identified simply by example, by "pointing" to paradigm cases of remembering. Whenever causal processes are of that kind—whatever that kind is, precisely—they are cases of remembering.[5]

A causal connection between earlier belief (or knowledge) of p and later belief (knowledge) of p is certainly a necessary ingredient in memory.[6] To remember a fact is not simply to believe it at t_0 and also to believe it at t_1. Nor does someone's knowing a fact at t_0 and his knowing it at t_1 entail that he remembers it at t_1. He may have perceived the fact at t_0, forgotten it, and then relearned it at t_1 by someone's telling it to him. Nor does the inclusion of a memory "impression"—a feeling of remembering—ensure that one really remembers. Suppose S perceives p at t_0, but forgets it at t_1. At t_2 he begins to believe p again because someone tells him p, but at t_2 he has no memory impression of p. At t_3 we artificially stimulate in S a memory impression of p. It does not follow that S remembers p at t_3. The description of the case suggests that his believing p at t_0 has no causal effect whatever on his believing p at t_3; and if we accepted this fact, we would deny that he remembers p at t_3.

Knowledge can be acquired by a combination of perception and memory. At t_0, the fact p causes S to believe p, by perception. S's believing p at t_0 results, via memory, in S's believing p at t_1. Thus, the fact p is a cause of S's believing p at t_1, and S can be said to know p at t_1. But not all knowledge results from perception and memory alone. In particular, much knowledge is based on *inference*.

As I shall use the term 'inference', to say that S knows p by "inference" does not entail that S went through an explicit, conscious proc-

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[5] For further defense of this kind of procedure, with attention to perception, cf. Grice, *op. cit.*

[6] Causal connections can hold between states of affairs, such as believings, as well as between events. If a given event or state, in conjunction with other events or states, "leads to" or "results in" another event or state (or the same state obtaining at a later time), it will be called a "cause" of the latter. I shall also speak of "facts" being causes.

ess of reasoning. It is not necessary that he have "talked to himself," saying something like "Since such-and-such is true, p must also be true." My belief that there is a fire in the neighborhood is based on, or inferred from, my belief that I hear a fire engine. But I have not gone through a process of explicit reasoning, saying "There's a fire engine; therefore there must be a fire." Perhaps the word 'inference' is ordinarily used only where explicit reasoning occurs; if so, my use of the term will be somewhat broader than its ordinary use.

Suppose S perceives that there is solidified lava in various parts of the countryside. On the basis of this belief, plus various "background" beliefs about the production of lava, S concludes that a nearby mountain erupted many centuries ago. Let us assume that this is a highly warranted inductive inference, one which gives S adequate evidence for believing that the mountain did erupt many centuries ago. Assuming this proposition is true, does S know it? This depends on the nature of the causal process that induced his belief. If there is a continuous causal chain of the sort he envisages connecting the fact that the mountain erupted with his belief of this fact, then S knows it. If there is no such causal chain, however, S does not know that proposition.

Suppose that the mountain erupts, leaving lava around the countryside. The lava remains there until S perceives it and infers that the mountain erupted. Then S does know that the mountain erupted. But now suppose that, after the mountain has erupted, a man somehow removes all the lava. A century later, a different man (not knowing of the real volcano) decides to make it look as if there had been a volcano, and therefore puts lava in appropriate places. Still later, S comes across this lava and concludes that the mountain erupted centuries ago. In this case, S cannot be said to know the proposition. This is because the fact that the mountain did erupt is not a cause of S's believing that it erupted. A necessary condition of S's knowing p is that his believing p be connected with p by a causal chain.

In the first case, where S knows p, the causal connection may be diagrammed as in Figure 1. (p) is the fact that the mountain erupted at such-and-such a time. (q) is the fact that lava is (now) present around the countryside. 'B' stands for a belief, the expression in parentheses indicating the proposition believed, and the subscript designating the believer. (r) is a "background" proposition, describing the ways in which lava is produced and how it solidifies. Solid arrows in the diagram represent causal connections; dotted arrows represent inferences. Notice that, in Figure 1, there is not only an arrow connecting (q) with S's belief of (q), but also an arrow connecting (p) with (q). In the suggested variant of the lava case, the latter arrow

would be missing, showing that there is no continuous causal chain connecting (p) with S's belief of (p). Therefore, in that variant case, S could not be said to know (p).

$$(p) \longrightarrow (q) \longrightarrow B_S(q) \qquad \qquad$$
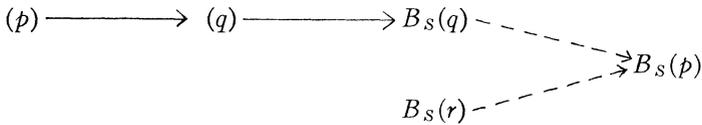$$\Rightarrow B_S(p)$$
$$B_S(r)$$

Figure 1

I have said that p is causally connected to S's belief of p, in the case diagrammed in Figure 1. This raises the question, however, of whether the inferential part of the chain is itself a causal chain. In other words, is S's belief of q a cause of his believing p? This is a question to which I shall not try to give a definitive answer here. I am inclined to say that inference *is* a causal process, that is, that when someone *bases* his belief of one proposition on his belief of a set of other propositions, then his belief of the latter propositions can be considered a cause of his belief of the former proposition. But I do not wish to rest my thesis on this claim. All I do claim is that, if a chain of inferences is "added" to a causal chain, then the entire chain is causal. In terms of our diagram, a chain consisting of solid arrows plus dotted arrows is to be considered a causal chain, though I shall not take a position on the question of whether the dotted arrows represent causal connections. Thus, in Figure 1, p is a cause of S's belief of p, whether or not we regard S's belief of q a cause of his belief of p.[7]

Consider next a case of knowledge based on "testimony." This too can be analyzed causally. p causes a person T to believe p, by perception. T's belief of p gives rise to (causes) his asserting p. T's asserting p causes S, by auditory perception, to believe that T is asserting p. S infers that T believes p, and from this, in turn, he infers that p is a fact. There is a continuous causal chain from p to S's believing p, and thus, assuming that each of S's inferences is warranted, S can be said to know p.

This causal chain is represented in Figure 2. 'A' refers to an act of

[7] A fact can be a cause of a belief even if it does not *initiate* the belief. Suppose I believe that there is a lake in a certain locale, this belief having started in a manner quite unconnected with the existence of the lake. Continuing to have the belief, I go to the locale and perceive the lake. At this juncture, the existence of the lake becomes a cause of my believing that there is a lake there. This is analogous to a table top that is supported by four legs. When a fifth leg is inserted flush beneath the table top, it too becomes a cause of the table top's not falling. It has a causal role in the support of the table top even though, before it was inserted, the table top was adequately supported.

asserting a proposition, the expression in parentheses indicating the proposition asserted and the subscript designating the agent. (q), (r), (u), and (v) are background propositions. $(q$)and (r), for example, pertain to T's sincerity; they help S conclude, from the fact that T asserted p, that T really believes p.

$$B_S(r) \qquad B_S(v)$$
$$(p) \longrightarrow B_T(p) \longrightarrow A_T(p) \longrightarrow B_S(A_T(p)) \dashrightarrow B_S(B_T(p)) \dashrightarrow B_S(p)$$
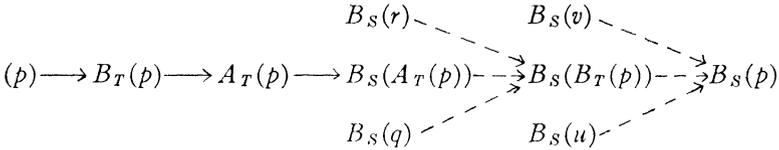$$B_S(q) \qquad B_S(u)$$

Figure 2

In this case, as in the lava case, S knows p because he has correctly reconstructed the causal chain leading from p to the evidence for p that S perceives, in this case, T's asserting (p). This correct reconstruction is shown in the diagram by S's inference "mirroring" the rest of the causal chain. Such a correct reconstruction is a necessary condition of knowledge based on inference. To see this, consider the following example. A newspaper reporter observes p and reports it to his newspaper. When printed, however, the story contains a typographical error so that it asserts not-p. When reading the paper, however, S fails to see the word 'not', and takes the paper to have asserted p. Trusting the newspaper, he infers that p is true. Here we have a continuous causal chain leading from p to S's believing p; yet S does not know p. S thinks that p resulted in a report to the newspaper about p and that this report resulted in its printing the statement p. Thus, his reconstruction of the causal chain is mistaken. But, if he is to know p, his reconstruction must contain no mistakes. Though he need not reconstruct *every* detail of the causal chain, he must reconstruct all the important links.[8] An additional requirement for knowledge based on inference is that the knower's inferences be warranted. That is, the propositions on which he bases his belief of p must genuinely confirm p very highly, whether deductively or inductively. Reconstructing a causal chain merely by lucky guesses does not yield knowledge.

With the help of our diagrams, we can contrast the traditional analysis of knowing with Clark's analysis *(op. cit.)* and contrast each

[8] Clearly we cannot require someone to reconstruct every detail, since this would involve knowledge of minute physical phenomena, for example, of which ordinary people are unaware. On the other hand, it is difficult to give criteria to identify which details, in general, are "important." This will vary substantially from case to case.

of these with my own analysis. The traditional analysis makes reference to just three features of the diagrams. First, it requires that *p* be true; i.e., that (*p*) appear in the diagram. Secondly, it requires that *S* believe *p*; i.e., that *S*'s belief of *p* appear in the diagram. Thirdly, it requires that *S*'s inferences, if any, be warranted; i.e., that the sets of beliefs that are at the tail of a dotted arrow must jointly highly confirm the belief at the head of these arrows. Clark proposes a further requirement for knowledge. He requires that *each* of the beliefs in *S*'s chain of inference be *true*. In other words, whereas the traditional analysis requires a fact to correspond to *S*'s belief of *p*, Clark requires that a fact correspond to *each* of *S*'s beliefs on which he based his belief of *p*. Thus, corresponding to each belief on the right side of the diagram there must be a fact on the left side. (My diagrams omit facts corresponding to the "background" beliefs.)

As Clark's analysis stands, it seems to omit an element of the diagrams that my analysis requires, viz., the arrows indicating causal connections. Now Clark might reformulate his analysis so as to make implicit reference to these causal connections. If he required that the knower's beliefs include *causal beliefs* (of the relevant sort), then his requirement that these beliefs be true would amount to the requirement that there *be* causal chains of the sort I require. This interpretation of Clark's analysis would make it almost equivalent to mine, and would enable him to avoid some objections that have been raised against him. But he has not explicitly formulated his analysis this way, and it therefore remains deficient in this respect.

Before turning to the problems facing Clark's analysis, more must be said about my own analysis. So far, my examples may have suggested that, if *S* knows *p*, the fact that *p* is a cause of his belief of *p*. This would clearly be wrong, however. Let us grant that I can know facts about the future. Then, if we required that the known fact cause the knower's belief, we would have to countenance "backward" causation. My analysis, however, does not face this dilemma. The analysis requires that there be a causal *connection* between *p* and *S*'s belief, not necessarily that *p* be a *cause* of *S*'s belief. *p* and *S*'s belief of *p* can also be causally connected in a way that yields knowledge if both *p* and *S*'s belief of *p* have a *common* cause. This can be illustrated as follows.

T intends to go downtown on Monday. On Sunday, *T* tells *S* of his intention. Hearing *T* say he will go downtown, *S* infers that *T* really does intend to go downtown. And from this *S* concludes that *T* *will* go downtown on Monday. Now suppose that *T* fulfills his intention

by going downtown on Monday. Can S be said to know that he would go downtown? If we ever can be said to have knowledge of the future, this is a reasonable candidate for it. So let us say S did know that proposition. How can my analysis account for S's knowledge? T's going downtown on Monday clearly cannot be a cause of S's believing, on Sunday, that he would go downtown. But there is a fact that is the *common* cause of T's going downtown and of S's belief that he would go downtown, viz., T's intending (on Sunday) to go downtown. This intention resulted in his going downtown and also resulted in S's believing that he would go downtown. This causal connection between S's belief and the fact believed allows us to say that S *knew* that T would go downtown.

The example is diagrammed in Figure 3. $(p) = T$'s going downtown on Monday. $(q) = T$'s intending (on Sunday) to go downtown on Monday. $(r) = T$'s telling S (on Sunday) that he will go downtown on Monday. (u) and (v) are relevant background propositions pertaining to T's honesty, resoluteness, etc. The diagram reveals that q is a cause both of p and of S's belief of p. Cases of this kind I shall call *Pattern 2* cases of knowledge. Figures 1 and 2 exemplify *Pattern 1* cases of knowledge.
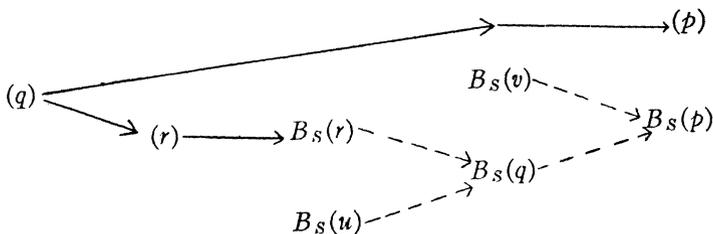

Figure 3

Notice that the causal connection between q and p is an essential part of S's knowing p. Suppose, for example, that T's intending (on Sunday) to go downtown does not result in, or cause, T's going downtown on Monday. Suppose that T, after telling S that he would go downtown, changes his mind. Nevertheless, on Monday he is kidnapped and forced, at the point of a gun, to go downtown. Here both q and p actually occur, but they are not causally related. The diagram in Figure 3 would have to be amended by deleting the arrow connecting (q) with (p). But if the rest of the facts of the original case remain the same, S could not be said to know p. It would be false to say that S knew, on Sunday, that T would go downtown on Monday.

Pattern 2 cases of knowledge are not restricted to knowledge of the

future. I know that smoke was coming out of my chimney last night. I know this because I remember perceiving a fire in my fireplace last night, and I infer that the fire caused smoke to rise out of the chimney. This case exemplifies Pattern 2. The smoke's rising out of the chimney is not a causal factor of my belief. But the fact that there was a fire in the fireplace was a cause both of my belief that smoke was coming out of the chimney and of the fact that smoke was coming out of the chimney. If we supplement this case slightly, we can make my knowledge exemplify *both* Pattern 1 and Pattern 2. Suppose that a friend tells me today that he perceived smoke coming out of my chimney last night and I base my continued belief of this fact on his testimony. Then the fact was a cause of my current belief of it, as well as an *effect* of another fact that caused my belief. In general, numerous and diverse kinds of causal connections can obtain between a given fact and a given person's belief of that fact.

Let us now examine some objections to Clark's analysis and see how the analysis presented here fares against them. John Turk Saunders and Narayan Champawat have raised the following counter-example to Clark's analysis: [10]

> Suppose that Smith believes
>   (p) Jones owns a Ford
> because his friend Brown whom he knows to be generally reliable and honest yesterday told Smith that Jones had always owned a Ford. Brown's information was correct, but today Jones sells his Ford and replaces it with a Volkswagen. An hour later Jones is pleased to find that he is the proud owner of two cars: he has been lucky enough to win a Ford in a raffle. Smith's belief in *p* is not only justified and true, but is fully grounded, e.g., we suppose that each link in the ... chain of Smith's grounds is true (8).

Clearly Smith does not know *p*; yet he seems to satisfy Clark's analysis of knowing.

Smith's lack of knowledge can be accounted for in terms of my analysis. Smith does not know *p* because his believing *p* is not causally related to *p*, Jones's owning a Ford *now*. This can be seen by examining Figure 4. In the diagram, (*p*) = Jones's owning a Ford now; (*q*) = Jones's having always owned a Ford (until yesterday); (*r*) = Jones's winning a Ford in a raffle today. (*t*), (*u*), and (*v*) are background propositions. (*v*), for example, deals with the likelihood of someone's continuing to own the same car today that he owned

10 "Mr. Clark's Definition of 'Knowledge'," *Analysis*, xxv.1, ns 103 (October 1964): 8–9.

yesterday. The subscript 'B' designates Brown, and the subscript 'S' designates Smith. Notice the absence of an arrow connecting (p) with (q). The absence of this arrow represents the absence of a causal relation between (q) and (p). Jones's owning a Ford in the past (until yesterday) is not a cause of his owning one now. Had he continued owning the same Ford today that he owned yesterday, there would be a causal connection between q and p and, therefore, a causal connection between p and Smith's believing p. This causal connection would exemplify Pattern 2. But, as it happened, it is purely a coincidence that Jones owns a Ford today as well as yesterday. Thus, Smith's belief of p is not connected with p by Pattern 2, nor is there any Pattern 1 connection between them. Hence, Smith does not know p.

$$(r)\longrightarrow(p)$$

$$B_S(t)\searrow \qquad B_S(u)\searrow \quad B_S(v)\searrow$$

$$(q)\to B_B(q)\to A_B(q)\to B_S(A_B(q))\dashrightarrow B_S(B_B(q))\dashrightarrow B_S(q)\dashrightarrow B_S(p)$$
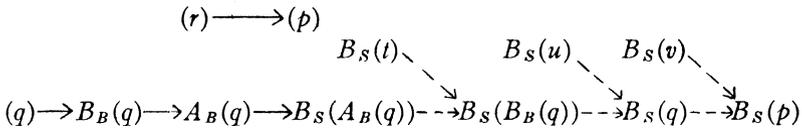
Figure 4

If we supplement Clark's analysis as suggested above, it can be saved from this counterexample. Though Saunders and Champawat fail to mention this explicitly, presumably it is one of Smith's beliefs that Jones's owning a Ford yesterday would *result* in Jones's owning a Ford now. This was undoubtedly one of his grounds for believing that Jones owns a Ford now. (A complete diagram of S's beliefs relevant to p would include this belief.) Since this belief is false, however, Clark's analysis would yield the correct consequence that Smith does not know p. Unfortunately, Clark himself seems not to have noticed this point, since Saunders and Champawat's putative counterexample has been allowed to stand.

Another sort of counterexample to Clark's analysis has been given by Saunders and Champawat and also by Keith Lehrer. This is a counterexample from which his analysis cannot escape. I shall give Lehrer's example (*op. cit.*) of this sort of difficulty. Suppose Smith bases his belief of

(p) Someone in his office owns a Ford

on his belief of four propositions

(q) Jones owns a Ford
(r) Jones works in his office
(s) Brown owns a Ford
(t) Brown works in his office

In fact, Smith knows q, r, and t, but he does not know s because s is false. Since s is false, not *all* of Smith's grounds for p are true, and, therefore, on Clark's analysis, Smith does not know p. Yet clearly Smith does know p. Thus, Clark's analysis is *too strong*.

Having seen the importance of a causal chain for knowing, it is fairly obvious how to amend Clark's requirements without making them too weak. We need not require, as Clark does, that *all* of S's grounds be true. What is required is that enough of them be true to ensure the existence of at least *one* causal connection between p and S's belief of p. In Lehrer's example, Smith thinks that there are two ways in which he knows p: via his knowledge of the conjunction of q and r, and via his knowledge of the conjunction of s and t. He does not know p via the conjunction of s and t, since s is false. But there is a causal connection, via q and r, between p and Smith's belief of p. And this connection is enough.

Another sort of case in which one of S's grounds for p may be false without preventing him from knowing p is where the false proposition is a dispensable background assumption. Suppose S bases his belief of p on 17 background assumptions, but only 16 of these are true. If these 16 are strong enough to confirm p, then the 17th is dispensable. S can be said to know p though one of his grounds is false.

Our discussion of Lehrer's example calls attention to the necessity of a further clarification of the notion of a "causal chain." I said earlier that causal chains with admixtures of inferences are causal chains. Now I wish to add that causal chains with admixtures of logical connections are causal chains. Unless we allow this interpretation, it is hard to see how facts like "Someone in the office owns a Ford" or "All men are mortal" could be *causally* connected with beliefs thereof.

The following principle will be useful: *If x is logically related to y and if y is a cause of z, then x is a cause of z.* Thus, suppose that q causes S's belief of q and that r causes S's belief of r. Next suppose that S infers q & r from his belief of q and of r. Then the facts q and r are causes of S's believing q & r. But the fact q & r is logically related to the fact q and to the fact r. Therefore, using the principle enunciated above, the fact q & r is a cause of S's believing q & r.

In Lehrer's case another logical connection is involved: a connection between an existential fact and an instance thereof. Lehrer's case is diagrammed in Figure 5. In addition to the usual conventions, logical relationships are represented by double solid lines. As the

diagram shows, the fact p—someone in Smith's office owning a Ford —is logically related to the fact q & r—Jones's owning a Ford and Jones's working in Smith's office. The fact q & r is, in turn, logically related to the fact q and to the fact r. q causes S's belief of q and, by inference, his belief of q & r and of p. Similarly, r is a cause of S's belief of p. Hence, by the above principle, p is a cause of S's belief of p. Since Smith's inferences are warranted, even setting aside his belief of s & t, he knows p.

$$(p) =\!=\!=\!= (q \ \& \ r) \qquad (q) \quad \rightarrow B_s(q) \quad \rightarrow B_s(q \ \& \ r) - - \rightarrow B_s(p)$$

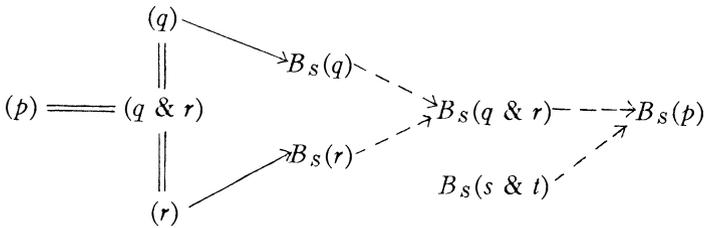$$(r) \quad \rightarrow B_s(r) \quad B_s(s \ \& \ t)$$

Figure 5

In a similar way, universal facts may be causes of beliefs thereof. The fact that all men are mortal is logically related to its instances: John's being mortal, George's being mortal, Oscar's being mortal, etc. Now suppose that S perceives George, John, Oscar, etc. to be mortal (by seeing them die). He infers from these facts that all men are mortal, an inference which, I assume, is warranted. Since each of the facts, John is mortal, George is mortal, Oscar is mortal, etc., is a cause of S's believing that fact, each is also a cause of S's believing that all men are mortal. Moreover, since the universal fact that all men are mortal is logically related to each of these particular facts, this universal fact is a cause of S's belief of it. Hence, S can be said to know that all men are mortal. In analogous fashions, S can know various other logically compound propositions.

We can now formulate the analysis of knowing as follows:

S knows that p if and only if
the fact p is causally connected in an "appropriate" way with S's believing p.

"Appropriate," knowledge-producing causal processes include the following:

(1) perception
(2) memory
(3) a causal chain, exemplifying either Pattern 1 or 2, which is correctly reconstructed by inferences, each of which is warranted

(background propositions help warrant an inference only if
they are true) [11]
(4) combinations of (1), (2), and (3)

We have seen that this analysis is *stronger* than the traditional
analysis in certain respects: the causal requirement and the correct-
reconstruction requirement are absent from the older analysis.
These additional requirements enable my analysis to circumvent
Gettier's counterexamples to the traditional one. But my analysis is
weaker than the traditional analysis in another respect. In at least
one popular interpretation of the traditional analysis, a knower must
be able to justify or give evidence for any proposition he knows. For
S to know p at t, S must be able, at t, to *state* his justification for be-
lieving p, or his grounds for p. My analysis makes no such require-
ment, and the absence of this requirement enables me to account for
cases of knowledge that would wrongly be excluded by the tradi-
tional analysis.

I know now, for example, that Abraham Lincoln was born in
1809.[12] I originally came to know this fact, let us suppose, by reading
an encyclopedia article. I believed that this encyclopedia was trust-
worthy and that its saying Lincoln was born in 1809 must have re-
sulted from the fact that Lincoln was indeed born in 1809. Thus,
my original knowledge of this fact was founded on a warranted in-
ference. But now I no longer remember this inference. I remember
that Lincoln was born in 1809, but not that this is stated in a cer-
tain encyclopedia. I no longer have any pertinent beliefs that highly
confirm the proposition that Lincoln was born in 1809. Neverthe-
less, I know this proposition now. My original knowledge of it was
preserved until now by the causal process of memory.

Defenders of the traditional analysis would doubtlessly deny that
I really do know Lincoln's birth year. This denial, however, stems
from a desire to protect their analysis. It seems clear that many
things we know were originally learned in a way that we no longer
remember. The range of our knowledge would be drastically re-
duced if these items were denied the status of knowledge.

Other species of knowledge without explicit evidence could also
be admitted by my analysis. Notice that I have not closed the list of

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[11] Perhaps background propositions that help warrant S's inference must be
known by S, as well as true. This requirement could be added without making our
analysis of "S knows that p" circular. For these propositions would not include p.
In other words, the analysis of knowledge could be regarded as recursive.

[12] This kind of case is drawn from an unpublished manuscript of Gilbert
Harman.

"appropriate" causal processes. Leaving the list open is desirable, because there may be some presently controversial causal processes that we may later deem "appropriate" and, therefore, knowledge-producing. Many people now doubt the legitimacy of claims to extrasensory perception. But if conclusive evidence were to establish the existence of causal processes connecting physical facts with certain persons' beliefs without the help of standard perceptual processes, we might decide to call such beliefs items of knowledge. This would be another species of knowledge in which the knower might be unable to justify or defend his belief. My analysis allows for the possibility of such knowledge, though it doesn't commit one to it.

Special comments are in order about knowledge of our own mental states. This is a very difficult and controversial topic, so I hesitate to discuss it, but something must be said about it. Probably there are some mental states that are clearly distinct from the subject's belief that he is in such a state. If so, then there is presumably a causal process connecting the existence of such states with the subject's belief thereof. We may add this kind of process to the list of "appropriate" causal processes. The more difficult cases are those in which the state is hardly distinguishable from the subject's believing that he is in that state. My being in pain and my believing that I am in pain are hardly distinct states of affairs. If there is no distinction here between the believing and the believed, how can there be a causal connection between them? For the purposes of the present analysis, we may regard identity as a "limiting" or "degenerate" case of a causal connection, just as zero may be regarded as a "limiting" or "degenerate" case of a number. It is not surprising that knowledge of one's own mental state should turn out to be a limiting or degenerate case of knowledge. Philosophers have long recognized its peculiar status. While some philosophers have regarded it as a paradigm case of knowledge, others have claimed that we have no "knowledge" of our mental states at all. A theory of knowledge that makes knowledge of one's own mental states rather different from garden-variety species of knowledge is, in so far forth, acceptable and even welcome.

In conclusion, let me answer some possible objections to my analysis. It might be doubted whether a causal analysis adequately provides the meaning of the word 'knows' or of the sentence (-schema) "S knows p." But I am not interested in giving the *meaning* of "S knows p"; only its *truth conditions*. I claim to have given one correct set of truth conditions for "S knows p." Truth conditions of a sentence do not always provide its meaning. Consider, for example, the following

truth-conditions statement: "The sentence 'Team T wins the baseball game' is true if and only if team T has more runs at the end of the game than the opposing team." This statement fails to provide the meaning of the sentence 'Team T wins the baseball game'; for it fails to indicate an essential part of the meaning of that sentence, viz., that to win a game is to achieve the presumed goal of playing it. Someone might fully understand the truth conditions given above and yet fail to understand the meaning of the sentence because he has no understanding of the notion of "winning" in general.

Truth conditions should not be confused with verification conditions. My analysis of "S knows p" does not purport to give procedures for *finding out* whether a person (including oneself) knows a given proposition. No doubt, we sometimes do know that people know certain propositions, for we sometimes know that their beliefs are causally connected (in appropriate ways) with the facts believed. On the other hand, it may often be difficult or even impossible to find out whether this condition holds for a given proposition and a given person. For example, it may be difficult for me to find out whether I really do remember a certain fact that I seem to remember. The difficulties that exist for *finding out* whether someone knows a given proposition do not constitute difficulties for my analysis, however.

In the same vein it should be noted that I have made no attempt to answer skeptical problems. My analysis gives no answer to the skeptic who asks that I start from the content of my own experience and then prove that I know there is a material world, a past, etc. I do not take this to be one of the jobs of giving truth conditions for "S knows that p."

The analysis presented here flies in the face of a well-established tradition in epistemology, the view that epistemological questions are questions of logic or justification, not causal or genetic questions. This traditional view, however, must not go unquestioned. Indeed, I think my analysis shows that the question of whether someone knows a certain proposition is, in part, a causal question, although, of course, the question of what the correct analysis is of "S knows that p" is not a causal question.

ALVIN I. GOLDMAN

The University of Michigan