BETWEEN ANALYTIC AND EMPIRICAL

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I

ONE of the most serious pre-occupations of post-medieval philo-
sophy has been to distinguish those kinds of assertion which are either
true or false from those which are neither true nor false. A solution
to this problem would be of the highest importance. It would indicate
in what areas rational inquiry has some hope of success and in what
areas it is doomed to frustration. It would tell us, for example,
whether it is worth trying to *think* about the possible mistakenness
of our moral principles, or whether such thinking is bound to be
ineffective since no truth or falsity attaches to them.

I confess that what led me to scrutinize one influential answer—
the logical empiricist's answer—to this problem was the baleful
influence which it seemed to me to have exerted on moral and
political philosophy; and one thing which is, to my mind, important
about the amendment I shall propose to that answer is that it makes
possible a more fruitful kind of moral and political philosophy.
But having declared my interest I shall say no more about ethics in
this paper.

The logical empiricist's contention that the only kinds of true-or-
false assertions, the only kinds of genuine statements, are analytic
and empirical statements is not arbitrary. It arose out of criticism of
Kant's answer to this problem. Kant's answer, as everyone knows,
was: analytic *a priori*, synthetic *a posteriori*, and synthetic *a priori*
propositions. There is no need to rehearse here the objections which
have been lodged against the idea of synthetic *a priori* propositions.
I will only mention that metaphysicians like Parmenides, Plato,
Spinoza and Bradley who did believe in this kind of proposition
were committed to and, indeed, explicitly maintained the thesis
that, whereas we can only have testable and revisable opinions about
the world of appearances, we can have incorrigible knowledge of the
realities which those appearances obscure (rather as a telepathist
might claim that he had a shadowy view of someone's face but
unerring insight into the thoughts behind it). I shall maintain
against the empiricist that we can have reasonable but untestable
metaphysical opinions and against the *a priori*-minded metaphysi-
cian that such opinions are *less* reliable than well tested scientific
theories.

In Kant's terminology, "analytic/synthetic" is an exhaustive
classification: every statement is either verbally true and factually

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uninformative, or informative and not verbally true. In recent discussions of this classification *analytic* has received all the attention. As a residuary legatee, *synthetic* has been left waiting outside the logician's office until the exact extent of *analytic's* legacy has been determined. But at the same time, the disappearance of the synthetic *a priori* has made it natural to characterize synthetic statements not only negatively as non-analytic, but also positively as empirical statements. For all that remains of Kant's trichotomy is analytic truths and synthetic *a posteriori*, or empirically grounded, statements. It is rather as if *synthetic* had been bequeathed both a specific legacy and the residue of the estate; but then the executors discovered that after paying the two legacies no residue remained. Thus the "analytic/synthetic" dichotomy has been regarded simultaneously as a necessarily exhaustive classification of statements and as a positive (one might say positivist) criterion for checking the credentials of sentences purporting to express genuine statements. It is this combination of restrictiveness and exhaustiveness which has made logical empiricism seem both tough and inexorable.

I shall challenge the empiricist's version of the "analytic/synthetic" dichotomy by drawing attention to a precise class of influential doctrines which inhabit a no-man's-land between analytic and empirical statements. Later, in section IV, paragraph (3), I shall prove that these doctrines are not analytic. My concern is an unempirical sub-division of *synthetic*. Consequently, my argument can proceed independently of any doubts, however justified by the kind of consideration which Professor Quine has raised, about the precision and applicability of the notion of analyticity. For my purpose it is enough to say that an analytic statement is a statement which is compatible with every synthetic statement and whose denial is self-contradictory. If a synthetic *a priori* statement is a *necessarily true* factual statement, then my argument has nothing to say about such statements. But if by "synthetic *a priori* doctrine" were meant a factual doctrine which may animate empirical investigations but whose truth *or falsity* is logically independent of empirical findings, then this is the kind of doctrine whose existence I shall try to establish. My argument will also proceed independently of any assumptions about prescriptive utterances.

The doctrines I have in mind have this peculiarity. They are universal statements which may be confirmed in the sense of being instantiated. Sometimes, indeed, the recognition of a very few instances would be regarded as a triumphant vindication of the doctrine. On the other hand they are in principle irrefutable. Unlike the statements of *a priori* metaphysics, they describe a realm which is not altogether beyond experience but connected with experience in an asymmetrical way, a realm of which we may catch glimpses

which inconclusively confirm these descriptions of it, but a realm which we cannot explore sufficiently to refute descriptions of it.

A familiar kind of confirmable but irrefutable statement is a statement that a house, say, is *haunted*. A ghost-watcher who witnesses no strange occurrences does not thereby refute such a statement, for a haunting presence is often invisible. On the other hand, a ghost-watcher who has eerie sensations, hears rustling noises and thinks he sees a moving shape, does thereby confirm such a statement, though not conclusively, of course, since there are plausible alternative explanations of his experiences. Since this asymmetrical confirmability-cum-irrefutability is one of several features shared by haunted-house statements and the kind of metaphysical doctrines I have in mind, I shall call the latter *haunted-universe* doctrines. Determinism is an example: it alleges that all the seeming irregularities and spontaneities in the world are haunted by an omnipresent system of strict necessitation, a system of which science has given us numerous confirming glimpses. No evidence can refute this doctrine. Seeming exceptions, seemingly lawless events, can always be regarded in the way in which Spinoza regarded miracles, as evidence only of our scientific ignorance: the ghostly laws governing apparent counter-examples exist, but undetected.

In this paper I shall confine myself to the technical problem of defining the form, the logical structure, of such doctrines, which I regard as true-or-false and as proper subjects for rational investigation. Since I am using them to drive a wedge into the "analytic/empirical" dichotomy, since I regard them as unempirical despite their confirmability, my first job must be to provide an acceptable criterion for *empirical* and then to inquire whether confirmable (or instantial) but irrefutable statements are empirical or not.

II

It is generally agreed that an empirical statement is one which "makes an observable difference," puts some restriction on the domain of possible observation-statements. It is also generally agreed that an empirical statement need not *by itself* entail any observation-statement since many scientific hypotheses are what Dr. J. O. Wisdom calls non-instantial, that is, some or all of their predicates denote unobservable properties, and to test them we have to combine them with further information and deduce observable conclusions from the combination of premises. In view of this, Professor A. J. Ayer, in the first edition of *Language, Truth and Logic*, defined a hypothesis as empirical (or, in his terminology, weakly verifiable) "if some observation-statement can be deduced

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from it in conjunction with certain other premisses, without being deducible from those other premisses alone."

But in the Introduction to his second edition he pointed out that this criterion lets through all statements whatever. Consider two sentence-frames, "( )" and "If ( ) then O" (where O stands for any observation-statement, such as "This is white"). We can take any utterly unempirical or nonsensical sentence—Ayer's example was "The Absolute is lazy"—and insert it between both pairs of brackets. Our two premisses will now jointly entail an observation-statement not entailed by either premiss alone. Thus *any* sentence can be made to satisfy Ayer's earlier criterion.

Clearly, the statement whose empirical status is in question must not be allowed to recur among the premisses with which it is combined when being examined for empirical content. Ayer's revised criterion prevents this recurrence. The criterion offered below is merely a re-formulation of Ayer's. I have followed Ayer here both because I think his criterion works and because, in advancing counter-examples to the empiricist's twofold classification of genuine statements, I want to employ a criterion of *empirical* which has been developed within the empiricist tradition.

Bearing in mind the hierarchical character of scientific systems, we can construct the following hierarchical scheme for empirical statements. (Throughout this paper I shall replace the clumsy formula "p in conjunction with q entails r which is not entailed by q alone" by "p in conjunction with q gives rise to r" and sometimes simply by "p gives rise to r.")

A statement is empirical if it is an observation-statement, for instance "This is black." Observation-statements are practically verifiable/falsifiable by observations.

An instantial or, as Professor J. H. Woodger calls it, a zero-level hypothesis, like "All ravens are black," and all of whose predicates describe observable properties, is empirical if it, in conjunction with observation-statements, gives rise to further observation-statements. Thus "All ravens are black" in conjunction with "This is a raven" gives rise to "This is black."

A non-instantial hypothesis, or system of hypotheses, like Newton's three laws, which cannot be directly tested, is empirical if it, in conjunction with empirical instantial hypotheses, gives rise to further empirical instantial hypotheses.

The idea behind this hierarchy is very simple. Observation-statements are the primary empirical statements. Instantial hypotheses are empirical only if they directly give rise to observation-statements, and non-instantial hypotheses only if they indirectly give rise to observation-statements. An instantial "hypothesis" is unempirical if

it in conjunction with any observation-statements is compatible with all other observation-statements, and a non-instantial system is unempirical if it in conjunction with any empirical instantial hypotheses is compatible with all the observation-statements with which those instantial hypotheses alone are compatible.

In short, a statement is unempirical if it makes no observable difference. I do not think anyone could reasonably claim that this is too severe. Let us now see how this applies to theories which are confirmable in the sense of being instantial, but irrefutable.

That a statement *is* empirical if it is instantial, and that a scientific hypothesis is empirically confirmed by observations of numerous satisfying instances of it, is still, I think, a widespread belief, although the grave difficulties or "paradoxes" which this conception of empirical confirmation involves have been plainly pointed out.[1] How they arise can be shown in the following way. Each of the following propositions seems intuitively acceptable:

(1) Observations of black ravens confirm "All ravens are black." (Generally, instances satisfying the antecedent and consequent of a universal conditional confirm it.)

(2) Observations of black shoes, white swans, etc., are neutral to "All ravens are black." (Instances not satisfying the antecedent of a universal conditional are neutral to it.)

(3) If observations confirm one formulation of a hypothesis they confirm any logically equivalent formulation. (This is Professor Hempel's "equivalence condition.")

But analysis shows that the three propositions are not mutually compatible: one of them has to go. This is because "All ravens are black" is equivalent to "All non-black things are non-ravens" and to "Everything is no raven or black," so that, by Hempel's equivalence condition, "This white thing is a swan" and "This is no raven" and "This is black" all instantiate "All ravens are black."[2] Since no one, I take it, is prepared to deny proposition (3) there are only two ways out of this *imbroglio*: deny the instantiation-theory of confirmation implicit in proposition (1); or deny the possibility of things constituting purely neutral evidence assumed in proposition (2).

The first course was taken over twenty years ago by Professor Karl Popper in his *Logik der Forschung* (now translated under the title *The Logic of Scientific Discovery*). All conceivable objects can be

[1] See especially C. G. Hempel, "Studies in the Logic of Confirmation," *Mind*, January and April, 1945, on which this paragraph is based.

[2] The same point can be made by treating a hypothesis truth-functionally, so that "$p \supset q$" is confirmed not only by "$p.q$" but also by "$\bar{p}.q$" and by "$\bar{p}.\bar{q}$." On this see D. Pears, "Hypotheticals," *Analysis*, January 1950.

exhaustively classified as: (1) non-ravens and black ravens, and (2) non-black ravens. The number of objects in class (1), all of which instantiate "All ravens are black," is obviously much (perhaps infinitely) larger than the number of possible objects in class (2), all of which would falsify "All ravens are black." Seeing that every empirical hypothesis is instantiated by a vast mass of irrelevant evidence and refutable by a small but vital amount of possible counter-evidence, Popper interpreted the confirmation of a testable hypothesis in terms of persistent but unsuccessful attempts to falsify it and not in terms of success in finding instantiating evidence. For Popper, a confirmed hypothesis is a hypothesis which has "proved its mettle" by withstanding severe tests. Certain allegedly empirical but unfalsifiable types of statement have been cited against his falsifiability-criterion of empirical science but, as we shall see, these "counter-examples" transpire to be unempirical. Here, as in many other places, I am a convinced Popperian. But I should be begging my present question if I adopted this criterion at the outset. My question is: Is a confirmable but irrefutable hypothesis empirical? And the answer entailed by Popper's criterion is that an irrefutable hypothesis is not confirmable. I shall therefore consider a theory of confirmation on which the idea of a confirmable but irrefutable hypothesis does make sense, namely, an instantiation-theory.

The second course was taken subsequently by Professor Hempel (op. cit.). Hempel retained the instantiation-theory of confirmation and dispensed instead with the idea that observation-reports about, say, white swans and black shoes, are irrelevant to "All ravens are black." It is a mistake, he said, to suppose that "Every P is a Q" asserts something only about objects having the property P—it asserts something about every object whatever, namely, that they all lack P or possess Q (op. cit., p. 18). Since "there is no object which is not implicitly 'referred to' by a hypothesis of this type" it follows that any object whatever *will* provide either confirming or disconfirming evidence, and *no* object will provide purely neutral evidence, for such a hypothesis.

Hempel claimed that the old instantiation-theory of confirmation could be made to work if it were suitably refined. If his claim is correct it means that an irrefutable hypothesis which has been confirmed *is* an empirically grounded hypothesis; and this would mean that the peculiar doctrines I have in mind are not, after all, unempirical. Hempel's revised instantiation-theory of empirical confirmation therefore represents a challenge to my thesis which I must now try to meet.

The chief factor in his revision is his introduction of the idea of the *development* of a hypothesis H for a finite class of objects C. "The development of H for C," he writes, "states what H would

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assert if there existed exclusively those objects which are elements of *C*" (op. cit., p. 109). Thus the development of "All ravens are black" for a class of objects *a, b, c* is: "If *a* is a raven *a* is black, if *b* is a raven *b* is black, if *c* is a raven *c* is black." Hempel now defines direct confirmation as follows: "An observation report *B* directly confirms a hypothesis *H* if *B* entails the development of *H* for the class of those objects which are mentioned in *B*." Thus the observation-report "*a* is a raven and black, *b* is no raven and black, *c* is no raven and not black" directly confirms "All ravens are black." An observation-report directly disconfirms a hypothesis if it directly confirms the denial of the hypothesis.

It was already clear, before Hempel discovered the "paradoxes of confirmation," that what matters, when you are investigating how well the evidence confirms some universal hypothesis, is not so much the existence of pro-instances as the non-existence of counter-instances. If, in the course of investigating the theory that all swans are white, you go to the keeper of a swannery, the question to ask him is not (*a*) "How many white swans have you seen?" but (*b*) "Have you ever seen a swan which was not white?" It was already clear that a highly favourable answer to question (*a*) ("I've seen hundreds of thousands of white swans") carries very little weight so long as question (*b*) (to which the reply might be, "Yes, we did have a black swan here some years ago") remains unanswered. To Hempel belongs the high credit of showing that the existence of pro-instances is even more trivial and irrelevant to the confirmation of a universal hypothesis than we already supposed. It is his equivalence-condition which generates the "paradoxes of confirmation"; the equivalence-condition tells us that if we are looking for pro-instances we can turn an (*a*)-type question into an (*a'*)-type question, like "How many things have you seen which were white or not swans?" (a question to which the puzzled swannery-keeper, after scratching his head, might reply, "Why, millions upon millions, I reckon.")

But Hempel seems to have been strangely unimpressed by his own simple but devastating discovery that *every* universal empirical hypothesis is *automatically* instantiated by millions upon millions of objects. Since answers to (*a'*)-type questions (questions which merely enquire about the existence of instantiating evidence) are *bound* to be hugely favourable—even to a hypothesis which has been empirically falsified and even to both of two contrary hypotheses— one might have expected Hempel to infer that the "confirmation" which (*a'*)-type answers provide is utterly spurious, and that it is only answers to (*b*)-type questions (questions which probe for counter-evidence, questions asked in the course of *testing* a hypothesis) which may genuinely confirm a hypothesis. One might have expected him to agree that the confirming value of (*a'*)-type answers compared

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to the confirming value of (*b*)-type answers is like the purchasing value of those paper *reichsmarks* which proliferated at a fantastic rate during the German inflation compared with the purchasing value of golden *reichsmarks*. In short, one might have expected him to adopt, with a conviction intensified by his own discovery, the view already advanced by Popper that failure, despite severe tests, to find counter-evidence, and not success in finding instantiating evidence, is the only thing which genuinely confirms a universal hypothesis.

But, alas, Hempel preferred to try to patch up the old instantiation-theory of confirmation. The criticism to which Hempel the author of a revised instantiation-theory is exposed is precisely the criticism one would have expected to come from Hempel the discoverer of the "paradoxes of confirmation"; namely, that his instantiation-criterion allows hypotheses to be massively confirmed (and their negations to be massively disconfirmed) by utterly irrelevant observation-statements.

Let our hypothesis be "All ravens are black" and let our observation-statements be "This swan is white" and "This shoe is black"; and assume that the properties of being a raven and being a swan and being a shoe are mutually exclusive. The development of our hypothesis for any two objects is "This is no raven or black and this is no raven or black." From our two observation-statements we can derive "This is no raven and this is black." Therefore our observation-statements entail the development of, and so directly confirm, our hypothesis.

Hempel admits that such a result is counter-intuitive, but assures us that the appearance of a paradox here "is not objectively founded; it is a psychological illusion"(op. cit., p. 18); for such a hypothesis says something about every object in the universe, and what it says is borne out by the two objects, the swan and the shoe, mentioned in our observation-statements.

But the common-sense conviction that these observation-statements *are* irrelevant to this hypothesis, far from being an illusion, can be proved very simply to be correct. For these observation-reports could be replaced by contradictory or contrary observation-reports, and these too would "directly confirm" the same hypothesis. From "This swan is not white" and "This shoe is not black," we can derive "This is no raven and this is no raven"; and from "This swan is black" and "This shoe is white" we can derive "This is black and this is no raven." Both these derivations entail "This is no raven or black and this is no raven or black," and so directly confirm our hypothesis.

A complementary situation arises in connection with disconfirma-tion. The negation of "All ravens are black" is "At least one non-black raven exists." The development of such a purely existential hypothe-sis for any two objects is, according to Hempel (op. cit., p. 109), the

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disjunction, "This is a non-black raven and/or this is a non-black raven." This development is contradicted by "This swan is white' plus "This shoe is black" and also by all pairs of observation statements made up of the contradictories and contraries of this pair.

We thus have the outrageous situation where a mass of evidence confirms a universal hypothesis and disconfirms its existential denial although a mass of flatly *conflicting* evidence would *equally* confirm the hypothesis and disconfirm its denial. The conclusion must be that the colossal inflation of instantiating evidence generated by Hempel's unquestionable equivalence-condition is utterly irrelevant for the genuine confirmation of a universal hypothesis. Since an empirical universal hypothesis is instantiated by every object whatever except those objects whose existence it prohibits, it follows that, for its empirical confirmation, instantiation counts for nothing and that only attempted dis-instantiation, attempted falsification, matters. Thus the instantial but unfalsifiable doctines I shall introduce later are "confirmable" only in a spurious way and are not open to genuine confirmation or disconfirmation.

Popper's theory of confirmation does not allow a hypothesis to be confirmed by irrelevant evidence, by evidence which could be replaced by flatly conflicting but equally confirming evidence, because according to it a confirming observation-report will describe the favourable outcome of some *test*. If the outcome had been significantly different, it would have been unfavourable to the hypothesis.[1] Hempel, however, rejects Popper's falsifiability-measure of the empirical content and simplicity and testability of scientific hypotheses for other reasons. I shall now consider Hempel's dismissal of Popper's criterion, partly to show that it was a wrongful dismissal, but mainly to prepare the way for a consideration of those non-analytic and unfalsifiable doctrines, to show the unempirical character of which is my main concern.

Hempel writes: "Popper's proposal to limit scientific hypotheses to the form of (relatively) falsifiable sentences [i.e. sentences contradictable by a *revocable* observation-report] involves a very severe limitation of the possible forms of scientific hypotheses; in particular it rules out all purely existential hypotheses as well as most hypotheses whose formulation requires both universal and existential quantification" (op. cit., pp. 119–120).

I will consider the case of universally-cum-existentially quantified hypotheses in section III. As far as purely existential statements are

[1] For a proposed measure of confirmation see his "Degree of Confirmation," *The British Journal for the Philosophy of Science*, v. 18, 1954. He comments on p. 144: "The three cases—support, undermining, independence—are easily seen to be exhaustive and exclusive on this definition."

concerned, we can at once agree that they are meaningful, unfalsifiable and verifiable. Do they overthrow Popper's falsifiability-criterion of empirical science? Now one of Popper's reasons for not equating that criterion with a criterion of meaningfulness was this. The negation of a statement is presumably as meaningful as the statement it negates (if we can understand *s* and *not* we can presumably understand *not-s*). Scientific hypotheses can be put in the form of negative existential statements ("There does not exist a non-black raven," "There does not exist a perpetual motion machine," etc.). The negation of a negative existential statement is, of course, a purely existential statement. A purely existential hypothesis is untestable and unscientific. Therefore, the class of scientific statements is a sub-class of the class of meaningful statements (op. cit., sects. 4 and 15).

To illustrate Popper's thesis about the asymmetry between scientific negative existential statements and unscientific purely existential statements, compare "There does not exist a metal which, on being heated, fails to expand" with its purely existential denial. The first puts a limitation on the entire universe and can be tested throughout the universe. The second introduces an ingredient into some unspecified corner of the universe and cannot be tested at all.

The fact that purely existential statements can logically contradict scientific hypotheses is compatible with the claim that they play no role in the refutation of scientific theories because what counts as a refutation in science is never the bare assertion that a thing prohibited by the hypothesis exists. The very least that will be required is the assertion that some identifiable object exists within some *circumscribed* space-time region, for instance that an object of such-and-such a description is at the top left-hand corner of the slide under my microscope. I call such statements "circumscribed existential statements." Statements which locate some identifiable object within some circumscribed region are refutable, at least in principle. Popper requires of "basic" statements in science that they should, moreover, be inter-subjectively testable in practice (op. cit., sect. 28). For the actual overthrow of a scientific theory he requires the acceptance of an incompatible, well tested, low-order *generalization*—of what I may call a trustworthy recipe for reproducing counter-evidence.

But while purely existential statements play no role in scientific refutations, they may be connected with scientific theories in other ways. First, a purely existential statement may be joined to a universal theory in order to give it existential import. Being a component of an empirical theory does not, however, entail that the component is itself empirical—for instance, the mathematics of a

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physical theory is not empirical. Indeed, a number of philosophers from Duhem to Quine have held that *all* the components of a testable system are individually unempirical because "our statements about the external world face the tribunal of sense experience not individually but only as a corporate body" (W. V. O. Quine, *From a Logical Point of View*, p. 41).

> "If the predicted phenomenon is not produced" [writes Duhem], "not only is the proposition questioned at fault, but so is the whole theoretical scaffolding used by the physicist. The only thing the experiment teaches us is that among the propositions used to predict the phenomenon, there is at least one error; but where this error lies is just what it does not tell us" (*The Aim and Structure of Physical Theory*, p. 185).

Or, in Quine's most recent formulation,

> "Statements are tied to the testimony of the senses only in a systematic or holistic way which defies any statement-by-statement distribution of sensory certificates" (*Mind*, October 1953, p. 434).

(This is, of course, the ground for Quine's repudiation of the divisibility of statements into analytic or synthetic.) But whether we go the whole way with the Duhem-Quine school or not, there can be no doubt that an individual component of an empirical system *may* itself be unempirical. I shall shortly give reasons for regarding all purely existential components as unempirical.

Another way in which a purely existential statement may be related to an empirical theory is as a logical consequence. For instance, from an empirical theory about evolution in conjunction with circumscribed existential statements about men and apes, the uncircumscribed existential statement "The 'Missing Link' exists" may be deduced. But the logical consequences of empirical statements need not be empirical—the empirical statement *p* entails the tautology *p or not-p*.

In an attempt to falsify his falsifiability-criterion of science Popper looked for counter-examples: in particular, for any purely existential hypotheses advanced during the history of science. But he found that the only candidates proved, on closer examination, to be existential components of a testable universal theory.[1] And his criterion applies to scientific *theories*, not to the several components of such theories, many of which are analytic or otherwise untestable. Neither he, nor so far as I know anyone else, has succeeded in unearthing a historical example of a full-fledged free-standing

[1] Op. cit., sect. 15. His example was, "There exists an element of the atomic number 72."

scientific theory with a purely existential and unfalsifiable character. Hempel contents himself with the purely existential allegation that purely existential scientific hypotheses do exist—an unscientific mode of rebuttal!

But my problem is not whether confirmable but unfalsifiable statements, of which purely existential statements are a species, ever figure as scientific hypotheses or as experimental refutations of them, but whether they are empirical; and does not the fact that these statements are verifiable by experience mean that they are empirical? If purely existential statements are meaningful negations of meaningful statements, are they not also empirical negations of empirical statements? I have given a reason which endorses the presumption that a statement and its negation have the same status so far as their meaningfulness is concerned. I will now give reasons which dispel this presumption so far as their empirical status is concerned.

It is logicians (and, as Professor Popper has reminded me, theologians) who deal in purely existential statements. Those existential statements to which we are accustomed in daily life and which are not expressions of some metaphysical faith are, I think, invariably circumscribed, either explicitly or contextually. Your worst expectations might be aroused on hearing a feminine voice cry out, "There's a man in my room!" But no expectations are legitimately aroused by the tenseless, uncircumscribed statement, "A man exists." Let there be a space-time region which I can exhaustively explore. This supposition, in conjunction with the statement that a mermaid exists within that region, entails that there is a probability of 1 that I shall observe a mermaid if I explore the region exhaustively. Now let the region be expanded so that I can only explore a random sample of one-tenth of it. This supposition, in conjunction with the statement that a mermaid exists within the region, entails that there is a probability of 0.1 that I shall observe a mermaid if I explore what I can of the region. As the circumscribed region expands, the observational expectations legitimately aroused by a circumscribed existential statement diminish. When the boundaries are removed, the observational expectations legitimately aroused by a statement alleging the existence of a thing within an uncircumscribed and infinite space-time region are precisely nil.

Thus a purely existential statement can make no observable difference, is compatible with every conceivable finite set of observation-statements, and is therefore unempirical. People who incline to this view when thinking of unverified statements like "Mermaids exist" may feel uneasy when they turn to verified statements like "Caelocanths exist"; yet the empirical or unempirical status of a statement cannot depend on contingent facts. Two considerations

may help to dispel uneasiness about verified existential statements. First, an existential statement which is grammatically uncircumscribed is, ordinarily, tacitly circumscribed by its context. A person who declares "Caelocanths exist" to someone who had supposed them extinct, intends something like, "Caelocanths are swimming in the ocean today." Secondly, observations give rise to circumscribed existential statements. When we observe something we observe it in some sort of spatial relation to ourselves at some moment of time. There would be no promotion for the coastguard who confined his telephone-reports to gnomic utterances like "Ships in distress exist!" A verified uncircumscribed existential statement is properly regarded as a weak entailment of the circumscribed existential statement(s) to which observation(s) originally gave rise; and an entailment of an empirical statement may be too weak to be empirical without being so weak as to be analytic. The only way to discover whether it is empirical or not is to discover whether it could have any observational implications. And purely existential statements cannot.

Another kind of unempirical existential statement is that which alleges the existence of something abstract without indicating how to discover it and which is compatible with persistent failure to discover it. An example (which I owe to Mr. Gellner) is, "There exists a solution to this problem." Another example is, "There exists a law of nature governing this phenomenon." Of course, such statements may be consequences of a wider theory, and this theory may be testable. But they themselves are compatible with all experience and therefore unempirical. Suppose that a man, in the search for a cure for some so far incurable disease, suffers disappointment after disappointment. If he loses hope and abandons the search his attitude is one of common-sense realism. He has, in effect, investigated and refuted the empirical hypothesis that a cure exists which is discoverable after, say, three years' hard research. But if he never loses hope, if he persists in the face of unremitting disappointment, then he displays a genuinely metaphysical temper. That a cure exists has become for him as much an irrefutable article of faith as the belief of certain Christians in a Second Coming. The pig-headedness induced by a certain metaphysical inebriation is sometimes more scientifically fruitful than sober acquiescence in the "lessons" of experience.

Thus existential statements, which looked hostile to my contention that confirmable but irrefutable statements are unempirical, turn out to be friendly. I will now return to the more interesting kind of metaphysical statement.

If it is granted that purely existential statements are unempirical, it follows that a universal hypothesis for which satisfying instances might be found but against which counter-instances could

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never be found is also unempirical. For in considering the empirical or unempirical status of purely existential statements we found that their verifiability, their conclusive confirmability, was outweighed by their unfalsifiability; so that the inconclusive confirmability of this hypothesis will certainly be outweighed by its unfalsifiability.

Moreover, if we consider how a hypothesis could be confirmable but irrefutable, it will be clear that such a hypothesis could not satisfy the criterion for *empirical* which I proposed at the beginning of this section. Such a hypothesis would have to give rise to statements alleging the existence of some observable state of affairs in some *un*specified space-time region; then, if that state of affairs is observed the hypothesis will be confirmed, whereas if it is not observed the hypothesis will not be refuted. But a hypothesis which, however combined with other information, only entails the occurrence of something in some unspecified region, makes no observable difference for space- and time-bound observers. In short, a hypothesis which gives rise only to purely existential statements will be confirmed whenever one of these is verified; but since its purely existential consequences are unfalsifiable, it is compatible with every conceivable finite set of observation-statements and is therefore unempirical.

The structure of such confirmable but unfalsifiable statements is straightforward—it has actually been exhibited by Hempel (though his purpose was the opposite of mine: he wanted to show that they are empirical statements wrongly ruled out by Popper's falsifiability-criterion of empirical science).

III

We must now consider statements of the form "For all . . . there exists some . . .", for instance, "Everybody has a mother," "There's no smoke without fire," "Evil-doing never goes unpunished." These statements have both universal and existential quantification and may be called "all-and-some" statements. (Their symbolic form is "$(x)\ (Ey)\,R(x,y)$".) They entitle us to infer from a particular instance of the universally quantified variable (this person, this smoke, this evil-doing) to the existence of a related instance of the existentially quantified variable (some mother, some fire, some punishment).

I shall show later that if a statement of this form specifies the relation between its variables with a certain rigour it is a falsifiable and empirical statement. But Hempel is concerned with statements of this form which are ruled out by Popper's criterion for being *un*falsifiable. He wants to show that these unfalsifiable statements are nevertheless empirical and may belong within science. Perhaps he (wrongly) regards them as empirical because he (rightly) regards

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them as meaningful—and in the empiricist tradition he equates being meaningful with being empirical. But I hope to show that "all-and-some" statements, like purely existential statements, teach us that being meaningful must not be identified with being empirical. Consider the example with which Hempel works (it is an admirable example of an unfalsifiable hypothesis). He writes: "The hypothesis 'Every substance is soluble in some solvent'—symbolically '(x) (Ey) Soluble (x,y)'—is neither entailed by, nor incompatible with, any observation-report, no matter how many cases of solubility or non-solubility of particular substances in particular solvents the report may list" (op. cit., p. 113). Hempel nevertheless holds that such a hypothesis is empirical since it is "capable of being confirmed or disconfirmed by suitable observation-reports." There is, of course, no difficulty about confirming this hypothesis in the sense of instantiating it: it will be confirmed each time a substance is observed to dissolve. Hempel does not describe in his articles how it could be *dis*confirmed. Let us see whether it could be.

For Hempel, it will be remembered, an observation-report directly disconfirms a hypothesis if it entails the development of the denial of the hypothesis. The denial of "Every substance is soluble" (H) is "An insoluble substance exists" (*not-H*). The development of *not-H* for objects a, b, . . . n is: "a is insoluble or b is insoluble . . . or n is insoluble." But no observation-report could entail this development; for whereas the fact that something has been observed to dissolve does entail that it is soluble, the fact that something has not yet been observed to dissolve does not *entail* that it is insoluble —a solvent for it may be found tomorrow. Thus H cannot be directly disconfirmed.

But Hempel has suggested to me in a letter that a further step can be taken. We can regard the development of *not-H* as a finite disjunction of *hypotheses* ("a is insoluble," etc.) each of which can in turn be developed for a finite class of possible solvents ("a is insoluble in b, c, . . . n," etc.). An observation-report which entails the development of any one of these alternative, low-level hypotheses directly confirms a statement which, in turn, directly confirms *not-H*. Thus such an observation-report indirectly (if I may expand Hempel's terminology) disconfirms H. But the old difficulty re-appears here.[1] The fact that a has not yet been observed to dissolve in c does not entail that a is insoluble in c. (If I observe a lump of sugar to fail to dissolve in a glass of water, I must not infer that sugar is insoluble in water.) Thus no observation-report can entail that a is insoluble in c, or directly confirm that a is insoluble in everything, or indirectly disconfirm H. And we shall be launched on an infinite regress if we try once more to repair the damage by treating "a is insoluble in c"

[1] Mr. J. Agassi has shown me how to strengthen my argument here.

as a hypothesis, direct confirmation of which would indirectly confirm "*a* is insoluble" and, at two removes, disconfirm *H*; for "*a* was not observed to dissolve in *c'*, *c"*, *c'"*" does not entail that *a* is insoluble in *c'*, *c"*, *c'"*, and so does not entail the development of "*a* is insoluble in *c*" for *c'*, *c"* and *c'"*. However often we develop the developments of "An insoluble substance exists" we shall never succeed in closing the open, unrestricted character of the predicate "insoluble," a predicate which can never be entailed by a finite number of singular observation-statements.

Thus on Hempel's instantiation-theory of confirmation, "Every substance has a solvent" turns out to be confirmable but not disconfirmable. And this is precisely what I should have expected. For *H* entails that, for any particular substance, there exists a solvent *somewhere*, so that if we do discover a solvent we do confirm, whereas if we do not discover a solvent we do not rebut, *H*. This instantial doctrine is compatible with every conceivable finite set of observation-statements and is therefore unempirical.

"All-and-some" statements may, as I have said, constitute falsifiable hypotheses. When is this so? Why do we regard "Everybody has a mother" as a reliable empirical hypothesis and "Everybody has a soul-mate" as a myth? (I use the word "myth" advisedly, for it is typical of myths that they are easy to confirm but practically or logically impossible to test.) My answer here draws on what I said in connection with existential statements. "All-and-some" statements are empirical if they give rise to circumscribed existential statements of a falsifiable kind; otherwise not. "Everybody has a mother such that he has been joined to her only by an umbilical cord" gives us directions for locating any particular person's mother, and thereby lays itself open to falsification. We might trace someone's biography back to his beginnings and find that he had never been joined by an umbilical cord to anyone but had started life in a test-tube. "Everybody has a soul-mate *somewhere*" gives me no directions for locating my soul-mate and would not be falsified by my failure to find her. An "all-and-some" statement is unempirical if it can only give rise to purely existential statements about instances of its existentially quantified variable. Professor Urmson has recently given renewed currency to the idea that Popper's falsifiability-criterion of empirical science (Urmson follows tradition in wrongly calling it a criterion of significance) is overthrown by the fact that we can "easily construct a statement which is neither conclusively falsifiable nor conclusively verifiable by making it contain both the unverifiable 'all' and the unfalsifiable 'some'" (*Philosophical Analysis*, p. 113). The boot is on the other foot. It is unfalsifiable "all-and-some" statements which are properly set aside as unempirical by Popper's criterion.

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A hypothesis which postulates an empirically testable relation between instances of two variables may be given the form of an ordinary universal scientific hypothesis by re-formulating it as a hypothesis which ascribes a relational property to instances of one universally quantified variable. Thus "Everybody has a mother" may be re-formulated as, "Everybody is mothered." Henceforth, I shall, for convenience, confine the name "all-and-some" to unempirical statements of this form.

The negation of an "all-and-some" statement is unfalsifiable because what it negates is unverifiable, and unverifiable because what it negates is unfalsifiable.[1]

IV

There are, so far as I can see, four possible ways in which a logical empiricist might try to defend the "analytic/empirical" dichotomy against these counter-examples. (1) He might declare "all-and-some" statements to be *meaningless*. (2) He might describe them as methodological *prescriptions* disguised as ontological descriptions. (3) He might maintain that an "all-and-some" statement is really a disguised definition, an *analytic* stipulation that two predicates (e.g. "substance" and "soluble") which in ordinary language have different applications are henceforth to have the same application. (4) He might weaken his criterion of *empirical* until it covers "all-and-some" statements. I will consider these defensive moves in turn.

(1) During the last few pages the empiricist-minded philosopher may have found it hard to contain his impatience. "I grant," he might say, "that you have successfully defended Popper's falsifiability-criterion by showing that the kinds of unfalsifiable statements which have been cited against it are in fact unempirical. But your very success here is ruinous to your main thesis. You are trying to establish the existence of *significant* counter-examples to the "analytic/empirical" dichotomy. But in showing that these unfalsifiable statements make no observable difference you demonstrate their vacuity and meaninglessness. Waste no more time on them." Thus Mr. Stuart Hampshire characterizes what he calls "multiply general sentences" (which bear a family resemblance to "all-and-some" sentences) as "meaningless" in an "artificially restricted but now familiar and useful sense."[2]

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[1] The negation can be expressed symbolically either by "$(Ex)\ \overline{(Ey)R(x,y)}$" (e.g. "Something exists such that nothing exists in which it is soluble"), or by "$(Ex)\ (y)\overline{R(x,y)}$" (e.g. "Something exists which is insoluble in everything").

[2] *Analysis*, March 1950, p. 76. "A multiply general sentence," he says, "is so constructed that no singular statement can be formulated which entails or is compatible with it." A sentence of this type "involves the double [or treble]

The charge that "all-and-some" statements are meaningless (and also the claim that they are prescriptive or analytic) can be rebutted by emphasizing their logical continuity with other statements which are undoubtedly meaningful (and neither prescriptive nor analytic). Consider the following series:

(i) Circumscribed existential statements which locate some easily identified object within some easily explored region, and which are both falsifiable and verifiable.

(ii) Universal scientific hypotheses which are falsifiable but not verifiable.

(iii) Purely existential statements which are unfalsifiable but verifiable.

(iv) "All-and-some" statements which are unfalsifiable and unverifiable.

An instance of (iii) can always be turned into an instance of (i) by circumscribing the region to which it applies, and an instance of (iv) can always be turned into an instance of (ii) by further specifying the relation between its variables so as to make the relation testable. Thus purely existential statements are weak entailments of circumscribed existential statements, and "all-and-some" statements are weak entailments of scientific hypotheses. "All-and-some" statements give rise to purely existential statements which are negations of scientific hypotheses. Consequently, a logical empiricist who resorted to the *ad hoc* tactic of singling out "all-and-some" statements as pseudo or meaningless would be committed to the strange view that a bogus statement can give rise to, and be entailed by, and be incompatible with, genuine statements.

(2) As an informal but realistic account of the way "all-and-some" doctrines operate in intellectual life, there is much to be said for the prescription-interpretation. One may catch the force of a research-worker's adherence to determinism better by regarding it as a resolve to look for causal connections rather than as a belief that they exist. But since these doctrines are entailed by scientific hypotheses, to characterize them formally as prescriptions would clearly be to commit the naturalistic fallacy. If factual statements cannot

occurrence of the sign of unrestricted generality, the second being implicit or half-concealed." He says that such sentences "have played an important part in philosophical arguments" and mentions determinism as an example. "All-and-some" statements differ from the sentences he describes in having existential as well as universal quantification and in giving rise to purely existential assertions. My attention was drawn to Mr. Hampshire's article by Mr. R. M. Hare and Mr. E. A. Gellner who, with Professor A. J. Ayer and Mr. J. Watling, have greatly helped me to clarify my ideas.

entail prescriptions, "all-and-some" statements cannot be pre-scriptions.

(3) That "all-and-some" statements are analytic may be suggested by their compatibility with all observation-statements. But it is a mistake to suppose (as, for instance, Mr. Warnock appears to suppose in his discussion of the "all-and-some" doctrine "Every event has a cause"[1]) that such compatibility entails complete vacuousness. "All-and-some" statements are neither vacuous nor analytic because they are *not* compatible with all scientific hypotheses. Thus although "Every substance has a solvent" is compatible with "Gold has never been observed to dissolve" it is not compatible with the falsifiable hypothesis "Gold is insoluble." Haunted-universe doctrines (as I call the more arresting and influential examples of "all-and-some" doctrines) can function as *regulative* principles in scientific research precisely because they are incompatible with, and forbid the construction of, certain hypotheses. A principle which forbade nothing would regulate nothing. Such metaphysical principles lie, not beyond the combined "analytic/empirical" area, but between its constituent areas. They are synthetic and an omniscient mind would know which are true and which are false.

(4) The logical empiricist may, if he wishes, weaken his criterion of empirical meaningfulness until, by allowing statements which are compatible with every observation-statement, it ceases to be threatened by the kind of counter-example which I have been examining. If he does this, logical empiricism, which began with such a bang, will have evaporated without a whimper.

V

In this paper I have confined myself to a formal account of the structure and status of one kind of metaphysical principle. To bring the idea of haunted-universe doctrines to life and to show its philo-sophical, methodological and ethical importance, a good deal more needs to be said. First, the idea needs historical illustration; and the history of thought is very rich in illustrations: the mechanistic world-view of Hobbes, Descartes, Boyle and Newton is one powerful example, and the wave or field world-view of Faraday is another. Secondly, the role of haunted-universe doctrines as principles regu-lating the formation of scientific theories needs a proper examination. Thirdly, what light does their existence throw on the character of philosophical problems and on the problem-solving activities of classical philosophers? Fourthly, what light does it throw on moral

[1] *Logic and Language* II, p. 107.

and political philosophy? Finally, since influential haunted-universe doctrines are neither demonstrable nor testable, it becomes urgent to investigate the ways in which they can be rationally supported and criticized. I shall try to deal with these matters on another occasion.

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