

# Logical Empiricism \*

HERBERT FEIGL

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## POSITIVISM, NOT NEGATIVISM

Probably the most decisive division among philosophical attitudes is the one between the worldly and the other-worldly types of thought. Profound differences in personality and temperament express themselves in the ever changing forms these two kinds of outlook assume. Very likely there is here an irreconcilable divergence. It goes deeper than disagreement in doctrine; at bottom it is a difference in basic aim and interest. Countless frustrated discussions and controversies since antiquity testify that logical argument and empirical evidence are unable to resolve the conflict. In the last analysis this is so because the very issue of the jurisdictional power of the appeal to logic and experience (and with it the question of just what empirical evidence can establish) is at stake.

It seems likely that this situation in philosophy will continue as long as human nature in its relations to its cultural environment remains what it has been for the last three or four thousand years. The tough-minded and the tender-minded, as William James described them so brilliantly, are perennial types, perennially antagonistic. There will always be those who find this world of ours, as cruel and deplorable as it may be in some respects, an exciting, fascinating place to live in, to explore, to adjust to, and to improve. And there will always be those who look upon the universe of experience and nature as an unimportant or secondary thing in comparison with something more fundamental and more significant. This tendency of thought may express itself theologically or metaphysically. It may lead to a faith in extra-mundane existence, or it may in various attenuated fashions assert merely the supremacy of some rational or intuitive principles.

Empiricism, Skepticism, Naturalism, Positivism, and Pragmatism<sup>1</sup> are typical thought movements of the worldly, tough-minded variety. Respect for the facts of experience, open-mindedness, an experimental trial-and-error attitude, and the capacity for working within the frame of an incomplete, unfinished world view distinguish them from the more impatient, imaginative, and often aprioristic thinkers in the tender-minded camp. Among the latter are speculative metaphysicians, intuitionists, rationalists,

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<sup>1</sup> Disregarding some of James' own tender-minded deviations.

and absolute idealists. An amusing anecdote concerning two celebrated contemporary philosophers has become widely known. One considers the other muddle-headed and the other thinks the one simple-minded. This fairly epitomizes the history of philosophy, that grandiose "tragicomedy of wisdom." <sup>2</sup> Plato and Protagoras, St. Thomas and William of Ockham, Spinoza and Hobbes, Leibniz and Locke, Kant and Hume, Hegel and Comte, Royce and James, Whitehead and Russell are in many regards, though of course not in every feature, outstanding examples of that basic difference.

Inasmuch as this divergence of attitudes establishes a continuum of positions between extremes, there is also among the tough-minded thinkers a gradation of shades from a nominalistic, pan-scientific radicalism to a more liberal, flexible form of empiricism. Typical among the radicals is the use of the phrase "nothing but." We are familiar with this expression from earlier doctrines, such as *materialism*: "Organisms are nothing but machines." "Mind is nothing but matter." "The history of ideas is only an epiphenomenon of the economic processes." We also know it from *phenomenalism*: "Matter is nothing but clusters of sensations." Or from *nominalism*: "Universals are mere words." Or from *ethical skepticism* and *relativism*: "Good and evil are no more than projections of our likes and dislikes."

One of the great merits of logical empiricism lies in the fact that it is conscious of the danger of these reductive fallacies. It may not always have been able to avoid them. A young and aggressive movement in its zeal to purge thought of confusions and superfluous entities naturally brandishes more destructive weapons than it requires for its genuinely constructive endeavor. But that is a socio-psychological accident which in time will become less important. The future of empiricism will depend on its ability to avoid both the *reductive* fallacies of a narrowminded positivism—stigmatized as *negativism*—as well as the *seductive* fallacies of metaphysics. Full maturity of thought will be attained when neither aggressive destruction nor fantastic construction, both equally infantile, characterize the philosophic intellect. The alternative left between a philosophy of the "Nothing But" and a philosophy of the "Something More" is a philosophy of the "What is What." Thus an attitude of *reconstruction* is emerging: an attitude which recognizes that analysis is vastly different from destruction or reduction to absurdity, an attitude that is favorable to the integration of our knowledge, as long as that integration is carried on in the truly scientific spirit of caution and open-mindedness. The reconstructive attitude demands that we describe the world in a way that does not impoverish it by artificial reductions, and it thus requires that we make important distinctions wherever there is an objective need for them. But, on the other hand, the empiricist will with equal decision reject wishful thinking of

<sup>2</sup> In a shrewd and entertaining book, *Die Tragikomoedie der Weisheit*, R. Wahle many years ago rewrote the history of philosophy from a positivistic point of view.

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all sorts, the reading into experience of features which are incapable of test and the multiplication of entities beyond necessity.

It would be puerile optimism to hope that out of such revision and reform should grow a generally accepted philosophy to end all philosophies. But what may seem questionable as an historical prediction may yet be justifiable as a working attitude in a living enterprise. The spirit of enlightenment, the spirit of Galileo, of Hume, and of the French Encyclopedists is fully alive again in the contemporary encyclopedists of a unified science. These modern logical empiricists hope to have freed themselves from the naïveté and dogmatism of the various nineteenth-century materialists and monists. They are conscious of their philosophy's rôle as a turning point in the history of critical thought. Nevertheless, they do not claim originality, for they are aware that the empirical and analytic trend in philosophy is no less persistent than the speculative and intuitive approach, though it is admittedly less spectacular and popular. The tradition they now represent has centered its chief inquiries around the two humble questions, "What do you mean?" and "How do you know?" The systematic pursuit of meaning by the Socratic method and the searching scrutiny of the foundations of knowledge are thus again declared the genuine task of philosophy, a task which differs from the quest for truth as carried on by science and yet is most intimately related to it.

Neither the construction of a world view nor a vision of a way of living is the primary aim. If through the progress of knowledge and through social, political, and educational reform one or the other objective is pursued, philosophy in its critical and clarifying capacity may aid or guide such developments. But it cannot, by mere reflective analysis, *prescribe or produce* them. Quackish and dilettantish projects in both directions have always been abundant and cheap in the market of ideas. The main contribution that philosophical reconstruction can make in this regard lies in the direction of an education toward maturer ways of thinking, thinking which possesses the virtues characteristic of science: clarity and consistency, testability and adequacy, precision and objectivity. Immature attitudes are associated with attempts to explain experience in ways which lack the distinguishing marks of science. Certain of these pre-scientific modes of explanation, like the magical, the animistic, and the mythological, are nearly defunct; others, like the theological and the metaphysical, still prevail.

Throughout its history philosophy has been the particular stronghold of verbal magic. By purely verbal means it has tried to explain things which only science could explain or which cannot be explained at all. In the process it creates its own perplexities, and at its worst it attempts the "solution" of these pseudo-problems—problems arising only out of linguistic confusion—by means of pseudo-techniques—more verbal magic. Analysis teaches us that all this is altogether unnecessary. Thus, if a little

levity be permitted, we may define philosophy as the disease of which it should be the cure.

#### THE ANALYSIS OF LANGUAGE AND THE MEANINGS OF "MEANING"

The systematic pursuit of the problem of meaning by means of a logical analysis of language distinguishes Logical Empiricism from the earlier, more psychologically oriented types of Empiricism, Positivism, and Pragmatism. The imperative need for a logic of language was impressed upon scientists and logicians most poignantly in the last few decades. Just as the seminal ideas of some nineteenth-century philosophies originated in a scientific achievement (Darwin's theory of evolution) so twentieth-century Logical Empiricism was conceived under the influence primarily of three significant developments in recent mathematics and empirical science. These are the studies in the foundations of mathematics (led by Russell, Hilbert, and Brouwer), the revision of basic concepts in physics (advanced especially by Einstein, Planck, Bohr, and Heisenberg) and the reform of psychology by the behaviorists (Pavlov, Watson, et al.). Though very different in context and subject-matter, these three developments focussed attention on the necessity for an inquiry into the limits and structure of meaningful discourse. Russell, through his discovery of logical and mathematical paradoxes, could show that traditional logic had to be revised and that certain laws, like his rule of types, had to be incorporated in logic in order to avoid inconsistencies in the very foundations of mathematics. Einstein, in his analysis of the electro-dynamics of moving bodies, was led to a most revolutionary critique of such basic concepts as simultaneity, length, duration, and mass. Thus he showed that the traditional phraseology of "absolute space" and "absolute time" was in certain important respects devoid of the factual meaning it was supposed to possess. Analogous revisions of basic concepts, touching also on the principle of causality, resulted from the elaboration of the theory of quanta. Finally, by developing objective procedures for the study of mental life, the behaviorists made us aware of the fact that all of the scientific content of psychology can be formulated in the physical language<sup>3</sup> and that the assumption of a "something more," a surplus of factual meaning attached to mentalistic terminology, is an illusion. (Earlier reductive naïvetés were gradually eliminated here, as elsewhere.)

Whatever the future of mathematics, physics, and psychology may decide about the theoretical content of these recent ideas, we have, in any case, been awakened once for all to the need for logical analysis, and we have been witnesses to the fruitfulness of its results.

<sup>3</sup> I. e., the language whose undefined, primitive terms are spatiotemporal coördinates (referring to observable or measurable locations and dates) and thing-predicates (referring to observable properties of things).

Three disciplines are being developed to carry out this task of clarifying language and meaning. *Pragmatics* investigates the functions of language in its full biological, psychological, and sociological setting. Here language in its relation to behavior is the primary object of study. By two successive steps of abstraction the disciplines of *semantics* and *syntax* are arrived at. Semantics analyzes the meaning of terms and expressions. Its studies center about the relation of designation and the concept of truth. While pragmatics is interested predominantly in the expression and appeal function of language, semantics explores the symbolic or representative aspect of language. Syntax, finally, ignores even the meaning-relation and studies exclusively the connections of linguistic signs with each other. It systematizes the purely formal, structural rules for the formation of sentences and the transformation rules of logical derivation.

Granting that language as used in common life serves in a fusion or a combination of various functions, it would seem imperative that some sort of theoretical separation of functions be undertaken for the sake of greater clarity and the avoidance of confusion. The list below is the result of such an analysis. Among the dozens of meanings of "meaning" we shall enumerate only those which are of prime importance for philosophical purposes.

THE FUNCTIONS OF LANGUAGE, OR THE MEANINGS OF "MEANING"

Cognitive meanings (Informational function)	Non-cognitive meanings (Emotive expression and appeal function)
<i>Purely formal</i>	<i>Pictorial (Imaginative)</i>
<i>Logico-arithmetical</i>	<i>Emotional (Affective)</i>
<i>Factual (= Empirical)</i>	<i>Volitional-motivational (Directive)</i>

This table, correctly understood and properly used, is a powerful tool in the disentanglement of the traditional puzzles of philosophy. Many metaphysical "problems" and their "solutions" depend upon the erroneous presumption of the presence of factual meaning in expressions which have only emotive appeals and/or a formally correct grammatical structure. And many an epistemological question has been obscured by mistaking logico-mathematical for factual meanings. It is such confusion or erroneous pretense that is exposed to criticism on the basis of our table of meanings. No evaluation of the functions of language as such is implied. Emotive appeals are indispensable in the pursuits of practical life, in education, in propaganda (good or bad), in poetry, in literature, in religious edification and moral exhortation. Some of the highest refinements of our civilized existence depend upon the emotional overtones of spoken and written language.

However, Logical Empiricism as an approach in the theory of knowl-

edge is primarily concerned with *cognitive* meanings. It avoids the errors of the psychologistic approach by the sharp distinction between the pictorial connotations of words, i. e., the imagery that accompanies their use, and the syntactical-semantic *rules* that govern their use. The meaning of words, then, or of signs quite generally, consists in the way in which they are used, the way they are connected with other words or related to objects of experience. The *definition* of a term, the declaration of its meaning, amounts to a statement of the rule according to which we employ or intend to employ the term. Dictionary definitions are translations of relatively less familiar into relatively more familiar expressions; the meaning of the latter is presupposed. Logical analysis, however, pushes beyond these familiar terms of common language. By stepwise procedures all terms are reduced to a comparatively small number of basic or primitive terms. Though further verbal definition is then still possible—no term can be said to be “indefinable”—to continue the process may turn out to be unenlightening and hence fruitless. At this point we must connect language with something outside of language, with experience. Thus in all full definitions of empirical terms there is a terminal ostensive step as an indispensable ingredient. In contradistinction to this, the symbols of purely logical or mathematical systems are introduced (i. e., whatever meaning they have is defined) by relating them only to each other by formal rules. In applied mathematics, as in every language with empirical reference, these purely formal or syntactical rules are supplemented by semantic rules that correlate at least some of the symbols with items of experience.

Philosophical or logical analysis, in the sense of a clarification of the meaning of language, differs from *philological* analysis in at least three important respects. First, logical analysis concentrates on terms of basic importance for the representation of knowledge. The more general these terms the greater is the danger of various confusions due either to unclarity in type of meaning or simply to vagueness or ambiguity of meaning. Hence the necessity and the value of such an analysis as a therapeutic measure. Second, the logical reconstruction is independent of the grammatical (and *a fortiori* the emotive) peculiarities of the specific language, living or dead, in question. Inasmuch as it is the cognitive meanings that we are interested in, idealized models, or in the extreme limit, an ideal language (something in the direction of Leibniz' *Mathesis Universalis*) may be used. The tools developed in modern symbolic logic prove of utmost value for this purpose. Third, logical analysis is usually *directed* analysis. That is to say, it is either *postulational codification* (as in the mathematical and the exact empirical sciences) or *epistemological reduction* (the reconstruction of factual terms and propositions on a basis of observational evidence).

A characteristic difference between two types of procedure in logical

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analysis is worth observing. Wittgenstein, very much like G. E. Moore before him, and like the English analytic school on the whole, pursues the Socratic task in a casuistic fashion; individual confusions are subjected to elucidation. It is the specific case that is treated, and the general theory of the treatment is not elaborated systematically. Carnap and his followers, on the other hand, proceeded with the development of a complete system, very much like Whitehead and Russell in *Principia Mathematica*. A whole system is set up, and the theory of the machinery fully set forth. In the course of later developments this difference in procedure became associated with another one; in their choice of a basis for logical reconstruction, Wittgenstein, followed by Schlick, Waismann, and others, remained experientialistic, whereas Neurath, Carnap, Hempel, and others became physicalistic.

#### THE CRITERION OF FACTUAL MEANING AND THE CRITIQUE OF METAPHYSICS

The most important, the most widely debated, and, unfortunately, the most frequently misunderstood regulative principle used by Logical Empiricism is the criterion of factual meaningfulness. The purpose of this criterion is to delimit the type of expression which has possible reference to fact from the other types which do not have this kind of significance: the emotive, the logico-mathematical, the purely formal, and—if there should be such—the completely non-significant.

If it is the ostensive steps that connect a purely formal array of signs (e. g., words) with something outside of language, no sign or combination of signs can have factual meaning without this reference to experience. Furthermore, if a sentence is considered true when it corresponds to an existing state of affairs, a sentence is factually-meaningful only if we are in principle capable of recognizing such states of affairs as would either validate or invalidate the sentence. If we cannot possibly conceive of what would have to be the case in order to confirm or disconfirm an assertion we would not be able to distinguish between its truth and its falsity. In that case we would simply not know what we are talking about. C. S. Peirce's pragmatic maxim, formulated in his epoch-making essay, "How to Make Our Ideas Clear,"<sup>4</sup> has essentially the same import. We may paraphrase it crudely: A difference that is to be a difference (i. e., more than merely a verbal or an emotive one) must *make* a difference. Or, a little more precisely: If and only if assertion and denial of a sentence imply a difference capable of observational (experiential, operational, or experimental) test, does the sentence have factual meaning. Another useful formulation is Ayer's:<sup>5</sup> "It is the mark of a genuine factual proposition

<sup>4</sup> *Popular Science Monthly*, Vol. 12, 1878. Reprinted in *Chance, Love, and Logic*, and in *Collected Papers of C. S. Peirce*, Charles Hartshorne and Paul Weiss, eds.

<sup>5</sup> A. J. Ayer, *Language, Truth, and Logic*, p. 26.

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. . . that some experiential propositions can be deduced from it in conjunction with certain other premises without being deducible from these other premises alone." This is simply empiricism brought up to date. The psychologistic formulations, an example of which may be found in Hume (ideas must have their basis and origin in impressions), are replaced by logical ones. The most helpful exposition of these concepts for physical scientists was given by P. W. Bridgman.<sup>6</sup> Realizing the close relationship between knowledge and action, or as Dewey would put it, the place of meaning in the context of inquiry, he asks by what procedures we decide the validity of our assertions. Thus Bridgman maintains that concepts and assertions are meaningless if no operations can be specified that define the former and test the latter.

It was, however, a typical reductive fallacy on the part of Auguste Comte to rule out as meaningless such a question as that concerning the chemical constitution of the stars because at that time no procedure was known to answer that question. Of course we can hardly blame him for not having conceived of spectroscopy before Bunsen and Kirchhoff developed it, yet even in Comte's day it should have been clear that the impossibility of solving that problem was neither a physical nor a logical one. It was a technical-practical difficulty of the sort that may have a bearing on the fruitfulness of an inquiry but certainly not on the meaningfulness of a question. Similar reductive fallacies are inherent in the insistence of some of the more radical positivists that only *directly* and *completely* verifiable or refutable sentences are factually meaningful. Although most of these thinkers never intended as drastic a restriction of meaningful discourse as they were accused of doing in effect,<sup>7</sup> it seems terminologically more convenient today to classify as factually-meaningful all sentences which are in principle capable of being confirmed or disconfirmed, i. e., capable of at least indirect and incomplete test.

Thus in a general classification of sentences and expressions we distinguish today: (1) Logically true sentences, also called analytic sentences. (2) Logically false sentences, also called contradictions. These sentences are true or false, respectively, by virtue of their form. Even if descriptive empirical terms are contained in them they function only "vacuously," and their factual reference is irrelevant to the validity of the sentence. (3) Factually true and (4) factually false sentences whose validity depends upon their correspondence to observed fact. In the majority of instances this correspondence or non-correspondence is only incompletely and indirectly indicated by whatever is immediately observable. Therefore these sentences are usually not *known* to be true or false but

<sup>6</sup> In *The Logic of Modern Physics*, New York, 1927.

<sup>7</sup> Scientific laws, hypotheses, and theoretical assumptions, for example, were considered by them perfectly legitimate frames for the formation of empirical sentences although, by terminological decision, they were not classified as genuine propositions.

are considered to be confirmed or disconfirmed to an extent which may vary considerably with the accumulation of favorable or unfavorable evidence. (5) Emotive expressions without cognitive meaning and the emotive components of otherwise cognitive expressions. Pictorial, figurative, and metaphorical expressions, exclamations, interjections, words of praise or blame, appeals, suggestions, requests, imperatives, commands, questions, and prayers belong to this category. Even in definitions we recognize a motivational element: the resolution or invitation to use a term in a certain way.

In the light of the preceding distinctions, we may say that an expression is devoid of empirical meaning (i. e., of factual reference) or, briefly, is *factually-meaningless*, if it belongs to any one or several of the following five groups: (a) Expressions violating the syntactical formation-rules of a given language; (b) Analytic sentences; (c) Contradictory sentences; (d) Sentences containing extra-logical terms for which no experiential or operational definitions can be provided; (e) Sentences whose confirmability, i. e., even indirect and incomplete testability-in-principle, is logically excluded by the assumptions of the system of which they are a part.<sup>8</sup>

As indicated above, the positivistic critique of metaphysics is primarily an attack upon confusions of meanings and is not intended as a wholesale repudiation of what has been presented under that label. In point of fact, "metaphysics" has been used in such a wide variety of ways that here also a little logical analysis of meanings is indispensable. The customary definitions of metaphysics as the discipline concerned with "first principles" or with "reality as a whole" are not illuminating as long as the methods of procedure remain unspecified. From the point of view of method, then, we may distinguish intuitive, deductive, dialectical, transcendental, and inductive metaphysics.

To take the last-mentioned first, we may say that inductive metaphysics, in the sense of a speculative cosmology derived by extrapolation from scientific evidence and scientific theory, need not contain factually-meaningless elements at all. There is no sharp line between the inductive generalizations of common sense and science on one side and those of cosmology on the other. It scarcely needs to be mentioned that metaphysics in *this* sense, though *logically* unassailable, is open to criticism from the point of view of the criteria of adequacy and precision,

<sup>8</sup> Illustrations: ad (a): "Soft is the square of green." "Nor here I you neither was." Also, Hegel's famous definitions of light and heat (these suffer as well from the defect classified under d). ad (b): "Octogenarians are more than ten years old." "Birds can build nests without previous training because they have nest-building instincts." ad (c): "Octogenarians are sometimes more than ninety years old." Also, H. G. Wells' idea of a time-machine. ad (d): "Entelechies are responsible for the adaptability of organisms to their environment." "The true essence of electricity is undiscoverable." ad (e): The ether hypothesis; and metaphysical realism—both as discussed below.

reliability and fruitfulness. Conjectures regarding the heat-death of the universe, the origin of life, and the future of evolution may be perfectly meaningful. But anyone with even a superficial acquaintance with scientific method will realize how uncertain and vague these guesses must be. Occasionally they may be valuable as suggestions for new approaches in scientific research, but with the exception of a few notable instances like the ancient atomic hypothesis, they are apt to remain barren, if not actually misleading. Inductive metaphysics is thus merely the risky, sanguine, disreputable extreme of science.

The critique of meaning, however, applies with full force to the other approaches in metaphysics. *Deductive* metaphysics indulges in the rationalistic practice of producing factual conclusions of a relatively specific character from a few sweepingly general (and often completely vague) premises. It thus misconstrues the nature of logical derivation and is guilty of a confusion of logical with factual meaning. Similarly, dialectical metaphysics, especially the Hegelian, confuses what may—most charitably interpreted—appear as a psychological thought-movement or as a form of historical processes with the logical forms of inference. Intuitive metaphysics, convinced of the existence of a privileged shortcut to “Truth,” mistakes having an experience for knowing something about it. Then, too, it is habitually insensitive to the distinction between pictorial and emotional appeals and factual meaning. Finally, transcendental metaphysics in its attempt to uncover the basic categories of both thought and reality may turn out to be nothing else than an unclear combination of epistemology and cosmology, which is then dignified with the name “ontology.” It could thus be salvaged and restated in purified form. But it is precisely in ontology that we find the greatest accumulation of factually-meaningless verbalisms. Speculations concerning the “Absolute,” even if not entirely devoid of empirical components, generally contain an ample measure of “absolutely” untestable pseudo-propositions. The customary excuse that further experience or reasoning will validate these ideas has no bearing on the question of meaningfulness. The most a patient empiricist can do here is to hope that doubtful promises to define empirically the terms, used so far only emotively, will sometime be fulfilled. But until that happens, the empiricist will fail to attach any glimmering of factual-meaning to the metaphysics which rotates about these terms.

To the empiricist one of the most gratifying trends in the history of science is the gradual liberation of theory from metaphysical bondage. The ideas of absolute space, time, and substance, of numbers as real entities, of the cause-effect relation as an intrinsic necessity, of vital forces and entelechies, and of all manner of obscure faculties and mythical powers have gradually disappeared from respectable science as it was seen that they were either ad hoc explanations or samples of verbal legerdemain or both. One incident in this process of growing epistemological sophis-

tication must suffice for illustration. When after many experiments (Fizeau, Michelson-Morley, de Sitter, Trouton-Noble) physicists realized that it was hopeless to look for effects of the universal ether upon moving bodies, some of them were nevertheless not ready to give up the ether hypothesis. H. A. Lorentz, certainly one of the greatest physicists, pardoned the ether of its undiscoverability by postulating an ingenious set of assumptions, which jointly guaranteed that whatever effects might be produced by the ether, such effects would be exactly cancelled by other counter-effects. Einstein very soon afterwards realized that by this token the stationary-ether hypothesis had become not only scientifically superfluous but strictly meaningless as well. An essentially similar situation prevailed long before in the Newton-Leibniz controversy regarding absolute space and time in which Leibniz used arguments very much like those of the modern pragmatists and positivists.

A word of warning should not be amiss here. The danger of a fallaciously reductive use of the meaning-criterion is great, especially in the hands of young iconoclasts. It is only too tempting to push a very difficult problem aside and by stigmatizing it as meaningless to discourage further investigation. If, for example, some of the extremely tough-minded psychologists relegate questions such as those concerning the instincts, the unconscious, or the relative rôles of constitution and environment to the limbo of metaphysics, then they cut with Ockham's razor far into the flesh of knowledge instead of merely shaving away the metaphysical whiskers. No meaningful problem is in principle insoluble, but there is no doubt that the human race will leave a great many problems unsolved.

#### THE LOGICAL ANALYSIS OF EMPIRICAL KNOWLEDGE

The question "How do we know?" presupposes the question "What do we mean?", and in the pursuit of both these questions we find ourselves urged to reconstruct our knowledge and to justify its truth-claims on a basis of observational evidence. Not the origin and psychological development of knowledge but its logical structure and empirical validation are the subject of a thus reformed epistemology. The psychology of knowledge (from the experimental study of discrimination behavior on the animal level to the scarcely begun investigation of the higher creative thought processes on the human level) is, after all, only one among the sciences and, therefore, itself one of the subjects of epistemological analysis.

As we shall deal with logical and mathematical knowledge somewhat more fully in the next section, only a few words are necessary to delimit it from empirical knowledge. A pair of Kant's distinctions, though not his philosophy as it elaborates them, are most helpful here. He distinguished between analytic (i. e., true by definition) and synthetic (i. e., factual) sentences and between *a priori* (i. e., logically independent of experience) and *a posteriori* (i. e., empirical) validity. All forms of em-

iricism agree in repudiating the existence of synthetic *a priori* knowledge. Here the logical empiricists differ from the pre- and the post-Kantian rationalists, from Kant and the Neo-Kantians, as well as from Husserl, the phenomenologists, and the English intuitionists. Logical Empiricism, with Hume and Leibniz, places both mathematical knowledge and formal logic in the class of analytic and hence *a priori* truth. In this respect, Logical Empiricism differs from the extreme empiricism of Mill, who considered mathematics and most of logic synthetic *a posteriori*. We agree with Mill, however, in the statement that all factual knowledge depends for its validity upon confirmation by experience.

As a consequence of all this, the concept of truth is disclosed to be ambiguous. In mathematical knowledge truth amounts to accordance with the formal (syntactical) definitions, the postulates, of the system. In the factual context it means accordance with the empirical definitions, the semantical rules. Thus we call a sentence true if its terms are so applied to fact that none of the designation-rules of the language in question are violated. Error, whatever its source may be (illusion, misinterpretation of evidence, or only misspeaking), simply consists in the disrupting of the one-to-one or many-one correspondence between the terms in the sentence and their referents, i. e., the constituents of the facts described. This version of the "correspondence" view of truth has none of the psychologistic inadequacies of the earlier "copy" or "picture" versions.

Yet we are guilty here of one gross oversimplification, if not distortion, of the actual situation. We presupposed that sentences can simply be confronted with the states of affairs which they claim to represent. At best, this is the case for the sentences describing facts of direct observation, and even this has been seriously disputed by many a full-fledged empiricist. But whatever the status of these basic observational (or "protocol") sentences may be, it is obvious that most of our knowledge, and especially almost all of the more interesting and important part of it, is highly indirect. It is shot through with interpretation, construction, and inference, and consequently is dependent on very general assumptions. It is here that empiricism finds itself confronted with what is traditionally considered to be its greatest problem: the validity of inductive inference and the meaning of probability. All attempts to "justify" inductive inference on rational, empirical, intuitive, or probabilistic grounds have turned out to be utter failures. Hume's critique stands still unshaken. If all *a priori* knowledge is analytic, then we cannot deduce a synthetic assertion, like the principle of the uniformity of nature, from *a priori* premises. And if we try to validate induction on the basis of its certainly eminent success in the past, we are simply making an induction about induction and thus presuppose the very principle we set out to prove. Similarly question-begging are the intuitive and probabilistic approaches. Both must assume that the samples of the world immediately experienced or statistically observed are

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fair samples, thereby relying also on an implicit premise of uniformity. In the same manner, Kant's ingenious twist of a transcendental deduction depends tacitly upon the constancy of the categories as embedded in our mental organization.

Logical Empiricism cuts the Gordian knot by bluntly asking the question, "What can '*justification*' possibly mean here?" And the surprisingly simple answer is that the only clear meanings of that term in common life and science are *deductive proof* for one thing and exhibition of *inductive evidence* for another. The "great problem of induction," therefore, consisted in the impossible demand to justify the very principles of all justification. If we must have a Principle of Induction, though, it had better be formulated not as a piece of knowledge but as a rule of procedure. As such it turns out to be a tautology with an added directive appeal: If you wish to discover reliable laws, you must try, try, and try again to generalize from a maximum of past experience and as simply as feasible. Then, if there is an order in nature, not too deeply hidden or too complicated, you will find it.

In this manner we are able to avoid the skeptical and psychologistic features of Hume's animal faith doctrine. Anxious to avert metaphysical pseudo-solutions, Hume concluded with a reductive fallacy by declaring inductive inference irrational. Here even the illustrious Hume created a pseudo-problem by a misuse of terms. In ordinary language we call a person "rational" if he is capable of learning from experience. Thus "rationality" does not even predominantly mean logicity in the narrower sense of formal consistency. The procedure of induction, therefore, far from being irrational, defines the very essence of rationality. The stubborn but misguided demand to know what we really don't know (or don't know yet) is perhaps only one of the expressions of an infantile quest for certainty.

A very similar, albeit somewhat more complex, group of confusions underlies the even more hotly argued issues of *the reality of the external world* and *the existence of other minds*. Reductive and seductive tendencies have dominated the scene here as elsewhere. Phenomenalists and subjective idealists, who rightly observe that knowledge must remain within the scope of experience (but note how vague that is), arrive at the conclusion of the immanence of the world within the human mind. (Any need to emphasize how absurd that is?) And metaphysical realists on the other hand, soundly maintaining that human experience is part and parcel of nature (very vague again), define the relation of subjective experience to the objective world in such a way that our knowledge of that world becomes something of a mystery, if not an outright impossibility. This has the logical result of making statements about the world by definition incapable of test. Analogous positions are taken in regard to the existence of "other minds."

Empirical Realism, held by most logical empiricists, removes the meaningless and the absurd elements from the contending philosophies in order