Proceedings of the Twelfth International Congress of Philosophy, 4, 1960, pp. 331-337.

PATRICK SUPPES

PROBLEM ANALYSIS AND ORDINARY LANGUAGE

In the present philosophical climate it is considered modish to pass from a crude question like « What is probability ? » to linguistic questions like « How is the word 'probability' used ? » and « What is the proper syntax of probability-sentences ? ». Moreover, if one asks for a general characterization of a concept like probability, it is fashionable to reply that there can be no general analysis, but that it is sensible to talk about the probability of particular events or propositions. In each particular case the context in which the question is raised will provide a clue as to how the word « probability » is being used and what are the relevant factors to take account of in explicating its meaning or use.

No doubt this method of linguistic analysis has contributed much to the clarification of philosophical problems, particularly of the more vague sort, but I hold that this method is often inappropriate or inadequate for the analysis and resolution of systematic problems. By « systematic problems » I have in mind the kind which arise in logic and the foundations of the empirical sciences. Especially in the case of the empirical sciences the claim is often made that the method of linguistic analysis is to be applied to the analysis of scientific terms by observing the way in which scientists use these terms. At the same time that this kind of suggestion is made, it is usually, even if subtly, implied that there is something philosophically illegitimate about the philosopher proving a new definition of the scientific term which does not exactly jibe with the scientists' usage.

To my mind such a prohibition is unnatural and historically unjustified. It is not possible clearly to separate scientific activity proper from philosophical activity proper. For example, is the exact analysis of the foundations of a given branch of physics a philosophical or a scientific problem? Historically, discussions of the foundations of mechanics are about equally divided among mathematicians, philosophers, and physicists. I maintain that if confusion about a problem of foundations is a conceptual confusion and not doubt about a matter of fact, then the problem of clarification is a philosophical problem, regardless of the professional allegiance of the person addressing himself to its solution.

The view that philosophical problems are, roughly speaking, to be defined as problems of conceptual confusion is, I take it, not far from the view held by linguistic analysts. The difference is to be found in the kind of problems treated and the kind of apparatus used. Detailed consideration of some examples will perhaps elucidate this difference better than would a series of general remarks. The examples are drawn from three fields: statistics, welfare economics and physics. Each problem mentioned is presumed to have the following four characteristics: 1) it does not arise in any obvious way from an inharmonious use of language, 2) it cannot be solved by new appeal to matters of fact, 3) it cannot be classified as a problem of pure mathematics, 4) it arises from or is related to problems which historically have been of philosophical interest.

I. Statistics. In his provocative essay, *Probability*[1], S. E. Toulmin begins by asserting « This subject is one in which the prolegomena are as neglected as they are important ». But in my view the trouble with Oxford oriented philosophers who write about probability and induction is that their writings indicate they have not got beyond the introduction of any modern book on statistics. One of the central problems of contemporary theoretical statistics is to discover good rules for inductive inference and for the taking of risky decisions in the face of uncertainty. The question does not arise of giving some general justification of induction. The problem is rather to provide good, indeed, rational rules of inductive inference or behavior for particular classes of situations. It is to be emphasized as strongly as possible

[1] *Essays in Conceptual Analysis*, edited by A. Flew, London, 1956, pp. 157-191.

that this is not a mathematical problem; what is involved is the discovery and defense of new principles, not mathematical computations on the basis of already accepted rules. The touchstone for evaluating the adequacy of a new proposal is the classical philosophical one of the investigation of consequences and the consideration of counterexamples.

Two particular problems may be used to illustrate the non-linguistic perplexities which arise in the foundations of inductive behavior.

(a) Military intelligence is faced with estimating the number of tanks being produced by the enemy. It is known that one large factory began numbering its tanks with the serial number 25,001. During the past weeks tanks numbered 26,242; 27,251; 28,034 have been captured, all of which came from the given factory. What is the best estimate of the number produced ? The simple maximum likelihood estimate is the unsatisfactory answer 3,034 (that is, 28,034-25,000). The intellectual, non-mathematical problem is to find better, more rational rules of estimation. (Problems of this character were tackled with considerable success during World War II).

From reading Toulmin's essay, one would gather that the solution of (a) is a cut-and-dried matter of pure mathematics. Thus Toulmin says « The sums we did in Algebra about ' the probability of drawing two successive black balls from a certain bag ' were as much *pure* sums as those others about ' the time taken by four men to dig a ditch 3 ft × 3 ft × 6 ft '. The former have no more to do with ' probability ' and throw no more light on what we mean by the term than the latter have to do with ' time ' » (p. 184). Similarly, in his review (« Mind », 1953, pp. 88-99) of Carnap's *Logical Foundations of Probability* Toulmin introduces a numerical mortality table without any mention whatsoever of the problem of statistical inference or estimation involved; for him the estimation of probabilities is a simple matter of computing numerical ratios.

Strawson's treatment of induction in the last chapter of his *Introduction to Logical Theory* is more sophisticated, but the only two principles of inductive inference he mentions are the obvious ones summarized in the statement « it is an analytic proposition, though not a proposition of mathematics, that, other things being equal, the evidence for a generalization is strong in proportion as the number of favorable instances, and the variety of circumstances in which they have been found, is great » (pp. 256-257). Granting without dispute his analyticity claim, I hold that Strawson does not seem to see that the central problem of induction is not prolegomena talk about induction in general but the discovery of further analytic propositions embodying specific principles to deal with specific problems like (a).

(b) A seed and grain distributor wishes to guarantee the proportion Θ of viable seeds in a given lot he has put on the market. He is not really interested in a point estimate of Θ but in knowing that with a very high probability Θ lies in some interval. Such an interval is called a *confidence interval*. Statisticians ordinarily talk about such intervals in the following somewhat mystifying vein: « We now abandon attempts to estimate Θ by a function which, for a specified sample, gives a unique number. Instead we shall consider merely the specification of a range in which Θ lies. We shall not attempt to specify whereabouts in the interval the value of Θ really is; all values in the range have an equal claim to be taken as the 'true' value. Nor shall we assess the probability that Θ lies in the interval in the sense that Θ is regarded as a random variable » (Kendall, *The Advanced Theory of Statistics*, vol. II, p. 62). Some statisticians, notably L. J. Savage, have denied that confidence intervals can be given a behavioral interpretation or that they have any practical application. The issue here are tangled and difficult. Attention to the technical linguistic usage of statisticians might be of some help in resolving them, but it is doubtful that any satisfactory resolution can avoid a substantial re-casting and sharpening of the concepts in terms of which the theory of confidence intervals is now formulated.

II. WELFARE ECONOMICS. Philosophers who consider ethics to be the logical study of the language of morals should be shocked whenever they dip into the literature of welfare economics, for this literature is full of a robust and direct concern with old-fashioned questions like « Is this principle just ? », « Is this distribution of goods equitable ? », « Can the values of one person be directly compared with those of another ? ». As far as I can see, very few of the problems of welfare economics can be solved by linguistic analysis, yet all of the fundamental problems are closely akin to those discussed by classical philosophers like Aristotle, Hobbes, and Kant. That is to say, the failure of linguistic analysis cannot be chalked up to the technical, non-philosophical character of the problems. I mention two rather specific ones.

(a) Equitable decision-making procedures for a social group, be it a legislature, a government committee, or a ladies' tea, have been the subject of much analysis. The naive idea is that the method of majority decision is always fair. The counterexample known as the *paradox of voting* shatters this illusion. Let the issues be A, B, C, and let the group consist of three persons. The first person ranks them A B C; the second, C A B; and the third, B C A. If the voting begins by considering A against B, C will be decided on; if it begins by considering A against C, B will win; and if it begins with B against C, A will win. In other words, which issue wins depends entirely on the order in which they come up for voting. This paradox is at the heart of all the recent economic literature on the existence of rational social decision procedures. In my own judgment this literature is of considerable philosophical interest; it is not clear that the analysis of ordinary language has anything substantial to add to it.

(b) As a raw, politically charged question of value, I mention the problem of a progressive income tax. Determination of the scale of such a tax seems to satisfy my four criteria stated earlier for a problem to be included here. True, as tax committee testimony and tax court litigation amply testify, considerations of matter of fact are highly pertinent to the fixing of tax schedules. But once all the facts are in, the central problem remains of determining and then applying relevant principles of value and welfare. It is, I think, a proper task for a philosopher to lay bare alternative sets of fundamental principles which are or should be used in determining tax policy. And if philosophers disdain such tasks, they should be prepared for the province of social and ethical philosophy to be increasingly governed by economists and other social scientists.

III. Physics. Certain philosophers have found that the uncertainty relationships of quantum mechanics have far-reaching significance for the classical problem of the freedom of the will. The most familiar of these relationships asserts that if simultaneous measurements of position and momentum are made, then

$$\text{(1)} \qquad \sigma_q \, \sigma_p \geq h/2$$

where h is a positive real number, σ_q is the standard deviation of the position, and σ_p is the standard deviation of the momentum. The relevance of this result to any aspect of the free-will problem seems very slight. But the considerations which lead to (1) also suggest the more fundamental question: what can be said about the joint probability distribution of position and momentum? Can such a distribution be derived from the principles of quantum mechanics? Except for special cases the answer is negative, and has as a corollary the somewhat startling conclusion that position and momentum are not simultaneously measurable at all [1]. To provide an exact methodological analysis of this result from the standpoint of quantum theory and classical probability theory is surely one of the most important philosophical problems in the foundations of physics.

The five problems which I have briefly sketched have two important common characteristics. In the first place their solutions are not to be found by mathematical computation, empirical investigation of matters of fact, or analysis of ordinary language. Secondly, they are problems which arise in relatively technical contexts. My claim is that a problem which cannot be solved by mathematical analysis or empirical observation qualifies as a philosophical puzzle, because it arises from conceptual confusion. I have used the phrase 'problem analysis' in the title of this paper, for the specific purpose of emphasizing that philosophy is more nearly to be defined by the problems it treats than by the methods it uses. Not so long ago it was maintained by many philosophers that the paradigm of philosophical analysis was Russell's theory of descriptions. Today many would hold

---

[1] For technical discussion, see J. Bass, *Applications de la mécanique aléatoire à l' hydrodynamique et à la mécanique quantique*, Paris, 1949; and H. Rubin, *Foundations of Quantum Mechanics*, in *Symposium on the Axiomatic Method* (*Berkeley, December*, 1957), North Holland Publishing Co., Amsterdam, 1959.

that Austin's analysis of performatory language is a more suitable one. Either view, it seems to me, implies an untenable reductionistic thesis about philosophical method. There is no single paradigm case which exemplifies philosophical method, for there is no single method. Not even the five problems I have mentioned can be attacked by a common method. For example, the ultimate test of any proposed solution of the paradox of voting may well be its ability to satisfy common, ordinary ideas of justice, but the final word on the simultaneous measurement of position and momentum need satisfy no such test of ordinariness.

The problems I have posed suggest that I consider the major role of philosophy to be the analysis of scientific concepts. My evangelical tone has been adopted only to oppose the rigidities of the new orthodoxy of linguistic method.

Stanford University
STANFORD (California, U.S.A.)