Book Reviews

FOUNDATIONS OF SCIENCE

Metaphysik, Skepsis, Wissenschaft

Zweite, Verbesserte Auflage. By Wolfgang Stegmüller. Pp. xii+459. (Springer-Verlag: Berlin and New York, 1969.) DM 22; $5.50.

This is the second edition of an important work which first appeared in 1954, and includes a lengthy new introduction which supplements the original arguments by reference to more recent discussions that have appeared. Not all these subjects will be of equal interest to readers of *Nature*, for whom probably some of the chief problems discussed, such as adequate definitions and putative justifications of metaphysics (though involving important discussions of the "verifiability theory of meaning", of phenomenalism, physicalism, logico-positivism), or again, the problem of "universal scepticism", will not lie at the focus of their everyday concerns. Nevertheless, there is plenty here that should yield material for reflexion. First of all, there is a very useful chapter, making up about twenty per cent of the book, on the philosophical foundations of logic and mathematics, including a careful and critical survey of the usual schools and the logistic, the intuitionist and the formalist. And all this is treated from the historical and the philosophical or critical point of view. Moreover, the results of the author's previous excursions into metaphysics and evidential foundations are here brought into play in an interesting manner.

This is followed by a chapter, entitled "Objective or Conventionalist Basis of Empirical Knowledge?", and the questions here raised are discussed via three connected problems: (1) the problem of a "basis" for science; (2) the problem of confirmation or proof of empirical statements; and (3) the problem of induction or inductive confirmation of propositions. The problem of the foundation of scientific knowledge receives a most thorough discussion. In some respects, it resembles Bertrand Russell's approach, by postulating a number of presuppositions, such as a principle of linguistic continuity, itself involving a belief in the verisimilitude of memory. But even with such principles we have not as yet enough for a foundation. Basic propositions, reporting observations, are necessarily always controvertible. One may overcome this difficulty by simply "fixing" some among the evidential statements as being incorrigible. The author rejects this as an unacceptable conventionalism. Within a certain given variance-space there may be such arbitrariness; for example, one may have to make a decision as to where within a given measurement-interval a point lies. But there are limits beyond which a judgment does not (or cannot?) fall. There is, however, no logical principle which would guarantee a decision; and the author hence postulates a degree of self-evidence ("evidenz"; in the English literature one thinks of "intuition"), where this aspect of intuition has previously been explained as one of the principal defining characteristics of metaphysics. Here, as in the other sections of this book, the analytical discussion is followed by a historical survey of the problem, such as the theories of Schlick, Neurath, Russell, Tarski, Popper, Carnap and Quine.

The list of these authors will show that Stegmüller belongs to the small but growing group of continental thinkers who try to effect some bridging between Anglo-Saxon and German thought in the philosophy of science. Thus, in the same spirit, there are sections on ontology, on theories of induction (the latter with a penetrating critique of Carnap), and the like.

The new introduction attempts to bring the text more up to date, and in this connexion the author suggests that his somewhat inconclusive results concerning the problem of the foundation of science and of inductive reasoning have more recently obtained greater clarification, especially through the work in subjective probability; and he singles out for detailed comment the work of R. C. Jeffrey (*The Logic of Decision*, New York, 1965). On the whole, however, one has the feeling that the new introduction lacks some of the freshness and enthusiasm of the "old wine". And it is for the sake of the latter that the book must recommend itself.

Gerd Buchdahl

THEORIES OF THE LIQUID STATE

Significant Liquid Structures

By Henry Eyring and Mu Shik Jhon. Pp. ix+149. (Wiley: New York and London, September 1969.) 95*s*.

It is only within the past ten years that theoretical physicists have been in possession of theories of liquid structure on which they can rely enough to make reasonable deductions about the form of the interactions between the molecules themselves. Before then, all that could really be done was to make order of magnitude predictions of properties such as pressure and of the variations with temperature and density of transport properties such as viscosity and thermal conductivity.

The first two chapters of the book give a very brief survey of modern distribution function theory and of various liquid models. Chapters three to nine then set up "significant structure theory" and apply it to a wide variety of properties of liquids. "The theory is based on the idea that the vapour is mirrored in the liquid as vacancies which transform solid-like into gaseous degrees of freedom." (Authors' words.) This is undoubtedly a satisfactory first approximation as is shown by the "law of rectilinear diameters" relating gas and liquid densities in the critical region. Moreover, it is certainly true that many properties of a liquid should be intermediate between those of a solid and a gas.

What exactly is one to make of the data collected out of published papers and presented in this book? In chapter after chapter there are experimental points and theoretical calculations in beautiful agreement! Sometimes several adjustable constants are available, but in some cases the authors claim that there are none. (See pages 33–35 in which some properties of simple liquids are discussed.) In some instances, for example, viscosity and thermal conductivity, it is surprising that satisfactory answers are obtained simply by adding separate contributions from the solid-like and gas-like degrees of freedom. Why are there no cross-effects? The theory of surface tension (chapter 6) required a fairly elaborate iterative process. Something analogous ought surely to have been done in the treatment of transport processes? A further cause for worry is that the early work of Kirkwood and his school did show (quite conclusively) that predictions, not only of transport coefficients but also of equilibrium pressure, could be very drastically changed by quite small errors in the liquid distribution function. (This work can show no such sensitivity, being rather like an interpolation process.)

In the field of statistical mechanics, apparent agreement between theory and experiment is not always the occasion for rejoicing that it is in other fields. (The Debye theory of specific heats gave impressive agreement with experiment though it neglected quite a number of considerations altogether.) A famous recent example of fortuitous cancellation of errors is provided by the fact that a two-body