Review

Reviewed Work(s): Public Knowledge by John Ziman

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of confirmation theory, starting with Hempel's work in the early forties; nor of Goodman's "new riddle" of induction. (Although the fine bibliography suggests a rich feast for the curious and intelligent reader.) There is no mention of the exciting work being done, at M.I.T. and elsewhere, in the area of generative grammar. And except for a brief citation and discussion on pp. 203–204, the Duhemian thesis is given short shrift. Quine's defense of this doctrine, as well as his important criterion of ontological commitment in terms of a canonical notation—i.e. quantification theory—are nowhere mentioned. In short, almost none of the recent technical developments in, or germane to, the philosophy of science is mentioned. Nor need this be attributed entirely to their formal complexity. For if one can offer clear introductory accounts of relativity theory and quantum mechanics, as Professor Wartofsky so ably does in chapter 12, then surely one could deal with the paradox of the ravens, say, in a manner intelligible to the philosophical neophyte.

There are occasional confusions and actual errors in the text, especially with regard to topics that use or treat logical notation. On p. 125 the author's treatment of reference and denotation is flawed by a failure to distinguish clearly between predicates belonging to semantics and predicates belonging to pragmatics. Indeed, the well-known distinctions between syntax, semantics, and pragmatics is only brushed upon on p. 131, and nowhere brought out clearly. Even in an introductory text one questions the sacrifice of the powerful insights that can be brought to bear with the introduction of this machinery. On p. 132, in his discussion of well-formedness, the author states that "... we recognize that, in the ordinary arithmetic, '$9-6 = 3$' is 'grammatical', in the sense of being in accordance with the rules of subtraction but that '$3 - 9 = 6$' is not." But this is to confuse grammaticalness (well-formedness) with truth or provability. For '$3 - 9 = 6$' is just as well-formed as '$7 + 5 = 12$'—they are both substitution instances of '$x + y = z$'—only false or nonprovable, as the case might be. Elsewhere, one finds confusions in the notational conventions adopted by the author. At the top of p. 141, 'x' and 'y' are used as statement variables, and in the middle of the same page as individual variables in quantification theory. The same sort of confusion is also found in Appendix C, where on the same page (483) 'P', 'Q', and 'R' are now used as statement variables (a strange shift from p. 141!), and now as predicate variables. A different sort of confusion occurs on p. 252, where Professor Wartofsky seems to be identifying Tarski's truth paradigm with the correspondence theory of truth. (Surely this is an error in editing.) Finally, the use-mention distinction is occasionally flaunted, as when the author speaks of "the reduction of organisms to mechanisms" on p. 348.

There is a more substantial error in Professor Wartofsky's presentation of the formalization of arithmetic (p. 146 ff.), where an attempt is made to construct a formal, uninterpreted system corresponding to Peano's postulates. The intuitive notion of property is carried over at this point from Peano's fifth postulate (the principle of induction) into the new formalism. But the formal syntactical analogue cannot correctly reflect the meaning of the fifth Peano postulate, referring as that postulate does to $2^{\aleph_0}$ properties. The formal analogue must be rephrased in terms of the denumerable number of properties defined by the syntactically well-formed formulas of the formal system.

Yet these are relatively minor flaws and lapses, easily repaired in a subsequent edition of the book. And certainly one expects and hopes that this fine introduction to the philosophy of science will have a long and fruitful life of many editions. *J. W. Swanson, University of Massachusetts.*

JOHN ZIMAN. **Public knowledge.** Cambridge: Cambridge University Press, 1968. xii+154 pp. $1.95.

In his influential little book *What is Science* (1921), Norman Campbell wrote "Science is the study of those judgments concerning which universal agreement can be obtained." Ziman begins his investigation of science very near to this thesis. According to the latter "*Science is Public Knowledge* ... its goal is a *consensus* of rational opinion over the widest possible field." (pp. 8–9) He believes that this "principle of consensus" is "no abstract formula, but ... a philosophical basis for action," (p. 126) and his book represents a brief and provisional attempt to demonstrate this fact. It is "an exposition of a general theory, which will be applied to a variety of more specific instances in a larger work." (p. 12) The latter will be a thorough investigation into the *sociology* of science.

The book is divided *roughly* into three parts. The first part (pp. 1–62) concerns many of the issues traditionally considered by philosophers of science, e.g., the demarcation of science from non-science, experiments, theories, discovery, prediction, etc. The second part (pp. 63–72) is on the education of scientists, and the third (pp. 73–142) is concerned with social institutions of the scientific community. In general, Ziman tries to show that the "principle of consensus" reveals something about each of these areas, areas which he labels "intellectual," "psychological" and "sociological" (p. 12). After some remarks about the "principle" itself and about Ziman's program, I will describe his treatment of these three areas.

It must be emphasized that the "principle of consensus" is *not* normative. It is not intended to tell us how scientists *ought* to behave. It is an empirical hypothesis about the motivation of scientists. W. O. Hagstrom began his research for *The Scientific Community* (New York: Basic Books, Inc., 1965) with the hypothesis that "scientists are influenced by their desire to obtain recognition from colleagues," and he traced its implications through a number of interesting subhypotheses. Similarly, Ziman is going to track down the implications of his hypothesis in the larger work referred to above. In the present volume he is merely offering *prima facie* evidence for his thesis. I want to insist on these points because I think we will do him an injustice if we criticize him too harshly for presenting a very primitive philosophy of science. He *has* presented such a philosophy, but it does not seem to be his primary concern. That concern is sociological, or, more precisely, the elucidation of fruitful sociological hypotheses.

Ziman's remarks on the philosophy of science are fairly general and not very novel. He suggests a continuum of scientific disciplines based on his understanding of the amount of agreement one may find in some of them and on his suppositions about their goals. Physical scientists are supposed to be completely committed to the "consensus principle" presumably because (1) they seem to have achieved a considerable amount of agreement on basic assumptions, procedures, laws, theories, etc., and (2) they seem to have such agreement as their goal. At the other end of the spectrum he would put something like the "mystical ineffabilities of the Teilhard de Chardin ilk" (p. 144). The rest of us are somewhere in between. Economics is nearer to physical science than is sociology (pp. 26–27), and the latter is "above" history (pp. 18–19). Some of philosophy "is not very different from [physical] science," but "the multiplicity of viewpoints indicates that there is no dominant urge to find maximum regions of agreement" (p. 23). And political science is like history and philosophy (p. 26). The evidence for these conclusions is largely impressionistic and, as in the case of philosophy, often joined to a *non sequitur*.

A discovery is supposed to be scientific when it is unexpected. "The 'unexpectedness' of the observation is what gives it weight as a contribution to public knowledge, and hence as a contribution to science" (pp. 49–50). As it stands, this view seems to make the most trivial (and often humorous) utterances of the mass media scientific discoveries. Of course, the more improbable a phenomenon is before it is produced, the more its production (logically) *can* increase our knowledge. However, this is not a question of psychology, but of logic. If, as a matter of fact, no one expected to observe a phenomenon whose existence was almost logically guaranteed, then although they might be psychologically overwhelmed by its appearance, almost nothing would be added to our stock of "public knowledge."

In general, Ziman insists that "all genuine scientific procedures of thought and argument are essentially the same as those of everyday life, and their apparent formality and supposed rigour is a result of specialization" (p. 144). With 'essentially' in the first conjunct, it is virtually undecidable. But 'apparent' and 'supposed' in the second are misleading. After all, if, say, a social scientist says he rejects some hypothesis at the 5 per cent level of significance, this is more than "supposed rigour". The idea of a "statistically significant difference" and the powerful apparatus designed in the past 40 years to identify such differences *are* quite extraordinary. The formalism, assuming that is what Ziman means by 'formality', is *genuine* and often forbidding to the average investigator.

Ziman's remarks on the education of scientists are fairly brief. In order to control admission to the scientific community and the opportunity to make a contribution, it is necessary for one to be properly educated. This usually requires, we are told, a Ph.D. and Ziman has some interesting things to say about programmes in Canada and the United States in comparison with Britain and Germany. In particular, he notices that in the former countries formal course-work usually proceeds to the beginning of the dissertation, whereas in Britain the tradition has been for formal education to cease after the first degree. "It was a point of honour for the supervisor of a research student not to interfere with the self-improvement and maturation of a young scholar" (p. 87). According to the "consensus principle," we must assume that these two different approaches had as their goal "a *consensus* of rational opinion over the widest possible field." In first blush, the British system does not seem to be a promising strategy if *that* is their goal. It would seem that the earlier we "turn our students loose," the greater the likelihood that they will not perform like their teachers. But I think the assumption would have to be that given more freedom, the students may well turn up more and better ideas, or discover more powerful laws and theories which in the end *will* contribute to the consensus.

Finally, Ziman's remarks on the relations of the "consensus principle" to the need for publication of discoveries and for citation of priorities (p. 103), the dangers of circulating unrefereed preprints (p. 111), and the responsibilities of referees and reviewers (pp. 111–113) are generally persuasive. Given his hypothesis, one would expect to find such phenomena with roughly the rationalization he suggests. Unfortunately, one would have the very same expectations given *other* hypotheses too. For example, if we assume that scientists are primarily concerned with discovering truth in the form of precise and powerful theories, then practically everything Ziman wants to say about the education and social community of scientists may be said. It is unlikely that Ziman believes that the two goals are co-extensive, because he asserts that "it is an essential element in the health of Science, or of a science, or of the sciences, that self-confirming, mutually validating circles be unable to close" (p. 63). Since there can be little doubt that faced with the unpleasant need for a *choice* between consensus and truth (as were the opponents of Lysenko, Hitler and The Inquisition), *qua* scientist one must select the latter, it is not clear to me why Ziman believes the "consensus principle" will prove to be a more fruitful hypothesis than, say, a "truth principle." *Alex C. Michalos, University of Guelph, Ontario.*