Empirical, useful, predictive enterprise

J. Z. Young

Reliable Knowledge: An Exploration of the Grounds for Belief in Science. By J. Ziman. Pp. 197. (Cambridge University Press: Cambridge, 1978.) £7.95.

PROFESSOR ZIMAN is a mathematical physicist but in this book he has devoted himself to the task of trying to define the aims and methods of all science. Wisely he begins with his own subject and bravely he goes on to extend his thoughts to biology and even sociology. Probably each scientist will like best the parts of the book that deal with subjects other than his own. But this is not to say that any of it is superficial or inaccurate, at least so far as my limited knowledge goes. Quite the contrary, he has succeeded in distilling the essence both of the results and limitations of very wide areas of science.

His general thesis is that "*the goal of science is a consensus of rational opinion over the widest possible field*" (p3) (italics throughout are his own). This is achieved because of the very specific "internal sociology" of the scientific communities, which allows for the communication of what he calls "consensual knowledge". The definition of this is that it is unambiguous and agreed to be true by all participants. The ideal form of it is mathematics and Professor Ziman takes a lot of trouble to explain how this approaches as ideal language. It is refreshing to find that he is under no illusions that it is perfect: "Unfortunately deficiencies of consensibility can be found even in the most sophisticated mathematical systems". In particular he emphasises that "the hope of finding a unique and *perfectly* logical language of this kind is vain". In order for scientists to agree, they have to share certain fundamental beliefs, for example, in the Kantian categories of space and substance. He is unwilling at first to define and delimit the range of these "supreme principles". As his exposition proceeds it becomes clear that he believes that they depend upon certain innate human capacities, especially "the mysterious skill that we call pattern recognition". Moreover, this is not amenable to complete logical analysis and is not even completely uniform amongst all men.

Having thus warned us that mathematics is not a perfect tool he nevertheless believes it to be the best available and proceeds to give an excellent account of how it functions. His beautiful description of the diverse powers of synthetic and analytical methods is presumably elementary for the mathematician but simple and direct for the rest of us; and done almost without abstract symbols. He follows it through to discussion of the place of experiment and of models and hypotheses. Popper's criterion of falsifiability he holds to be "strategically sound but tactically indefensible", a polite way of saying that it is no use. Here, as very often, he speaks of the scientist actually at work, a rare virtue in a theoretician. Every theory can be falsified by some of the observations, the question is whether it is the best available; and he illustrates this by the controversy over the missing solar neutrinos, which are much less numerous than theory predicts. He rightly contrasts the "calm order and perfection of well established theories" with the "controversy, conjecture, contradiction and confusion" of the frontline of research.

His determination to show science as it really is leads him next to discuss the principles of observation and particularly pattern recognition. "The assumption that *all observers are equivalent* is not merely a basic principle of Einstein's theory of special relativity; it is the foundation stone of all science". However, obvious though this seems, it in fact implies that "scientific knowledge cannot be justified or validated by logic alone". As observers differ, "statements about the real world are always subject to uncertainty. They cannot all be given precise status—'true' or 'false'—their logic is *three-valued*, falling into the categories 'true', 'false' and 'undecided'." Ziman gives much discussion of the implications of this thesis which, as he says, may not be of great importance in physical science but imposes limits in biology and especially in sociology. In particular he emphasises the great influence of the sociology of belief in determining the observations that are made. Every scientist must use the paradigms of his age and Ziman gives examples of how they determine the observations he makes and the interpretations that he puts upon them.

So much cautious scepticism might well lead to scientific pessimism. But Ziman is much too practical to be a defeatist. Whatever the fundamental

logical difficulties of validating science, "there is nearly universal human consensus concerning certain aspects of of the material domain". He leaves open the question "whether the categorial framework of everyday realism is the only possible scheme for describing and understanding nature in its physical aspects". He is content to leave it like this, but is not optimistic that "psychology and neurophysiology can arrive at a better understanding than, say, the ancient art of introspection".

Here I should disagree with him. Although he has taken the trouble to study these biological subjects seriously, I do not think he appreciates the speed with which they are approaching the capacity to achieve consensual communication that is useful even if not completely unambiguous. It is not too wild a statement to say that we are within sight of a 'complete' science of biology with principles that cover the origin, evolution and present operations of living things. It is true that the extension of this to include Man raises special difficulties. He rightly dwells in his concluding chapters on the difficulties of precise definition of such concepts as "intelligence", "caste", "peasant" or "psychosis". In fact "we do not have a taxonomic framework for human behaviour, individual or social, in which the categories are both meaningful and distinct". True enough, and we all deplore the weakness of sociology. The difficulties introduced by hidden variables will of course always make the study of complex systems more difficult than that of simple ones. If the aim was to find some logically perfect science of man then indeed I should be pessimistic. But Ziman has taken pains to show us that the whole of science is simply an empirical, useful, predictive enterprise, characteristic of modern *Homo sapiens*. The life sciences are a part of this enterprise that is at present developing very rapidly, and I believe that his careful attention to them has already been very helpful and will be even more so in the future. □

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Systematic theory of meaning

George Steiner

Truth and Other Enigmas. By M. Dummett. Pp. 470. (Duckworth: London, 1978.) £18.

FOR Michael Dummett, Frege's *Grundlagen der Arithmetik* is not only "unquestionably the most brilliant sustained performance of its length in the entire history of philosophy," but the whole of logic "came of age only with the work of Frege." It follows that the "most urgent task that philosophers are now called upon to carry out is to devise what I have called a 'systematic theory of meaning'." This systematic theory will proceed from the cardinal distinction between 'sense' and 'reference' in Frege and from Frege's concepts of the relationships between logic and mathematics on the one hand and logic and language on the other. Concomitantly, the philosopher, though fully aware of the attractive 'nihilism' in Wittgenstein's belief that philosophy is not "in the least concerned with establishing true propositions", will turn to Frege's systematic programme to establish a logical foundation for the determination of such propositions. And though, again, aware of the teasing finesse of Quine's thesis on the indeterminancy of natural language propositions, he will reject this thesis. Only in this way, argues Professor Dummett, can philosophy aspire to a 'scientific' status and emerge from a 'scandalous' historical situation in which interminable effort and ingenuity "appears to engender nothing but unending disagreements."

Dummett's own papers represent this programme. They are closely-argued, rigorous and subtle steps towards a 'theory of meaning' capable of generating and testing a better understanding of 'truth', of the conditions under which a sentence may be correctly asserted, about whether the reality that renders key classes of empirical statements true or false can be shown to be fully determinate. These concerns are closely linked to a series of highly technical considerations (of special interest to the mathematician, to the mathematical logician but also, at several points, to the scientist in general) on the conflict between realists and intutionists in mathematics, on the philosophical reach of Gödel's theorem and on the justification of deduction. Physicists, familiar with notions of time-reversal, will find much to instruct and delight them in two essays on "Can an Effect Precede Its Cause?" and "Bringing About the Past". Professor Dummett is a master of logic and of analytical exposition, and where one fails to agree—has he allowed for the characteristic and shrewd pragmatism which underlies Quine's thesis on the indeterminancy of translations between languages, a thesis which cannot be