Appeared in
Times Higher Educational Supplement
1975

Review of

Quantum Physics and Ordinary Language,

by T. Bergstein

(Macmillan £1.95)

SBN 333 14156 3 61 pp

The first half of this short book is an account of the now traditional 'Copenhagen' interpretation of quantum mechanics. Some experiments unambiguously show that light and matter behave like particles, while others equally unambiguously show light and matter manifesting the interference and diffraction characteristic of waves. The dispute between Einstein and Bohr about the interpretation of these experiments is carefully analysed, the conclusion being that the 'wave-particle duality' leads to no contradiction, because the two sets of experiments are mutually exclusive, and give 'complementary' information about the system being investigated.

The second half of the book is a series of philosophical speculations inspired by the principle of complementarity in its general form, which concerns ' the fundamental interdependence of observation and description of natural phenomena', and the 'subject - object partition'. It is claimed that natural science requires this partition to be fixed, while the study of the relation between language and mind centres on the movability or even abolition of the partition; therefore natural science and 'psycholinguistics' must be mutually exclusive, i.e. 'complementary'. The author concludes 'An adequate description of human existence must be sought in the ordinary use of language, in the humanistic sciences, and in poetry - not in natural science'.

The whole book contains much to quarrel with. To start with it is not clear what is meant by 'ordinary language'. The author seems to include mathematics and logic, but in that case what is 'non-ordinary language'? Our common experiences are supposed to be describable in terms of ordinary language, but it is hard to identify such experiences - different generations, cultures, sexes, perceive the world differently.

Of particular relevance is the assertion that 'Classical mechanics is a straightforward mathematical idealisation of the part of ordinary language dealing with the external world'. To whom is it straightforward that forces produce changing velocities - i.e. accelerations - rather than, say, velocities themselves or changing accelerations? Certainly not to Aristotle, or the 'person-in-the-street', and even physicists can stumble over the explanation of the wobbling of a spinning-top, or the child's 'pumping' of a swing. The fact is that the concepts of classical mechanics - force, work, momentum, energy - are the refinements of centuries of intense debate. Nowadays the subject is undergoing a renaissance, and even its causal structure has been plunged into uncertainty by the recent discovery that in quite simple systems (three interacting bodies) there can occur 'unpredictable' orbits, where tiny changes in the starting conditions produce radical changes in the subsequent motion.

The 'straightforwardness' of classical mechanics is supposed to contrast with the statistical, non-causal quantum mechanics, and the inevitable disturbance of small systems by the act of measurement suggests, it is claimed, that 'an atomic object is a conceptual construction connecting.....quantities in a practical way .....a product of human intellect only'. I cannot resist quoting Wald's opposing argument: 'Physicists study atoms. But physicists are made of atoms. Therefore a physicist is an atom's way of learning about atoms'.

The author's philosophy relies heavily on the impossibility of a causal description of atomic phenomena, and it is true that quantum theory is quite unable to explain, for example, why a radioactive atom decays at a particular time. However, we should not assume that quantum mechanics is the ultimate physical theory - for all its success it may eventually be seen as a special case of some deeper theory, just as classical mechanics, for all its success, is now known to be restricted in its applicability.

Finally, it is fundamentally wrong to claim that the scientist's knowledge and the poet's or artist's insight are mutually exclusive. They are not; indeed they are interactive: my study of the rainbow enriches and intensifies my perception of it, and vice versa.

26th March 1975

Michael Berry
(Reader in Physics, University of Bristol)