

the curriculum should change (which is not the same as to say that there has been no innovation) to meet the needs of students as well as those of higher education.

Dingle's Answer

EVERYBODY is fond of Professor Herbert Dingle, as well as of the clock paradox in special relativity which he has single-handedly nurtured since the early 1930s. Like Morris-dancing and the tossing of pancakes on Shrove Tuesday, the sporadic outbreaks of controversy which Professor Dingle stimulates are delightfully English in quality. For is it not marvellous that while the whole world goes about its business not merely believing in Special Relativity but using it, there should be philosophers in England willing to proclaim that Einstein was, after all, quite wrong?

The most recent development in this saga is Professor Dingle's latest book, *Science at the Crossroads* (Martin Brian and O'Keefe, £3.00). Dingle sets out not merely to restate his view that Special Relativity is false but also to document his complaint that the profession of science and the scientific journals (*Nature* prominent among them) have denied him a proper hearing. Thus he charges that *Nature* denied him an opportunity to criticize the Royal Society for not accompanying a rejection of a paper with a detailed refutation, mistaking the sympathy of one journal for another's referees for kow-towism. He recounts the history of his complaint to the Press Council in 1968 that *Nature* had suppressed the truth, and of the subsequent publication of a letter (*Nature*, 216, 119; 1968) which triggered off a further series of refutations, the most recent of which was a simple declaration by Professor J. L. Synge that "I cast my vote" for Special Relativity. Professor Dingle goes on to complain that a promised leading article rounding off the correspondence has never appeared, apparently oblivious of the way in which his own scorn for prospective contestants and his promises to "bring discredit on the journal" may have discouraged the judicious summing-up for which he asked. In his book, Professor Dingle persists however in asking for a simple refutation of his position. Will what follows do the trick?

Professor Dingle's book has the virtue of putting his question of orthodox physics in a simple form. "According to the special relativity theory . . . two similar, regularly running clocks . . . in uniform relative motion must work at different rates. Hence one clock must work steadily at a slower rate than the other. The theory, however, provides no indication of which clock that is, and the question inevitably arises: How is the slower clock distinguished? The supposition that the theory merely requires each clock to appear to work more slowly from the point of view of the other is ruled out merely by its many applications and by the fact that the theory would then be useless in practice but also by Einstein's own examples. . . ." The trouble, of course, is that in the last of these sentences, Dingle is denying the central principle of relativity. And why should he not accept that each of two clocks in uniform relative motion should appear to run slow from the other's point of view? That, according to the relativists, is what the real world is like.

The fact that one observer's view of reality may differ

from another's is not a paradox but a characteristic of the universe.

Professor Dingle's example from Einstein is the well-known prediction that a clock at the Equator would be observed to run more slowly than an identical instrument at one of the poles. But why should it not be the other way around? That is what Dingle asks. It seems now to be accepted that Einstein's original argument was uncharacteristically loose. The point of the illustration is that a clock at the pole of rotation may be taken to be in an inertial frame which is nearly (but not quite) properly defined by the direction of the Earth's motion around the Sun. The clock at the Equator is in another. Einstein's lack of clarity concerns the inertial frame of the observer of the two clocks. Dingle's difficulty is in accepting that the predictions of the special theory of relativity require great care in the definition of inertial frames and it is true, of course, that a close examination of the relationship between two such frames leads quickly to general relativity. The confusion which runs through much of the arguments which Dingle has skilfully conducted is his obstinate refusal to accept the disciplines which relativists set for themselves. Is it any wonder that he comes to contrary conclusions? And is there any hope that he will now be satisfied with the demonstration that moving clocks run at different speeds from clocks at rest which has been provided in the past few months by the experiments in which Hafele and Keating have flown caesium clocks in different directions around the world (*Science*, 177, 166; 1972, see also *Nature*, 238, 244; 1972)? It will be sad to see the clock paradox disappear, but this work is the last nail in the coffin.

100 Years Ago



NOTES

MR. DARWIN'S forthcoming work on "Expression in Man and Animals" bids fair to be of a more popular character than any of his other publications. It will commence with a statement of the general principle of Expression;—that serviceable actions become habitual in association with certain states of the mind, and are performed, whether or not of service, in each particular case. This will be illustrated in the case of expression of the various emotions in man and the lower animals. The means of expression in animals will then be discussed, and the special expressions of animals and man, such as the depression of the corners of the mouth in grief, frowning, the firm closure of the mouth to express determination, gestures of contempt, the dilatation of the pupils from terror, the causes of blushing, &c. In conclusion, the bearing of the subject will be spoken of on the specific unity of the races of man, the part will be discussed which the will and intention have played in the acquirement of various expressions, and the question of their acquisition by the progenitors of man will be referred to. Seven heliotype plates reproduced from photographs will illustrate the work.

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