The Absolute Relations of Time and Space

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In my smaller book, “The Absolute Relations of Time and Space,” I gave an abbreviated account of this work and added an appendix showing how the various complicated geometries which are treated of in Einstein's generalized relativity could be obtained by means of a modified measure of interval.

However, most relativists have been too busily engaged in praising Einstein to spare the time to go into my work.

One result of this has been that, by taking the idea of measurement as the fundamental thing, a very large number, if not the majority, of relativists have fallen into the very serious error of asserting that the length of what they call a “world-line " is a minimum between any two points of it. In my “Theory of Time and Space "I showed (p. 360) that this is not correct.

Finding that a number of writers were making this mistake, I wrote a letter which appeared in *Nature* (February 5, 1920, p. 599) in which I invited attention to this matter and pointed out that in what I called “inertia lines " the length, so far from being a minimum, was actually a maximum in the mathematical sense; while, in what I called “separation lines” the length was neither a maximum nor a minimum.

In this letter I gave actual numerical examples to illustrate these points. I invited attention to the matter again in my “Absolute Relations of Time and Space" (p. 71), published in 1920.

In spite of these efforts of mine, I again find this blunder cropping up in works published this year. Now it seems to me that it is a very important point since, in ordinary geometry, there is no such thing as a “longest” line joining two points. The idea would, I think, be apt to cause bewilderment in the mind of a person meeting it for the first time, unless it were properly presented to him.

The idea of a “straight line” which was neither a maximum nor a minimum would, I fancy, cause even greater bewilderment, and he would wish to know how such lines were to be defined. In Einstein's generalized relativity, the element of interval is taken as a starting-point, although the idea of an interval in the minds of many writers is so obscure that they ascribe a minimum property to it which it does not possess.

Although I have tried so often to impress on relativists that the ordinary method of treating space-time theory is unsatisfactory, I propose to make one more attempt to show that the measurement of intervals is not the simple thing that is so often supposed. Let us consider the simple time-space theory in which the length of an element ds of what I call a “separation line” is given by the formula:

$$ds^2 = dx^2 + dy^2 + dz^2 - dt^2.$$

Let O be the origin of co-ordinates and let P be any point on the axis of x, at a distance l from O, measured, say, in the positive direction.

Let $F(x)$ be any arbitrary differentiable function of x which is continuous and single valued, and which is equal to zero for $x = O$ and for $x = l$.

Now consider the space-time curve the equations of which are:

y = t = F(x), 2 = O.

It is evident that this curve passes through *O* and *P*. But now we have

dy=dt,
dz=o
ds2=dx2
and so on. Thus we have ds=dx, so the length measured along the space-time curve from O to P is equal to the length of O to P measured directly along the axis of x. That is, it *i* equal to *l*.

Thus a space-time curve the equation of which contain an arbitrary function can have the same length between two points as the direct length measured between those two points.

—*Nature*, Volume 110 [1922]

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