11
Einstein's Assumptions

Let us review and restate the essential elements of Einstein's argument as they emerge after consideration of the simultaneity definition and the rod experiment, expounded in the first two chapters of the 1905 paper. These chapters, headed *Definition of Simultaneity* and *On the Relativity of Lengths and Times*, contain the core of the Einsteinian argument and incorporate a number of basic assumptions which we are now going to separate and briefly examine. Our examination will indicate that the tenets of relativity are contained in the assumptions, particularly in the assumptions of length change and time change. Einstein refers to them as *the relativity of lengths and times.*

1. Newtonian space. Despite relativistic claims that Einstein has "overcome", "invalidated" or "rejected" Newtonian absolute space, his argument cannot get off the ground and proceed through its various twists without it. What he calls the *stationary system* is an absolutely fundamental and essential concept in his reasoning, and at the beginning of his exposition he defines it as one *in which the equations of Newtonian mechanics hold good.* The stationary system is used to derive all other assumptions of the argument and it is, therefore, of utmost importance to realise that without the explicit acceptance of Newtonian space this would not be possible. The first and most important ingredient of the rod experiment is the *stationary rigid rod* which represents the *stationary system.* The Einsteinian rod is stationary because it rests absolutely in space, and it is rigid because the stability of its internal structure is directly related to the absolute homogeneity and immutability of space. What Einstein is affirming and applying in his first assumption are two entirely Newtonian properties of space: absolute rest and absolute rigidity. Both have been abstracted and extracted from nature and are fundamental concepts of physics.

2. Newtonian time. Not only is Newtonian space indispensable for the Einsteinian argument, but also Newtonian time. A second system, which becomes later the moving system, is introduced after the *stationary system* has been established, and this system is also one *in which the equations of Newtonian mechanics hold good* because it is described as identical with the first system. Both are defined *by the employment of rigid standards of measurement and the methods of Euclidean geometry.* Motion is imparted to the second system, and Einstein, quite correctly, says that *if we wish to describe the motion* of this system, *we give the values of its co-ordinates as* *functions of time*. The time referred to is Newtonian time. It is universal and its progression is absolutely constant. Thus the two systems, or components of the Einsteinian doublet, and the components of the motion of one of them, are determined and originate entirely within the framework of classifical physics.

3. Einsteinian doublet. This is a pair of "systems" or a system which has two components. The relativistic doublet always consists of one system which is stationary in Newtonian space and another which is moving in relation to the first. It is a binary entity in which the two components differ. Their difference can be described only with the help of Newtonian concepts. The system specification is the first purely Einsteinian idea and the first step of the relativistic argument. It restricts the applicability of the subsequent stages of the argument to a particular kinematical arrangement.

If we take a closer look at the two components of the doublet, we will find that they are very narrowly, and at the same time quite insufficiently, determined. Furthermore, they do not resemble anything that can be found in physical reality. Einstein commences his argument in the first chapter of his 1905 paper by saying: *Let us take a system of co-ordinates in which the equations of Newtonian mechanics hold good*. But in the second chapter he modifies his initial idea by saying: *Let there be given a stationary rigid rod; and let its length be as measured by a measuring rod which is also stationary*. What has happened to the stationary system is this: it has been reduced from a three-dimensional to a one-dimensional configuration and has, at the same time, been "decentralised" from a one-point intersection of co-ordinates to a two-point distance or line, represented by a stationary rod. This rod may just as well be a base line determined by two points in absolutely resting space. The second component of the doublet is represented by a moving rod. It is introduced by Einstein in the following way: *We now imagine the axis of the rod lying along the axis of x of the stationary system of co-ordinates and that a uniform motion of parallel translation with velocity v along the axis of x in the direction of increasing x is then imparted to the rod*. As far as this description is concerned, the real significance of all these words lies in the fact that the moving rod is displaced coaxially with the stationary rod. What is taking place is a one-dimensional superimposition of a moving line on a stationary base line. This is a basic requirement of the Einsteinian argument which imposes a considerable and quite arbitrary and unrealistic restriction on its physical meaning and practical applicability. Einstein assumes that systems are one-dimensional and unilinear, and that a point of the stationary system can be *at the same place* as a point of the moving system. If the axis of a *given* base line does not coincide with the axis of a *given* line in motion, whatever this may mean, and if the two lines cannot be telescoped into each other, the argument will not work. This is a very peculiar and curious approach to a physical problem which is supposed to have universal ramifications, and no justification is advanced at all why it should be adopted or why nature is presumed to act in a particular "relativistic" manner only when we have two coaxial and telescopic line segments.

Einstein uses the word *rod* to give his line segments a life-like appearance, but it is obvious that these rods are not corresponding to anything existing in real life. The stationary rod can certainly be *measured by a measuring-rod which is also stationary* (Einstein), but the *imparting of uniform motion of parallel translation* to a second rod and everything else after that is completely unreal. It is, of course, not possible to impart such motion to anything within the terrestrial region. An unsupported rod moving coaxially with a *given* base line and remaining unaffected by the physical environment is simply not a valid proposition in any circumstances. The whole arrangement becomes even more fantastic when it is suggested that an *observer moves together with the given measuring-rod and the rod to be measured* (Einstein). It is obvious that we are not dealing with ordinary rods, encountered in real life, but with fictional objects. Furthermore, Einstein attaches clocks to the rods, synchronises them, within each rod, by light rays and considers it possible to have a stationary and a moving clock "at the same place". There is no need to delve any further into the labyrinth of Einstein's imagination. What has been said is sufficient to indicate that his argument, right at the beginning, has no practical or theoretical meaning. An Einsteinian doublet is a pseudo-physical conjecture which has no recognisable connection with physical reality and the body of physical knowledge.

4. Uniform motion. By suggesting that a doublet of coaxially related line segments, one stationary and one moving, represents a peculiar class of systems which differ substantially from any other kinematical systems Einstein removed himself from the mainstream of physics. He imposed a further restriction on the applicability of his ideas by the requirement that the motion of the moving line segment must be a *uniform motion of parallel translation with the velocity v along the axis of x.* This means that the motion must be rectilinear and constant in relation to the stationary line segment or rod. The axes of the two components must not only remain coaxial or parallel with each other, but also remain aligned in such a way that all points of the stationary as well as moving rod are located on, or proceed along, one geometrical line. In addition, the progressive displacement of the moving rod must occur at an absolutely uniform rate. Again, the question arises why nature should be expected to deviate from classical physics only under such exclusive, narrowly defined, and in practice unobtainable conditions, and also why Einstein's assumption should be given any attention in view of the lack of any convincing reasoning or empirical justification in its favour.

5. Local time. The two preceding assumptions, relating to systems and uniform motion, restrict the applicability of Einsteinian views to certain classes of "phenomena", but they do not as yet affect Newtonian space or time. The local time or non-universality of time assumption, however, disaffirms one of the two essential properties of the Newtonian time concept and replaces it with a new Einsteinian assumption. The substance of this assumption is the denial of the universality of time, but not of the constant time-flow as far as "local time" is concerned. It is asserted that the idea of the universality of time requires proof or a definition, and that neither has ever been attempted. Non-universality must therefore prevail.

That not only the development and success of physics, but the entire body of science and our personal life and work, rest on, and are permeated by, the idea of universal Newtonian time, is considered of no consequence at all. The question why the personal opinion of Einstein must be accepted has never been answered by relativists.

The non-universality of time is the most important postulate of the Einsteinian theory. It enables relativists, among other things, to accuse their critics of being *obviously and demonstrably wrong* (McCrea) purely because they continue to base their physics and their reasoning on the Newtonian concept of universal time. Thus any criticism is "neutralised" and declared to be meaningless without any necessity to justify Einstein's assumption. The non-universality of time also enables relativists to make many other startling assertions, such as the following: *It is not much sense for an astronomer, who sees a flare appear on the sun, to say that the flare occurred eight minutes earlier because the light takes eight minutes to travel this distance. Since no faster means exist to inform the observer sooner of this event, the latter only acquires physical reality for him at the moment when he sees it* (Mendelssohn). This is the same as saying that if a person dies, for instance, the fact of death *acquires physical reality* for the person's relatives and friends only when they are informed of it. If someone succeeds in suppressing a piece of information, he is altering physical reality. The end result of such views is an extreme and grotesque phenomenalism, and a breakdown of meaningful communication between people.

6. Time-motion equivalence. The disaffirmation of the universality of time is a negative and empty statement expressing a personal belief. It is obviously insufficient to undermine the generally accepted idea of Newtonian time. Einstein, therefore, introduces a further assumption dealing with the time-flow and the measurement of "local time". He asserts that the idea of time-flow is derived from the idea of uniform rectilinear motion. In effect, he says, it is equivalent to uniform rectilinear motion, the only type of motion which is significant in special relativity. Although Einstein is not actually announcing that length/time = time, or length/time = time/time = 1, he certainly wants to produce an effect analogous to these two equations in order to establish the new, non-composite and fundamental dimension of motion and justify its interchangeability with time. When it is expedient to do so, motion can still be considered as composed of a space component and a time component. But, on the other hand, the equation length/time = time is endowed with an aura of metaphysical, and subsequently physical, respectability and prepares the way for time being interpreted as length or motion, and vice versa when the necessity arises.

As it is not easy to use uniform rectilinear motion in its pristine condition for the execution of time measurements, Einstein decrees that the next best thing, namely uniform circular motion, is just as valid. Thus the standard device to measure time-motion is, according to Einstein, a clock with a circular clock face, and time is then defined by him as *the position of the small hand* on the clock face, i.e. the point of the small hand moving along the graduated circumference of the clock face.

As a result of the non-universality assumption a specific time, that is, clock reading, can be ascribed only to the strictly circumscribed place where the relevant clock is located, and not to any remote place where another clock may be located. Einstein's time is applicable only to events in the *immediate neighbourhood* of the clock reading which can be encompassed by one simultaneous visual inspection. The boundary between immediate neighbourhood and remoteness is not defined or explained by Einstein, but it is quite apparent that clock readings or events which cannot be viewed by one observer at the same time cannot be regarded as simultaneous from the point of view of the observer.

Although the purpose of the time-motion equivalence assumption is to establish an operational relativistic alternative to the Newtonian time concept, Newtonian space is implicitly also undermined. If time is a local phenomenon, if only the fact of simultaneous visual perception by one observer and not actual or specific distance is material, and if the length travelled by the small hand of a clock on the clock face is really an inseparable feature of the new time concept, then there is no necessity to consider space as of equal qualitative and fundamental importance as time. In fact, length must now be considered subordinate to time. However, although Newtonian concepts have been undermined, disaffirmed and set aside, they cannot be expelled from Einsteinianism. The new assumptions cannot nullify the necessity and the positive affirmation of the Newtonian concepts at the beginning of the argument and at various stages of its subsequent development.

Einstein does not hesitate at all to adapt physical reality to his way of thinking if such adaptation is required to support or reinforce his argument at any particular stage. The equating of time and motion, and specifically of the circular motion of the small hand of a clock to uniform rectilinear motion, is a case in point. In reality, circular motion is an accelerated motion which presupposes the existence and operation of a force. Einstein's time concept is thus an expression of the force which moves the clock hand. It is intricately connected with Newtonian dynamics. But Einstein is not bothered by any implications arising from the circularity of his time, just as he is not bothered by the logical circularity of many of his "discoveries", including the circular argument contained in his time-motion equivalence assumption. Thus, at the beginning of the first chapter of his 1905 paper he says: *If we wish to describe the motion of a material point, we give the values of its co-ordinates as functions of time.* But later he suggests, without any embarrassment, that if we wish to describe time, we give the values of its periods as functions of the motion of a material point on a clock face.

7. Light constancy. This assumption is represented by the first part of Einstein's light postulate which declares that the velocity of light is constant. It also includes the proposition that the velocity of light is a maximal, that is, absolute, velocity. The motion of light is uniform and rectilinear, a type of motion to which, as has been mentioned before, the Einsteinian theory attaches special significance. It is also the only motion to which it is supposed to be applicable. But light and its motion play a different role from the motion of the moving system in the Einsteinian doublet. It is the one and only means of communication, indispensable for what Einstein calls the remote synchronisation of clocks, as we shall see, and for the establishment of relations between Einsteinian systems in general, but not between the stationary rod and the moving rod in the initial argument.

The idea of the constancy of light velocity is an inductive inference from empirical evidence and, apart from Newtonian space and time, the only instrument in the arsenal of Einsteinian assumptions which has a physical basis. Einstein elevates it, together with any other uniform rectilinear velocity, to a fundamental dimension, again disregarding the fact that a velocity is conceptually as well as operationally a composite physical quantity. Euclidean geometry and Newtonian physics are still required, not only in order to measure the velocity, but also to provide a basis for the uniformity and rectilinearity of the motion. Without empty and rigid space the velocity of light could neither be constant nor absolute. Newtonian concepts are still indispensable preconditions, but this is not acknowledged by Einstein who is silent on the question of emptiness and in respect of rigidity appears to maintain that it is the constant velocity of light which gives substance to this property of space and not vice versa. Light, according to Einstein, forms the rigid and timeless bridge which is the ontological and ultimate connection between separate systems. But it must be pointed out again that he does not adhere to his view in his initial argument where the light bridges are used within the stationary system and within the moving system and not between the two systems. In effect, Einstein's argument could not proceed if he would use light ray communications between the two rods.

8. Clock synchronisation. A prescriptive supposition in Einstein's argument is made in relation to the synchronisation of clocks. Since universal time is denied, clocks and clock readings at particular places and rules for their synchronisation are elevated to an ontological status which is quite out of perspective and not related to their real significance. Furthermore, Einstein admits only two specific methods for the comparison of clock readings which are also the methods for assigning time instants to events occurring at the places where the clocks are located: (a) the visual inspection of two adjacent clocks by one observer, and (b) light ray communications by two remote observers associated with clocks at the places where they are located. The latter method requires, as we have seen, the emission and return of a light signal. In all cases the time of an event must be measured by reading a clock at the place of the event by an observer. The observer must be able to view the event and the clock simultaneously. The direct timing of remote events in other than local time readings is an invalid procedure, and so is the assignment of times on the basis of calculated distances or rational considerations. To obtain the local time values of remote events it is necessary to use light signals based on equal forward and return paths. The making of assumptions as to any non-local time which may have elapsed during the journey of the light signal is not permitted. No time relation exists with the remote clock until the signal has returned. Einstein's synchronisation assumption is neither logically necessary nor is it required by any empirical conditions. Like so many other relativistic inventions, it is arbitrary and useless. But Einstein needs the assumption in order to develop his argument.

9. Observers. Special relativity denies that there is a fundamental unity in the universe and assumes that any particular place or event has its own spatial and temporal characteristics. In order to explain or to experience these specific "relative" characteristics Einstein always introduces a further assumption, namely that the presence of an observer is obligatory. The question has been raised whether Einstein's argument necessarily requires observers and some relativists have denied that they are necessary. There cannot be any doubt that not only are observers required at all places where measurements are made or anything takes place, but also a superobserver and grand master who establishes the rules of the game and the existence of doublets, and determines how the individual observations in a doublet hang together. Special relativity is a sort of situation physics, but within a set of restrictive rules laid down by grand master Einstein. In fact, the rules are so restrictive that observers represent nothing more than robots programmed to react in terms of relativistic assumptions.

It is the strict application of programmed reactions which makes a dialogue with relativistic fanatics impossible. An instructive example of the futility of such dialogue is the Dingle-McCrea exchange of views concerning the contradictory nature of Einstein's time concept applied to one event viewed by observers in two different systems, and in particular McCrea's statement published in *Nature* of 14 October 1967. *Dingle's assertion is obviously and demonstrably wrong*, says McCrea, the guardian of relativistic purity, because *he deals with objects to which the theory explicitly denies a meaning*. McCrea explains that *here, and in physics generally, event means something happening at a particular position at a particular instant. The crucial feature is that an observer experiences an event if, and only if, the event is part of his own history, that is the event is in his own worldline.* Dingle is talking about the event as the primary element of physical reality, but for McCrea the primary element is not the event as such, but the experiences of observers. Dingle, quite correctly on the basis of classical physics, infers that Einstein's theory is contradictory, but McCrea, using Einstein's assumptions, sharply rejects Dingle's conclusions by saying the same thing again and again: *His* (Dingle's) *assertion is false, because he is not talking about the same thing, but two different things* (McCrea).

There cannot be the slightest doubt that for a relativist the primary importance of a physical event is not the event as such, but what a particular observer experiences in relation to the event. The experiences of two observers are contradictory within the framework of classical physics, but in terms of relativity they may not be contradictory. Obviously, the local observer must be an essential part of the relativistic set-up. Without his presence Einstein's subjective phenomenalism cannot be sustained.

That the presence of an observer is a basic requirement of the theory is made explicit at every turn of Einstein's argument. For instance, how can two clocks or two events be synchronised without an observer, or how can light signals be exchanged without them? How can anything be viewed in the other system without an observer, and how can any relativistic differences be made explicit without the use of observers attached to systems in relative motion? Of course, classical physics also requires observers, i.e. human beings who experience and formulate empirical observations. But in classical physics the observer is a builder who retreats when his section of the edifice is completed. In relativity the observer is a permanent fixture of the building. In classical physics reality exists quite apart from any observers and any observations. In the relativistic argument physical reality exists primarily, or even exclusively, in the mind of the observer. Firstly, because he has to accept Einstein's belief system in his mind. Secondly, because he has to apply it and to interpret observations in accordance with this belief. And thirdly, because his observations are supposed to depend upon his location and the motion of his physical system, anyway.

10. Length change. Einstein now applies the preceding assumptions to the interaction of his two systems, the stationary and the moving rod, and arrives at a new assumption, namely that the length of the moving rod differs from that of the stationary rod. Before motion was imparted to it, its length was the same as that of the stationary rod. It is necessary to consider this assumption in some detail because it forms, together with the time change assumption, the key section of the argument. For this consideration it is important to know what happens to the two ends of the rods. In order to distinguish them we will identify the two ends of the stationary rod as white end and red end, and those of the moving rod as front end and rear end. The two rods are in physical contact with each other along their longitudinal axes. The white end and the front end are pointing in the same direction. The moving rod moves along the longitudinal axis in the direction of its front end. In the stationary rod several clocks are positioned along the whole length of the rod and synchronised in accordance with the Einsteinian light ray method.

The following operations are now theoretically executed. First, the length of the moving rod is ascertained by observers in the moving system. A measuring-rod is used which is travelling with the moving rod. The measurement discloses that the length of the moving rod is equal to its length when it was measured with the same measuring rod before motion was imparted to it. At that stage the length of the moving rod was identical with the length of the stationary rod.

A second measurement operation is conducted by observers in the stationary rod. The stationary observers come to a different conclusion. The second measurement of the moving rod is executed *by means of stationary clocks set up in the stationary system* (Einstein) and synchronised in accordance with the prescription for remote clocks. Einstein continues: *The observer ascertains at what points of the stationary system the two ends of the rod to be measured are located at a definite time. The distance between these two points, measured by the measuring-rod already employed, which in this case is at rest*, is the length which may be designated *the length of the moving rod in the stationary system.*