The Logical Redundancy of Einstein's Second Postulate

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Abstract

In 1987 a mathematical journal published a paper entitled 'A New Approach to Special Relativity'.[1] This was reported in the Citations Index as 'a modelling approach to relativity'. That description, however, missed the essential point of the paper, which was that it had derived Einstein's basic relativistic formula, not only in a very simple way but, which was of particular significance, also without any need of Einstein's Second Postulate regarding the 'speed of light *in vacuo*'.

In the years since that publication the logical and philosophical implications of these findings, although well-enough published, have remained completely sidelined in favour of the standard orthodox view (*pace* Einstein) that light has a constant speed relative to everything and nothing (the vacuum). This present paper seeks to reaffirm, in an updated way, the essential point that was made in that original paper, spelling-out its significance for both physics and philosophy which, it seems, is otherwise easily missed..

1. Pythagorean time-dilation

It is customary to speak of the measure of the unaccelerated motion of a body as a *velocity*. Classically, the magnitude of that velocity (let's denote it by $v_{\text{class.}}$) is a distance s in metres travelled by a body in a time t measured in seconds, as depicted in Figure 1.

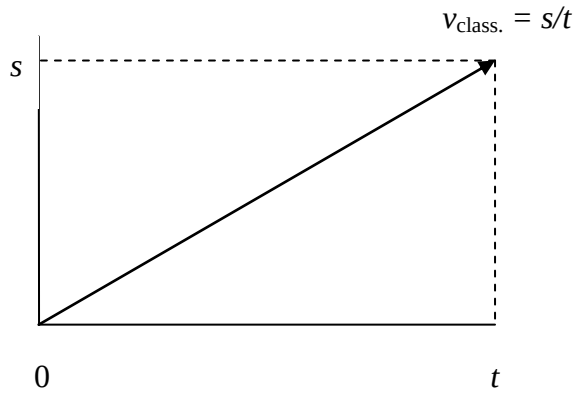

Figure 1. Classical velocity

In this graph, s is taken to be an *instantaneous* extension (that is, for all points along s, $t = 0$) and t is the duration of the motion of a body between 0 and s as measured by

some set of standard, well-regulated clocks carried by both the moving body and by the observer of the motion.

This classical representation contained two concealed assumptions which have turned out to be false. One was that distance and time are *independent* measures, so that Figure 1 was regarded as a scalar diagram, with purely arbitrary choices of units along both axes; the other was that it didn't matter which clock the time was measured by, the clock of the moving body or that of the observer, just so long as its time-readings were synchronised with those of all other standard clocks in a postulated overall cosmic 'GMT'.

However, in 1676, it was discovered, from observations made by the Danish astronomer, Olaus Römer, that the units in Figure 1 are fixed by nature, such that if the *t* axis is measured in seconds, the *s* axis has to be measured in units of either 186,000 miles or 300,000 kilometres. In other words, Römer had ascertained that observational distances in space are also times in that constant ratio of units, *c*. It was then further discovered, by Michelson and Morley, in 1887, that *c* is the same for all observers in all states of relative motion and rest.

The plain, theoretically unadorned logical consequence of these two discoveries is that no longer can the speed of a body be regarded as the scalar measure depicted in Figure 1, that it is a *geometrical* – or, rather, a geometro-temporal – measure, a measure defined by altogether *four* observational dimensions. This is depicted in Figure 2, below, where *t* is the time registered by the travelling clock over the distance (distance-time) *s/c*, measured in the three spatial dimensions, and t_R is the observational resultant of the two orthogonal [2] components *s/c* and *t* in the Pythagorean relation:

$$t_R = \sqrt{(s/c)^2 + t^2} \qquad (1).$$

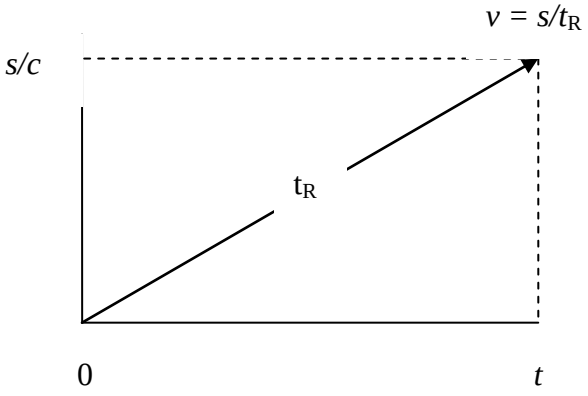

Figure 2. *Relative* velocity

This tells us that the motion of a body may be described not by just one but by *two* velocities. One is the original classical velocity $v_{class.}$ shown in Figure 1, which is the observational distance *s* travelled by the body in the time *t* registered by the body itself ($v_{class} = s/t$), and the other, *v*, depicted in Figure 2, is that same classical distance *s* travelled by the body in the time t_R measured by the observer of the motion ($v = s/t_R$).

The question of what actually constitutes these measures *s* and *t* will be addressed in due course. Meanwhile, let it be emphasised that all the measures

indicated here, even the time registered by the travelling clock (as seen in the observer's telescope, say) are made in *the one observational frame of reference*, namely, that of the observer of the motion.

This is all that is necessary to produce Einstein's famous relativistic time-formula. For instance, since the *relative* velocity is $v = s/t_R$, the distance s in formula (1) can be replaced by vt_R. Simplifying the result then produces

$$t_R = t/\sqrt{(1 - (v^2/c^2))} \qquad (2),$$

which is the familiar relativistic time-dilation formula of Special Relativity, QED.

We see, then, that this famous formula may be deduced, by plain Pythagoras, from the barest minimum of observational premises without involving Einstein's Second Postulate regarding the speed of light *in vacuo*. This logical by-passing of Einstein's assumption that light travels in space (in the void) sufficiently demonstrates that there was never any logical need for that problematical conception as a basis for relativity. The theory could have been deduced by plain Pythagoras from phenomenological premises alone in terms of the bare observational data supplied by Römer and Michelson & Morley – and, of course, ordinary commonsense logic.

The record of this discovery of the logical redundancy of Einstein's 'light *in vacuo*' postulate spans almost fifty years.[3] That it has been virtually ignored by the physics establishment is perfectly understandable, given not only the natural priority of presumption in favour of the tradition of electrodynamics on which Einstein based his theory but also the academic Arts-Science schism by which, in modern academia, the interests of Physics and Philosophy have become disunited. Nevertheless, it might prove useful to consider, from a viewpoint of purely uncommitted natural curiosity, what the logical consequences for physics might have been if history had favoured this simpler and more conceptually economical approach to relativity that is based purely on Römer, Michelson-Morley and Pythagoras.

2. The EPR non-paradox

In the first place, there could never have arisen, in this conceptually minimalist approach to physics, the sort of controversy that arose between Bohr and Einstein over whether distant interactions may be instantaneous or limited to the 'finite speed c'. [4] The Pythagorean equation shows very clearly that an action may, without logical contradiction, be *both* instantaneous, in the classical manner required by Bohr, *and* time-delayed in the manner required by Einstein. It all depends on which clock is used to time the motion, the clock of the observer or that of the travelling entity. For instance, let that 'travelling entity' be a quantum of light-interaction between two atoms over an observational distance s. If that interaction is direct – that is, if it involves no intermediate atoms – then in its own time the interaction has to take place *instantly*. This, of course, is so that energy and angular momentum may be conserved in the way quantum physics requires. (There is no way in which a quantum of action can 'hang about in limbo' awaiting consummation.) With this intrinsic or 'proper' time, t of the transition being zero, the Pythagorean equation tells us that the *relative* time, or observer-time of that same interaction is the delayed time $t_R = s/c$. There is, then, no need to dispense with the instantaneous length s of classical physics, which the equation allows us to think of as extended between two points A and B all in a time $t = 0$ – or, which is the same thing, at a speed $v_{class.} = s/t = \infty$. Since that

instantaneity is the same in all systems of reference, it follows that all space measures *s* are *absolutely objective* in the way classical science envisaged.[5]

So much, then, for what *distance* means in this minimalist context (more of this later). Let us now consider what *time* means in this same context. The straight and unadorned, empirical (*i.e*., anti-metaphysical) description of time is that it is what clocks measure. The ultimate clocks, of course, are *atoms* whose quantum ticks are the periods *h/e*, where *e* is the energy manifest in the light-spectrum identifying the atom as one of hydrogen, helium or some element in the table of elements. These atomic periods are the time-basis of all physical processes, chemical, biological or whatever.

Now as we have seen, the premise on which our minimalist interpretation of relativity is based is that of the evidence supplied by Römer and Michelson & Morley, backed-up by experimentalists such as James Bradley, Armand Fizeau, Christian Huygens, *et al*, that all observational distances *s* in metres are times in seconds in the constant ratio *c* which, as Michelson and Morley discovered, is the same for all measurers in all situations of relative motion and rest. This, of course, is for light as actually observed. Whatever we might think of as the 'transition-time' of that light is intrinsically $t = 0$, whence, observationally, according to the Pythagorean equation (1) it is the delayed-time $t_R = s/c$. By that same equation, in all other cases, as the time *t* of a body's motion becomes longer and longer, the increase in the observational time t_R becomes progressively less and less, so that $s/t_R = c$ represents an absolute upper limit on all observational velocities *v*. This velocity-limit *c* is the same as in Einsteinian relativity but now, of course, without *c* being a *velocity* of anything, far less of light in or relative to a *vacuum*. [6]

3. The Clock non-Paradox

The logical and philosophical implications of this conceptual economising of our ideas of time and motion are altogether profound.[7] Let us now examine some of these implications for the motions of bodies relatively to one another. First, let us remind ourselves of what *time* is. In its plainest, least metaphysical (most empirical) interpretation, time is simply what is measured by clocks. The ultimate clocks are, of course, the atoms of which all things, including ourselves, are made. Every atom has its characteristic set of ticks which, like a finger-print, a bar-code or DNA readout, identifies it for what it is in the atomic table. The instrument we use for reading these clocks is the spectroscope. In that instrument we read not only the characters of these atomic clocks but also the extent to which, relatively to us, they are running fast or slow (that is, whether their spectra are blue-shifted or red-shifted, respectively).

With our spectroscopes, then, we can read the periods of the atoms and therefore the characteristic duration-rate of any body at any distance, just so long as it is visible, directly or instrumentally. In principle, then, the period of a standard second of time on any body is readable at any distance whatsoever, in such a way as to be compared with that of the observer's local GMT.

A standard clock makes one tick per second. For the sake of simplicity, let us suppose that the following exercise takes place at some location so remote from any other bodies as to be virtually isolated. Let there be a set of these standard clocks at that location. Properly constructed and regulated, standing alongside one another and set to tick in synchrony, all these clocks will continue from then on to tick in unison, at the same standard rate.

Now let O and P be two observers at that same location. While O remains with the clock group at that location throughout, we may suppose that P enters that locality having travelled from afar at a steady speed and, in passing, synchronises his own standard clock with those of the group. He then travels away from O and the others, unchecked, at the same steady speed such that when O sees him reach a distance, of, say, one light-year (*i.e.*, $s = 9.46 \times 10^{15}$ metres), he sees P's clock register one year (*i.e.*, 3.1536×10^{7} seconds) at that point.[8] Since every metre of this distance adds 3.3 nanoseconds to the time of P as observed by O, that distance-time *s/c* has to be added to P's clock as seen by O and by his fellows in the local system. But that's not all. What also has to be added to that time of P as seen by O during that first part of P's journey is the time-increase $t_R - t$ according to the Pythagorean equation (1). The number of ticks registered by O's local clock up to the moment he sees P's clock read one year will therefore be

$$t_R + s/c = \sqrt{[(s/c)^2 + t^2]} + s/c \qquad (3),$$

which is 76170361.92 seconds, or 2.415346332 years.

Now at that precise moment, let's say, in his telescope/spectroscope O sees P turn around and approach him at the same speed as that with which P set out,[9] the event being signified by the change, throughout the remainder of P's return journey, in the rate of P's ticks as seen by O, from the slower rate on the way out to a faster rate on the way in, where the number of P's ticks over the distance *s* on that inward leg is now, in O's time,

$$t_R - s/c = \sqrt{[(s/c)^2 + t^2]} - s/c \qquad (4),$$

which is 13056572.68 seconds or 0.414 of a year.

On the re-uniting of O and P, therefore, the total time that P has been away from O is 2.83 years for O, whereas for P it has been no more than two years. If O and P had been twins, then the effect of P's motion away from O and back would be to make P, at the end of the motion nearly 10 months younger than O, and in that same event, O that same amount older than P. If it had been P, rather than O, who had physically undertaken the turning action, then the difference in ageing would have been the other way around. In other words, what distinguishes the two ageings is the reversing action taken by either P or O to bring them back together. Only in the case where, by some carefully prearranged and pre-timed action on the part of both observers in reversing the relative motion would they both reunite at the same age.

This is no more nor less than what is meant by the *relativity* of time. It confirms the projections of standard relativity, that time (duration) is not the same for all bodies everywhere, as classical physics presumed, but that it depends, *unparadoxically*, on how bodies move relatively to one another. In the words of a commentator, it reverses the classical idea of bodies being in time by putting time into bodies. It also dispenses with any idea of there being any time in empty space (*i.e.*, in the void or vacuum).

It might be pertinent to mention, here, what this writer regards as one of the strangest objections that have been raised against this thesis. It is that these effects of motion apply 'only to clocks', and not to 'time itself', whatever that might mean. The underlying reasons for this sort of objection will be discussed in due course (section 8: **'**The psychological problem with relativity').

On that same subject of objections, it is often objected that light 'obviously' travels in space, since it can be projected, in the form of torch-beams and laser beams to form images on screens, and so on. Sunrays can be seen shining through rooms, and casting shadows on walls. If that doesn't prove that light travels (so the objection goes), then so much for plain experience and logic!

From a strictly logical point of view, however, this argument is false. It is by no means 'obvious', as the medieval scholars well knew, that these experiences can be logically construed as 'seeing light travelling'. They used to demonstrate this by shining sunbeams through holes in opposite sides of a barrel. Looking down into the darkness of the barrel nothing could be seen of the beam if the atmosphere inside the barrel was free of dust. Only when some dust or smoke was introduced into the barrel did the 'beam' appear. Strictly logically, then, the phenomenon in question is not that of light *travelling*, far less in a vacuum. The phenomenon is that of illuminated particles of dust or smoke. To say that this is caused by 'light travelling' is to state one logical possibility. A logical alternative, however, is to say that the phenomenon consists of pure sequences of illumination of mediating particles. In the advertising industry, this is called the *phi* phenomenon, a standard example of which is the sequential switching on and off of light bulbs in a timed sequence so as to create an illusion of mechanical motion. Even more striking examples are, of course, the cinematography and the sequences of pixel-events into which, on a television or video screen, a TV or video drama ultimately analyses.

Is what we call the 'speed of light', then, a mechanical or a cinematic-sequential phenomenon? The currently received, standard view is that it is mechanical – or, at least, quasi mechanical. With the coming of quantum theory and (especially) relativity this mechanistic interpretation of light has become less and less plausible. However, more of this later. For now let it simply be recorded that the 'obviousness' of the mechanistic explanation of 'light travelling' is no proof of its logicality.

Distant instantaneity

A particularly pernicious fallacy in Einstein's version of relativity is to assume that the theory dispenses with instantaneous distance-extension. To negate one fallacy is often to create another. The classical conception of simultaneity is based on a completely unjustified assumption of its universality, the assumption that simultaneity is defined, as it were, by a kind of omnipresent 'God's-eye-view' of the readings of all synchronised and well-regulated clocks everywhere, both real and imaginary, in matter and in the void or vacuum. Unfortunately, in disabusing us of this strange assumption of universal simultaneity, relativity also seems to remove the *instantaneity* of distance-measures *s*. However, as we have seen, the instantaneity of these distance-measures (that is, the objective simultaneity of placings of the points marking the ends of that measure) is as much an axiomatic precondition of our relativistic formulae (1) and (2) as it is for the conduct of quantum physics.

5. The phenomenological implications of the relativistic time-formula

Our logical alternative to Einsteinian relativity therefore conserves the classical, commonsense idea of instantaneous extension that is also a prerequisite for modern Quantum Physics. Stating (1) in terms of *s*, for $t = 0$ we have $s = ct_R$, which is an instantaneous extension measured in metres. How, then, is that extended instantaneous distance *s* measured? When we look at a star we are seeing that star immediately in the obvious sense that what we are seeing we are seeing right here and

now, regardless of what we customarily assume to be its distance. But of course, we do not actually *see* the distance that astronomers tell us the star is at.[10] Nor, of course, do we *see* the time ct_R that is the extrapolated equivalent of that distance. So how is that distance measured? The answer is that first we see the star and then, from the patterns and sequences of the informational data supplied by that image such as its direction with regard to other objects, brightness comparisons, parallax, spectral analysis and so on, in all those ways known to the science of astronomy, we project the three dimensions of observational separation between that object and other objects in space. These observational dimensions are the angular measures: i) *azimuth*, or horizontal angle, ii) *elevation*, or vertical angle, and iii) *range*, or radial separation. And, of course, not only can the distances *s* of those objects be extrapolated in that way, but so also can their comparative sizes, characters, motions … in fact, everything we know about them. Also, from that same immediate (instantaneous) informational presentation, the distance-times of those astronomical objects can be extrapolated in the way that was discovered by Römer, *et al*.

6. An information-theoretical alternative to mechanistic physics

Needless to say, in that purely informational contact there is no question of any separation between the observed *object* (the *encoder* of the information, so to speak) and the *observer* of that object (the *decoder*). So far as concerns the quantum 'pixels' into which, as Planck discovered, this information ultimately analyses (in units of action *h*) there is no sensible question of how those quanta 'behave', at what 'speed' or whatever, *en route* from the object to the observer or observing instrument. In this purely information-theoretical context, Einstein's fanciful description of these quanta as space-travelling 'photons' is a complete misnomer, suggesting as it does a picture of these quantum elements as incidental space-travelling mediators between objects and our perceptions of them.[11] Of these alleged 'corpuscles of light', John Locke (the accredited 'father' of modern phenomenalism) once declared that the idea was as absurd as if someone had suggested to him that there were little tennis-balls that fairies all day long struck with racquets in a hit-or-miss way against men's foreheads.

For Locke, of course, like his phenomenalist successors, Berkeley, Hume and Kant, and then *via* Mach, and others right up to Quantum Physicists in the 'Copenhagen' tradition of Bohr, it was unempirical (hence, 'meaningless' in their terminology) to talk about perception being mediated by things like light corpuscles travelling in the void in such a way as to be inscrutable, not only to human observation but also to instrumental detection.[12] For them, perception comes first and foremost (*a priori*), and our knowledge of things underlying it only, at best, secondary (*a posteriori*).[13] Some physicists calling themselves 'realists' seek to reverse this procedure by insisting that Science's conventional theoretical knowledge of the world is more basic and more reliable than our actual perceptions of it. But whichever way we choose to think about it, a single quantum can tell us nothing as to whether its 'source' is something a metre away or in a distant galaxy; so to think of these informational quantum blips as space-travelling 'photons' is no more than metaphysical. Only in informational associations with other quanta, in contexts of directly perceived and rationally processed observational data can objects and their distances signify as such.

7. The incommensurability of the informational and mechanical approaches

Such, then, is the nature of the measure *s* in the Pythagorean equations (1) and (2). It is 'instantaneous', but not in the mystifying sense of something shooting across the

classical void in a 'travelling time' $t = 0$, the 'something' being an informational quantum transacted between an emitter and an absorber in 'space' as ordinarily conceived. Stated more sensibly, a quantum is as much a part of the object as of one's observation/detection of it. This, in its plainest terms, is what, quite literally, *relativity* means, that the object is an integral part of our perception. It is also, in its plainest terms what *quantum physics* is about, which is the same thing; namely, that all the qualities and properties of objects, including their fundamental dimensions, length, mass and time, do not exist in and of themselves but only *relatively to the observer*, in contexts of directly presented observational/instrumental *information*. Such a 'relativity' mediated by light travelling at an absolute velocity *c in vacuo* from objects that are otherwise detached from observation in distance and in time is logically and philosophically incomprehensible.

Not surprisingly, then, the history of Relativity has been a history of intellectual confusion. The best that can be said about it is that for purely practical. mathematical physics purposes, it works – and spectacularly so, it must be said. But as far as *understanding* is concerned, no-one has yet succeeded in making any logical sense of it. Richard Feynman one declared: 'Nobody understands quantum physics'. And if that is true of Quantum Physics, then the same is certainly true of Relativistic Physics.

The reason for this confusion, when analysed, is that from a logical standpoint the way these theories are constructed, they are logically *impossible* to understand. How, for instance, can bodies be connected in overall-conserved angular momentum relationships, as quantum physics requires, when Relativity forbids that anything can connect with anything else in a time less than it takes for light to travel between things at the 'finite speed *c*'? Yet the Pythagorean formula tells us plainly that physical interactions that are said to take place at the time-delayed observational 'speed *c*' are intrinsically instantaneous.[14] So far as the formula is concerned, there is no contradiction whatsoever between these two statements, that distant interaction is both instantaneous *and* observationally time-delayed. In that case, the infamous controversy between Einstein and Bohr was never more than a 'storm in a teacup' with no logical foundation whatsoever.

8. The psychological problem with relativity

All this is intensely puzzling if we insist on looking at the observational facts with our classical-physics conceptual blinkers on. We find ourselves wondering how 'photons' can travel instantly (in their own time) from A to B while in observer-time they may take aeons. The whole thing seems a complete logical contradiction. How, we wonder, can we possibly be looking *directly* at a star which astronomers tell us is so many million light-years away? Yet it cannot be denied that when we look at a star we are seeing it as it is *right now* in our own time, relatively to ourselves, and it is difficult, to say the least, to think of it as existing *relatively* to oneself in a remote way behind and beyond the light by which we see it – by proxy, as it were. So far as commonsense is concerned, the reality of the star is its immediate appearance, like that of everything else, in one's field of vision.[15] But classical science prompts us to ask, what about the star as it is 'in itself', behind that vision? Convention demands that at its observational distance *s*, the time of the star has to be set at now (*i.e.*, this present moment) minus *s/c*, which removes it from the present and puts it into the past. For instance, if $t_R = 0$ is the time of our view of a star at this present moment, and *s* is the observationally extrapolated distance of the star (say, our nearest one,

Proxima Centauri) then the star we are looking at right now is not the star as it is in itself, but the star as *it was* at a time $t = t_R - (s/c)$, which is about four years ago as astronomers customarily reckon it.

So, according to the scriptures of classical physics we habitually suppose that the star we are looking at right now is not the real star but an image of what that star was four years ago – or, with some astronomical objects, *billions* of years ago. How can that be? Which is the real star, the one we are seeing right now or the one that was there all those years or aeons ago? What is it like on that star right now? Is it, indeed, still there? What can we know of distant reality?

Are there, then, *two* realities, the one we directly perceive and another that we can never perceive other than remotely in space and in time, by proxy, care of light *in vacuo*? These 'two realities' were first introduced into Western science by the French philosopher, René Descartes (1598-1650). Known as 'Cartesian dualism', this presented a problem which has enervated practically the whole of Western philosophy ever since. What made this problem completely insoluble was the persistence, throughout that time, of the notion that light is not what we see but a mediator between what we see and the object itself, the notion that gets its most recent expression in Einstein's 'velocity, *c*, of light *in vacuo*'.[16]

Einstein seems not to have realised that his relativistic time-formula (the same as ours) tells us that there are not two realities but only one. It tells us that both observational conditions, of instantaneity and time delay, are part of the same realistic package. The only difficulty with this is a psychological – or, rather, psycho-social – one. It stresses us, like having to think of the earth as round from an entirely recalcitrant, traditional view of the earth as flat. We simply cannot embrace the logical consequences of the relativistic formula whilst continuing to think of time in the usual manner, as ticking away metaphysically, everywhere, all at the same instant. To understand relativity is simply to dispense with the traditional underworld of remote and unseen realities, the world of pure *theory* that so many regard as 'physics', nowadays, and settle for the one and only true reality there is, the reality of ordinary everyday perception, the root source of all our knowledge in all sectors of science. This means, first of all, doing something that is much easier said than done: dispensing with the whole mess of modern theories about a world of wondrous goings-on that is as remote from mortal man as that of the gods of the Greek Pantheon.

The point of departure between those 'two realities', the empirical one that is based on direct observation and the other, the purely theoretical one that, in comparison with the Greek Pantheon might be called the '*Pan-theoron*', is to interpret 'light' in the sense of ordinary vision, not in the theoretical sense of the invisible 'light *in vacuo*'. By 'vision', of course, is meant the whole spectrum of optical information that is available not only to our eyes but also to our instruments that can respond to that information in what is, to us, complete darkness. Our Pythagorean space-time formula then expresses the degrees of freedom, or *dimensions*, that this informational system, or 'hologram', contains. The informational projections *s*, in Figures 1 and 2 are thus conceived somewhat in the manner of the 'stills' in a movie, which are sequenced in the time *t* shown in Figure 2 to produce the phenomenon of action (position, motion, *etc*.) whose dimensions are s/c and t_R.

Developments in this 'New Approach to Special Relativity', over the sixteen years since was first published [17] have revealed how the invisible, purely theoretical

entities such as the *in vacuo* 'field-forces' of traditional gravitation, electrostatics and magnetostatics, can be replaced in their entirety with a completely 'up front' observational account of overall-conserved angular momentum.[18] Further studies (so far unpublished [19]) indicate that *in vacuo* nuclear forces may be dispensed with in the same way. Indeed, it appears that the whole of physics could, in principle, be reconstructed on the basis of a systematic quantum-informational phenomenology to match the advantageous shift that has taken place from 'analog' to 'digital' in modern Communications Technology.

Summary

The reason why 'Relativity' remains such a byword for intellectual obscurity among the populace at large is perfectly plain. It is because, in terms of commonsense logic, the theory *simply makes no sense*. In the one breath it says that the mass, length, duration, motion and any other properties and qualities of a physical object can be predicated only in relation to observation, while in the other breath it says that nothing is ever related to observation directly but only through light – that is, not light as we see it but as an invisible and purely theoretical space-travelling intermediary. Those two ways of thinking about physical objects are impossible to reconcile.

In this paper, we have seen that there is no need to divide reality in this incomprehensibly split-minded, Cartesian way. There is just the one way of thinking that does for all purposes of science, philosophy and commonsense. This is to see 'relativity' as meaning precisely what the word literally implies, that the root of all our descriptions of nature lies in *observation*, not in some mathematical empyrean. This *relative* world is not the world we read about in science books nowadays, a world of 'hidden mechanisms' with its invisible 'fields', 'photons' 'wormholes' and other denizens of the theoretical 'vacuum', a 'world' of which only certain specialists can claim knowledge. It is, basically, the world that is relative to perception. It is *our* world, the world of everyone's ordinary everyday familiarity. True logical science once had to rescue commonsense from the clutches of canonised religion. Perhaps it needs, once again, to rescue commonsense – not from religion, this time, but from the suffocating coils of a no less priestly Modern Physics and Cosmology. ■

Notes and References

[1] Pope N.V and Osborne, A.D: *International Journal of Mathematical Education in Science and Technology*, **18**, 2, 191-198.(1987).

[2] 'Why orthogonal?' a critic asks. Because, we reply, only in that way can two measures be represented such as not to encroach on each other – like the measures up-down and side-to-side, or north-south and east-west. Only for obscure and (in this context) unnecessary reasons may they be represented in any other way.

[3] The record of this discovery and its fortunes at the hands of the Establishment may be read in the archives of County Hall, Swansea (Archives ref. D/D NVP/1-17, http://www.swansea.gov.uk)

[4] See 'Can Quantum Mechanical Description of the World Be Considered Complete?', Albert Einstein, Boris Podolski and Nathan Rosen, 1935.

[5] If it seems impossible to conceive how some single action can be both instantaneous and time delayed, then we have only to take as a model for atomic light-interaction what a movie director calls *action* which, in the movie, analyses out to a time-delayed sequence of instantly extended still photographs, or 'stills'. In this way of thinking, the interactions between the atoms are like those 'stills' in cinematography and the world as we know it is like the action of a movie, which is the phenomenon consisting of time-sequences of those instantaneous quantum 'stills'.

[6] It is often objected that the Einsteinian dictum states that the 'velocity of light' is constant *in* a vacuum, not 'relative to' a vacuum. In response to this objection it has been continually pointed out that 'in a vacuum' implies 'relative to a vacuum' in the same way that saying that sound travels *in* air at a certain speed logically implies that the sound travels *relatively to* air at that speed.

[7] See Viv Pope, *The Eye of the Beholder: The Role of the Observer In Modern Physics* (*phi* Philosophical Enterprises, Swansea, 2004).

[8] The fact that this gives P a speed which happens to have the same value as c has no particular significance in this present context. This is because this speed of P is his so-called '*proper*' or classical speed s/t, as opposed to his relative, or observational, speed $v = s/t_R$ in formula (2). In any case, the same principle that is explained here applies in the same way no matter what (classical) speed might have been chosen for this example.

[9] Arguments about *acceleration* can be circumvented by assuming that on his way out, P passes close to another observer, Q, who is moving towards O at the same speed as, but in the opposite direction to, that with which P moved away. And in the same way that P originally synchronised his clock with that of the group O, this third observer, Q, can be thought of as synchronising his clock-system with that of P, on his way in towards O. In this manner, the 'time-baton', as it were, leaves O and returns to O having travelled the distance $2s/c$ without raising any question of acceleration. Here, for reasons of simplicity, we employ the designation 'P' for both out-and back motions.

[10] The first people to see these objects had no idea how far away they were as we now estimate them, as neither would we but for the meticulous attentions of our modern astronomers.

[11] It is reported that Einstein was never really happy with this concept of the 'photon' as a space-travelling light-particle. However, although he himself regretted this notion and more or less jettisoned it, his ardent followers, unfortunately, got stuck with it.

[12] Strictly speaking, wherever, a detector is placed is, logically, not a void but a medium.

[13] Pope, N.V., 'From Light in Space to Space in Light: the Complete Relativistic Revolution, *Journal of Theoretics*, Vol. 1, February-March 2004

[14] See Lewis, G.N., 'Light Waves and Corpuscles', *Nature*, 117 (1927), p. 256 – see also 'Quantum Touching' on INTERNET.

[15] Refer J. L. Austin, *Sense and Sensibilia* , OUP, (1962)

[16] Descartes thought of light as a rigid, rod-like connection in space between the light-emitting object and the observer.

[17] Actually, its first academic appearance was more than thirty years ago, when it was submitted as an M.A. thesis at the University of Wales, U.K. This was under the title of 'A Philosophical Re-Examination of some Present Physical Concepts', by N. V. Pope, 1972. The record of the fortunes of this thesis is contained in the set of bound volumes held at the Archives. Reading this record, Karl Popper declared it to be a scandal. The failure of the thesis, he said, signified more than anything the failure of its examiners. For instance, one examiner had commented: 'If he says there is no such thing as the speed of light, then does he think that all physics should be conducted in the dark?'.

[18] See, for instance, Pope, N.V., and Osborne, A.D., 'Instantaneous Relativistic Action at a Distance' *Physics Essays* **8** vol;.3, 384 – 397. (1992) Also Osborne, A.D., and Pope, N.V., 'An Angular Momentum Synthesis of Gravitational and "Electrostatic" Forces, *Galilean Electrodynamics* Vol. 14, Special Issue 1, pp 9 - 19 (2003)

[19] This is in an ongoing project in the Department of Mathematics, Keele University, U.K.

For further information on this subject, see

Websites: www.poams.org

http://www.vivpope.co.uk/

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