The following two papers were first read at ANPA (the Alternative Natural Philosophy Association), Department of History and Philosophy of Science, Cambridge University, UK. See *Proceedings of ANPA 15*, September 1993. The original texts, reproduced here, are slightly edited.

1. Normal Realism: A Challenge to Physicists
2. Rustic Relativity

Abstract to both papers

These papers are designed to convince physicists that the old and unspoken reasons for seeking a physical reality 'behind' or 'underlying' the appearances, which motivates so much of modern physics and cosmology, are no longer philosophically viable. The logical consequence of this is that insofar as this remains the motive for doing theoretical physics its survival is purely vestigial and its pursuit philosophically vain. In short, the message of these papers is that the current scientific aim of looking beyond the direct and instrumental observations of things for original 'hidden mechanisms' of creation, evolution, perception and suchlike, needs to be philosophically revised.

The first paper explains, logically and in detail why this is so, and the second paper gives some examples of how much more simply and efficiently – and understandably – physics can operate without that Cartesian assumption of dual reality. Comments showing how these papers were received by the professionals reveal difficulties in even contemplating such a proposed paradigm changes in the conceptual course of Physics. The attentive reader will surely see that these difficulties owe more to psychology, sociology and plain vested interest, than to logic.

Prologue

Just to remind us, and for the benefit of the general reader, ANPA, where the following papers were read, is the **Alternative Natural Philosophy Association**, whose meetings are held at the Universities of Cambridge, England (**ANPA East**) and Stanford, California (**ANPA West**). Its primary purpose, as described in the ANPA literature, is 'to consider coherent models based on a minimum number of assumptions, to bring together major areas of thought and experience within a natural philosophy alternative to the prevailing scientific attitude.' The Association, it says, 'will remain open to new ideas and modes of action however suggested, which might serve the primary purpose.' In that case, Philosophy says to Physics, 'Well, if that's what you want, then that's what you get!' In the following we see what happens when that philosophical challenge is accepted.

A theme which has gained much unpopularity at ANPA is as described in these two papers, delivered verbatim in September, 1993. The first describes in logical detail a new development of philosophy, in the modern Linguistic mode, called Normal Realism, whose aim is to employ methods of modern linguistic analysis in the service of science. The second gives an example of how this service to science can be put into effect.

For those who may know nothing about it, Linguistic Analysis is a philosophical method developed by the later Ludwig Wittgenstein and others such as G.E. Moore, Gilbert Ryle and J.L. Austin. Its aim is to remove from common language its tendency to generate spurious philosophical and scientific problems of the sort Wittgenstein called *Scheinprobleme.* These are problems arising mostly from the way in which, by a catastrophic misuse of ordinary language, the seventeenth-century philosopher-scientist Descartes, artificially split the world we see before us into two metaphysical divisions, thereafter

distinguished as 'Matter' and 'Mind'. Since then, philosophers and scientists have been plagued by spurious problems such as, typically, 'How can mind know matter?' or, in physics, 'What is the object *really* like behind our observations of it?' Questions like this are un-answerable because in the way Descartes defined them, Matter and Mind are categories which absolutely exclude each other. Matter is essentially mindless and Mind is essentially matter-less, or non-material, with no knowledge of anything but itself other than via senses which, Descartes believed, are provided by a God who 'is no deceiver'. In agnostic science, the lack of any such religious conviction leaves an epistemological gap between things and our perceptions of them. Scientific ingenuity has filled this gap with all sorts of theories of interconnection, such as 'light-waves', 'photons', 'gravitons' and so on, either travelling 'in a self-sufficient void' or conveyed by theoretical intermediaries such as 'fields' and 'ethers'. All this is attended by a whole gobbledygook of mechanistic and geometric explanations as to how these entities behave in the space separating us, as observers, from the Cartesian world of self-sufficient matter. These ideas, theoretically unstable though they continue to be – and are philosophically guaranteed to remain – are now so much a part of the cultural 'package' that it is difficult to imagine how we could ever manage without them.

The developments in modern philosophy which reveal the fallacy of the Cartesian schismatology therefore threaten the whole structure of our Western society, which has moulded itself around that Cartesian schismatology. This threat is essentially to Western science, which, on account of these philosophical developments, is now required to abandon the prestigious game, on which so many reputations and institutions have been built, of interpreting physical data in ways which confound commonsense logic and start again from a kind of linguistic, common-sense 'scratch'. So the suggestion that we get rid of that spurious 'void' between us and physical reality, together, dispensing will all the various theories as to how it is bridged, is not likely to be well-received. It is as though someone with a laser were to vaporise a fox when the hunters are all dressed up, in full cry after it. The fact that this does the job those hunters intended, and in the most humane and efficient way possible, is hardly likely to win the heartfelt thanks of those involved in the chase.

Tensions of that purely psycho-social sort may be discerned in the account given here of how these suggestions for modernising physics along the lines of modern philosophy were received, even by a Physics association dedicated to the freedom of expression for unorthodox approaches to the subject.

Paper 1

Normal Realism: A Challenge to Physicists

By N. V. Pope

When I look at a physical object, what am I seeing? Am I seeing the object or only my mental impression of it? This is a classical philosophical question, to which there are two classical answers. One is the Phenomenalist's answer, that what we see, in standard or 'paradigm' conditions – that is, when not being fooled by things like mirrors, illusionists, hallucinogenic drugs or whatever – is the object itself. The other is the so-called 'realist' response, which is that we never see the object as it really is but only its effects on our sense-organs due to influences travelling between the object and ourselves at speeds never exceeding that of light. The real object, these Realists say, is therefore always something 'out there', behind and beyond what we see and sense in the different ways, so that what we perceive is never, even at best, anything more than a subjective representation, or 'pale shade' of the real thing.

To this the phenomenalist replies 'But if we never perceive the object as it really is, then how can we ever know that our impressions of it are anything like it – or even that there is any underlying object there at all?' So far as Phenomenalism is concerned, therefore, all 'Realist' talk of 'underlying objects' which are more real than those we perceive is sheer nonsense.

But if that is so, reply the Realists, then that means that nothing exists anywhere except 'inside our heads'. And how, they ask, can any practical science like physics possibly be conducted on such an assumption? Besides, they say, hasn't physics proved beyond all doubt that objects are separated from our perceptions of them by space, across which nothing can travel faster than the finite speed of light?

So here we have something of a 'Mexican stand-off' between those two warring factions of physicists, the Realists and the Phenomenalists, each convinced of each other's insanity. The Realists see themselves as seeking to determine the way they believe things 'really' are behind our perceptions of them and the Phenomenalists see themselves as seeking reality in logically and mathematically refining what we actually (that is, directly and instrumentally) perceive.

However, there is an irony in all of this. This is the traditional idea that there is some kind of 'light-barrier' separating the object and the observer, that light forms some kind of ultimate intermediary between things and our perceptions of them. That is to say, we customarily think of those quantum elements of light which we call 'photons' as little particles which take time to travel across some kind of intervening 'void'. If it were not for this institutionalised 'light-barrier' idea, the logic of the Phenomenalists' argument would automatically prevail. That is to say, if these 'photons' could be thought of as bits of *immediate and instantaneous contact* between object and observer – that is, as *events common to both* – then this would mean that at that basic photonic level, objects and our perceptions of them are one and the same, and the Phenomenalists' position would be unassailable.

Now that, as Gilbert Lewis demonstrated as far back as 1926,[1] is precisely the consequence of Einstein's Special Theory of Relativity, that although in observational (or relative) time a light *signal* has the dimensions of a 'speed', the 'proper-time' and 'proper distance' of its photonic constituents are always nil. This means, in Lewis's words, that no matter how far apart we might judge the emitter and absorber of a light signal to be, in every microphysical, or photonic interaction they are literally 'touching'.

However, so ingrained in our science is the traditional, yet nonsensical, notion of a self-extended 'void' across which those photons have to 'travel' that although just about every student of Relativity has heard of Lewis's demonstration, it seems that none of them has any more idea of what to do with that knowledge than a cow with a musket. Yet, as Aristotle once remarked, the idea of a void separating things is a self-contradiction, because since a 'void' means literally, 'nothing', then to say that things are separated by void means that they are separated by nothing, which means that they are not separated. So Aristotle and Lewis concur on that point, that there is no need to distinguish between the ultimate quantum elements of physical objects and the ultimate quantum elements of our perceptions of them, because in object-observer light-interactions, the elements both of those physical objects and of our perceptions of them are *the same*.

This means that at the quantum level there is no absolutely radical distinction of the sort Descartes imagined, between the way things are constructed 'physically' and the way

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[1] Lewis, G.N. 'Light Waves and Corpuscles', *Nature* **117** (1926), 256.

they are constructed 'mentally', since the same quantum elements and the same principles of logical, quantitative and geometrical construction are common to both. As soon as this relativistic consequence of quantum emitter-absorber indistinguishability is realised it makes nonsense of the traditional conflict between 'Realism' and 'Phenomenalism'. In that case, there is nothing to prevent those artificial academic divisions of 'Physics' and 'Philosophy' from re-combining into something like what used to be called Natural Philosophy. Attempts at such a merger were documented in the 1970s, in a form which, for identificatory purposes, was called Normal Realism. In Normal Realism, to the extent that objects and our perceptions of them (*qua* logical constructions) are concurrent, the object as we properly perceive it and the object as it really is are identical, in the same way that when I am correctly 'tuned-in' to a radio or TV broadcast, the programme I am watching and the one that the station sends out can be sensibly regarded as the *same*.

And just as there are always, in such cases, things going on ‘behind the scenes’ which I may not be privy to, so there are always things going on in and behind the objects of perception which we don't necessarily perceive. But that is far from implying the radical sort of separation on which Cartesian Realism, is based because the only way in which this lack of perception 'fails' is in the matter of the *completeness* of our knowledge of things. This does not make those things of which our knowledge is lacking *absolutely inaccessible* to us in the way they would be if the elements of those things and our perceptions of them were separated in the Cartesian way. (This Cartesian dualism is, of course, aided and abetted by Einstein’s ‘light-separation’ hypothesis with its notoriously paradoxical ‘EPR’ implications.)

What organises our perceptions is, of course, *language*, which is just another form of the same natural logic in terms of which objects themselves are constructed. This is what the Greeks called *logos*, a now archaic word for which there is no adequate modern equivalent but whose vestiges survive in the word 'logic' and in those various '-ologies' we use to distinguish departments of science, such as geology, zoology, palaeontology ... and so on.

The commonsense assumption which Normal Realism incorporates is that logic and mathematics we use to construct our theories and calculations as to what there *is*, is in essence common to both human language and the natural world, or *logos* of things So the more of sheer subjectivity we winnow-out of scientific language and the more of objective logic we replace it by, the more 'tuned-in' to physical reality our scientific perceptions become. Also, which is most significant, this process is not balked by any epistemological 'veil of illusion' of the sort which the Cartesian tradition of dualism places between things and our perception of them.

However, due to the inevitable accumulation of venerated imperfections, the language we customarily use in describing scientific experience may just as easily blind us to objective reality as bring it to a fine cognitive focus. This is why, to the annoyance of many physicists, Linguistic philosophers like Austin, Ryle and Wittgenstein placed so much stress on 'linguistic analysis' as an approach to reality. This is a method, not unlike psychoanalysis, whose aim is to refine-out from the way we currently use language, all the age-old accumulation of sheer metaphysical claptrap. Unfortunately, the current academic schism between Science and Philosophy has prevented Linguistic philosophers from mobilising linguistic analysis in the service of science where in some sectors that sort of service is most sorely needed. The only way Education [Link here to the poem ‘To Hell With Education’ Relevant Publication section No. 26] has been able to cope with this academic 'schizophrenia' has been by instituting a sort of academic apartheid, separating the two factions into the Administrational categories of 'Arts' and 'Science'. In this way, the traditional conflict is kept within the bounds of civility, but only at the cost of keeping ‘science’ and ‘philosophy’ apart

and thereby making the contentious words 'reality' and ‘realism’ *verboten* in decent, educated circles.

Heedless, however, of these conventionalist constraints, Normal Realism, for purely philosophical reasons, applies linguistic analysis to those uses of scientific language which it reveals to be not only unnecessary but also confusing – as, for example, by unthinkingly perpetuating too many old and outworn precepts. Central among those precepts is the notion, pregnant with dualism, that the way things *really* are is one thing and the way we describe them is another. This leads to the assumption that in physics we needn't give a damn about language because it is the 'real' things behind the language, that physicists are interested in, leaving the 'language' whose integrity concerns philosophers something incidental, so that physicists may mess with it as they like.

In mitigation, of course, it has to be said that at the conceptual 'cutting-edge' of science, where things and the properties of things are discovered which may not necessarily fit neatly into the usual ordinary-language categories and divisions, it may be necessary, as a matter of pure expediency, to invent all sorts of strange and bizarre ways of describing and identifying those new phenomena. Some of these descriptions may eventually prove useful, but many, outliving their immediate usefulness, may do no more than add to the conceptual clutter. Exotic experiences in areas like cosmology and particle-physics, lie on the outermost fringes of human experience and therefore inevitably involve the most probing and tenuous mobilisations of language. These are remotest from the tried and tested uses of language which have been evolved over millennia by ordinary folk like hunters, farmers, sailors, merchants, housewives, engineers and so on, who live 'cheek by jowl' with nature on the most commonsense-practical levels. This provides the datum of what ‘linguistic’ philosophers like J.L. Austin identify as 'Ordinary Language'. So far, the only way those philosophers have been able to preserve the integrity of that common-sense core of language has been to keep it untainted by what they disparagingly call 'scientism' – to which segregation the academic Arts-Science division is, of course, well-adapted. Normal Realism condemns that artificial ‘apartheid' that Descartes created between the language of Physics and language in general and seeks to restore a proper linguistic, logical exchange between science and common-sense.

This by no means entails sanctifying ordinary language as an 'Oracle of Truth'. As Normal Realism sees it, the aim of philosophers is not to act as 'Language-Police', protecting some idealistically conceived 'Ordinary Language' from threats to it posed by the ‘Scientific Philistine’. It is to provide and maintain, as far as possible, a common-language basis for free and informed, democratic dialogue between science and the common man. This is not so 'Utopian' as it sounds. It is fully cognisant of the fact that insofar as the more 'dodgy' language of new and half-baked theoretical science has infiltrated and polluted ordinary language – much of it via the popular 'Gee-Whiz' type of science media – ordinary language has lost whatever pristine innocence it ever had. So there is no way in which 'ordinary language', especially these days, can be taken as it stands as *a priori* in the dogmatic sense of that phrase. But intellectually corrupted though that ordinary language may have become, it remains for better or worse 'the only game in town'. That is to say, it is psychologically and socially the best hope we can ever have of understanding the world we live in. To tidy it up, to prune it and nurture it along logical lines, by methods of linguistic analysis, seems preferable to letting it become, more and more, just a monopoly on free thought and dispenser of didactic confusion.

For practising scientists, of course, this philosophical concern for the integrity of common language may threaten to put a severe drag on what they see as ‘scientific freedom’. So, as far as Normal Realism is concerned, that is where the philosophers come in, not as purely descriptive, clip-board accountants of what scientists are currently doing, which is

what the old 'Philosophy of Science' tended to be, but as true partners in the business. As such, these philosophical contributions may be *prescriptive* rather than just descriptive. This means, serving as 'consultants to the trade', as it were, exploring, testing and advising new ways of making leaner and more efficient uses of scientific language, preventing it from obscuring natural truth and reality – 'blinding us with science', as the saying goes. By no means does this require philosophers to *do* science, that is, to oversee laboratory experiments or in any other way to 'get under the feet' of the scientists. In that respect, despite the promise of greater co-operation between the two disciplines, something of the old academic division of labour would need to be respectfully maintained.

There also remain, of course, the more traditional roles of philosophers, such as acting as custodians and interpreters of the history of ideas and expanders of knowledge into domains such as metaphysics, ethics and theology. However, the need to explore new, systematic and logical ways of keeping scientific language 'down to earth' – that is to say, in touch with reality according to the common language meaning of that word – opens up a whole area of philosophical employment which for far too long has remained academically neglected (or rather, perhaps, partitioned-off). But now, looking at the naïveté with which so many physicists apply 'do-it-yourself' philosophy to their subject and seeing what a mess they make of it, one becomes more and more convinced that this kind of employment for philosophers in the services of science is urgently needed.■

Follow-up relevant remarks aimed specifically at the ANPA members

As I think I have told this group, or have written somewhere, the well-known physicist John Bell once said to me, many years ago, at CERN,[2] 'Where the hell are you philosophers? We are struggling to articulate our findings, here, and it's "open house", so why aren't you here in droves helping us?'

'Good question!' I said, and went off to do something about it.

So here I am, at ANPA, trying to do just that. An example of how I employ philosophy in this way can be seen, by anyone who is interested, in my forthcoming tail-end talk on Sunday, called 'Rustic Relativity'. This is an application of Normal Realism to the language of Relativity and Quantum Physics. It will show how certain central ideas in those two notoriously divided areas have been obscured by over-interpretation and that when those ideas are properly trimmed and clarified, the two divided sectors can be seen logically and naturally to combine. Physicists who follows this will surely see that an attention to 'proper usage' in language is far from being 'airy-fairy philosophical'. In the meantime, the length of this present paper has been curtailed so as to allow maximum opportunity for discussion of these philosophical remarks of mine and how they may relate to the Combinatorial Hierarchies, a subject on which I have recently had some interesting correspondence with the principals of this ANPA movement.[3] My final write-up for the Proceedings will take account of points raised in this discussion.

To start off, here is my opening sally. From what I have said about constructions, there is obviously some need, to say the least, for discussions of combinatorial principles in the logical constructions of natural phenomena. I stress *phenomena* because, for those reasons I have explained, I reject as meaningless all dualistic double-talk about 'hidden mechanisms' or 'hidden variables' underlying what we see, touch or otherwise sense, directly or by means

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[2] The ORGANISATION EUROPÉENE POUR LA RECHERCHE NUCLÉAIRE, formerly (1952-54) CONSEIL EUROPÉEN POUR LA RECHERCHE NUCLÉAIRE, English EUROPEAN ORGANIZATION FOR NUCLEAR RESEARCH.

[3] Professor C.W. Kilmister and Dr. T. Bastin

of instruments. So, whatever mechanical, geometrical, or combinatorial principles apply to phenomena apply, so far as I am concerned, as much to the objects of perception as to our perceptions of those objects because, as I say, in the last analysis there is no absolute distinction. By the same token I reject as nonsensical all talk of a self-sufficient 'vacuum' or 'void' as something which can do anything, contain anything, or possess any property or attribute in its own right. For those same reasons I reject all talk of such things as 'waves in a vacuum', 'vacuum vortices', space-travelling 'photons', 'virtual particles', 'superluminal action-at-a-distance' and so forth. Like 'the first moments of creation', 'the beginning of time', 'the expanding universe', 'black holes'... *etcetera, etcetera*, these things are prime examples of the sort of nonsense which Normal Realism absolutely and categorically rejects.

But more to the point of the Combinatorial Hierarchies, what Normal Realism also rejects, according to its lights, is any talk of mathematics, geometry, or whatever, as residing in some Platonic 'world-apart'. This includes Hawking's idea that we and everything we see before us, our lives, our loves, our aspirations, our triumphs and disasters, our … this, that and the other, are all manifestations of some primordial Mathematical Equation. To me, this is not just nonsense but nonsense in neon lights. As I see it, there can be only one true starting-point for our scientific studies, whether of the microcosm or macrocosm. That common epistemological 'Square One' is, to me, what we perceive right there before us, as described in ordinary everyday language. We may analyse anything we perceive right down to its ultimate phenomenological irreducibles and then study how those irreducibles interrelate or combine to form the things and systems of things we perceive. Insofar as the Combinatorial Hierarchies does this, then I am all for it and keen to be instructed in those combinatorial principles. But insofar as those principles are thought to have some absolute, ghostly and primordial pre-existence out of which the world 'materialises', like spirits out of ectoplasm, then I am definitely 'agin it'. Over to you!

End of Paper 1.

Paper 2 First edition read at ANPA (the Alternative Natural Philosophy Association), Department of History and Philosophy of Science, Cambridge University, UK. See *Alternatives*, *Proceedings of ANPA 15*, September 1993.

A Rustic Rediscovery of Relativity

by

N. V. Pope

(2nd Edition)

An Intuitive, Common Language Approach to Relativity Theory Developed in Discussions at the 'Blue Anchor' pub on the Gower Coast.

Preface

The usual academic language employed for articles of this kind is set aside in the following for the simple reason that it fails to reach the sorts of ordinary intelligent folk the article is intended to reach. This text is therefore the end-product of a gradual winnowing-out, in genuine bar-room discussion, of the usual specialised language that clearly doesn't work when those on whom it is inflicted leave to sit elsewhere – or choose a different pub.

The few who have survived this protracted process at the 'Blue Anchor' are, as a member jocularly called them, 'The Committee', and what appears here is a text which, after

many failed attempts and as many altered scripts, the Committee has passed as putting the case for the relativity of time 'most clearly and unarguably'. How it will be received by one's academic colleagues remains to be seen. [4]

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That was written prior to my reading of the paper at the ANPA 15 conference at Cambridge. My intention, in presenting the paper, had certainly not been to slight my academic colleagues. Nevertheless, some of my listeners were deeply offended, to the point of asking what was the purpose of 'discussing relativistic physics with morons' and even accusing me of 'corrupting the populace' – a classic charge if ever there was one! Perhaps the most telling protest, however, was this, from a well-known and well respected – usually urbane – Conference member:

> How very strange that a number of excellent fellows on the Gower peninsula are able to formulate something which in many ways is equivalent to Relativity when, at the turn of the century and before, it cost a very great number of dollars to carry out the experiments by which the theory was originally discovered. I think Viv is going to answer that they weren't thinking about it in the right way and that it's really obvious if they thought about it, so all that money could have been saved. I would not believe that! I think that it cannot be true! So I ask myself, how has it been managed by this "Committee"? I am led to the conclusion that it must be connected with the strength of the beer at "The Blue Anchor", because Viv accuses people like Einstein, and people who draw certain diagrams, of "playing God". But it's Viv who is playing God, because he had two pieces of information coming in; one of them was a time-sort of information and the other was a distance-sort of information. And for no (bleep-bleep) reason at all he drew them on a piece of paper, at right angles and used Pythagoras. But Pythagoras had (bleep)-all to do with the business, because he could have drawn them any way he liked![5]

At the close of the conference I was offered a drink, with the invitation: 'What will you have, Viv, wine. gin or hemlock?' I trust that on cooler consideration of the argument and of its implications for physics my academic colleagues will allow me to settle for just the wine or the gin.

Part One: An Ideal Intuitive Approach

1t is a fine summer night and I'm sitting here on the patio having a quiet, contemplative drink. The tide is in on the marsh and I'm looking across it at the lights on the other side of the estuary. What do I see? Do I see the light from those lights leave their sources, travel across the distance and then enter my eye .to create in my brain a mental impression of the light-source? Of course I don't, because in seeing the light 'reach' me I am also, at that same instant, seeing it 'leave' its source. So what we customarily think of as 'those two events' are, in fact, one and the same. It is the same, of course, for any other observer or observing instrument, no matter where placed. Also, it is a well-known fact that light in space (that is, in a vacuum or void) cannot be observed. In any case, wherever there is anything to detect light is, by definition, not a vacuum.

So where did I get this impression that things and my observations of those things are separated by light travelling in that way? From our scientific traditions, where else? Well,

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[4] Mention needs to be made here of the late Alan Montague Smart, the staunchest and most regular attendee at these 'Blue Anchor' discussions. A South Wales newspaper once described him as 'The Penclawdd Philosopher'. An early convert to the philosophy of Normal Realism, he was critically involved at every stage in its long-term development. He was also a main moral support to its author and lifelong friend Viv Pope. His recent, sudden demise, at the age of 64 was little short of catastrophic for the continuation of those 'Blue Anchor' discussions, revealing that his genial presence had been virtually the cement binding those meetings together. .

[5] In later correspondence, this forthright criticism was as forthrightly withdrawn, see footnote 5.

let's pretend for the moment that we'd never learned those traditions and let's continue to muse on what we actually, naïvely perceive, right there in front of us.

From any one of those twinkling lights in itself it would be difficult for me to gauge its distance. It might be a light on the hill, the wing-light of an aeroplane, an artificial satellite or a distant star. So I fetch my binoculars and focus it on one of those lights. What do I see? A whole pattern of smaller twinkles in a form which I recognise as a street lamp. From that I can gauge the distance as, say, roughly four miles, which I could measure exactly if I had a theodolite or some other such instrument. But what about those smaller twinkles? Suppose I reduce every twinkle right down to the smallest twinkles there are – quantum twinkles, let's call them. Without any pattern to those twinkles – and that includes comparing the directions of other twinkles from the same source from different viewpoints, as in triangulation and other parallax methods – how can I possibly gauge their distance? So none of those quantum twinkles in itself has, for me, where I sit, any distance in it – nor time, since I see the twinkle and its source simultaneously. The only way I can tell the distance of an object is from those patterns of twinkles which form the object in my normal field of vision, in the same way that patterns of paint on a flat canvas inform me of the distances of objects in a landscape.

A landscape, however, being static, has only three dimensions. To bring it alive we must add another dimension, and that extra, animating dimension is, of course, time. But to think of time as something that goes on all by itself, not only in all things everywhere but also in the spaces between those things is absurd. Time is what is ticked by clocks, and any object we see is a clock.[6] Also, those objects/clocks may move as well as tell time. In that case, they measure distance and time in some proportion or other between two dimensional extremes, or limits. One of those limits is that of all-distance-and-no-time; the other is that of all-time-and no-distance.

Now let's just suppose that this had been the way motion was measured originally. That is to say, let's imagine that instead of measuring distances and times in the customary metres and seconds we had happened, by sheer chance, to employ the same units for both distance and time, in the way we measure vertical and horizontal distances in the same units – miles, metres or whatever. All measures of motion might then have been expressed as ratios of numbers of those units in the one dimension – the all-distance-and-no-time dimension – to numbers of those same units in the other dimension – the all-time-and-no-distance dimension. The logical result of that would have been to remove all necessity for thinking of time as something indescribably mysterious and allowing it to be seen for what it is, just the remaining dimension of ordinary, live geometry.

Now, regardless of how unlikely may be the possibility of such a historical coincidence in choosing the same units for both distance and time, that possibility cannot be logically excluded. Had it occurred, the consequences would have been most interesting. For instance, with distance being already time, there would have been no reason to be surprised at Römer's discovery, confirmed by Doppler, Fizeau, Michelson, *et al*., that as objects increase or decrease their distances from us they respectively add or subtract those distances to or from their observed durations. Nor would there have been any need to interpret that phenomenon in the now customary way, as due to the 'speed' of any optical agency or intermediary, called 'light' or whatever. So in our customary ways of thinking, that concept of 'the speed of light' is no more than circumstantial and therefore logically redundant.

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[6] Spectroscopically speaking, every atom of every object has an optical period, which is Planck's constant *h* divided by the optical energy.

Another consequence of this imagined fortuitous geometrical merging of observational space and time would have been the effect which was discovered by Lorentz and Einstein, at the end of the nineteenth century and expressed in a form which, after nigh on a century of interpreting it in the usual way, continues to mystify us. This is what has been technically called 'relativistic time-dilation', on the evidence of which modern physics is built and on which point it takes its departure from classical physics. The way this would have arisen, in our idealised situation, would have been simply as a common-sense result of applying ordinary Pythagoras to the dimensional components of motion already described. For instance, if s is the observational distance travelled by an object in a time t as measured by the object (see Figure 1), then the geometrical distance-time resultant, t_R, of those two dimensional components, represented by the hypotenuse of that triangle (all in idealised units, of course) is, by Pythagoras: [7]

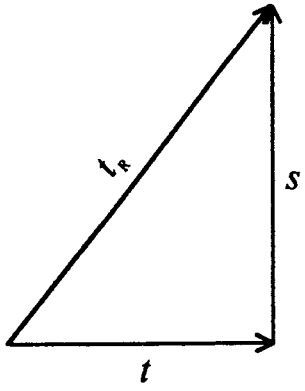

Figure. 1

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

Now in those ideal circumstances that is all 'Relativity' need have amounted to. So we could, dare I suggest, have been spared all the – albeit illustrious – historical rigmarole about 'light' and how it is supposed to travel 'in the ether', or *'in vacuo*', by wave-propagation, light-particles (photons) or whatever, which has led so circuitously, via the observations of Michelson & Morley, *et al*., to modern relativistic physics, with all its paradoxical implications about 'action-at-a-distance' and so on. What theoretical shape physics might have taken in that imagined event is not pertinent to speculate on at this stage. Suffice it to say that the essential mathematical consequences of that 'Ideal Relativity' can be shown (see Part Two) to be *precisely the same as those of Einsteinian Special Relativity*. So, at least, we can be assured that the purely factual implications of that ideal theory would be familiar to exponents of modern relativistic physics. [8]

One special consequence of that ideal theory, however, might well have been to avert that alienation from common-sense which characterises current Relativity. This, of course, is because the theorem of Pythagoras is much simpler as a basis for relativity than the notoriously unfriendly mathematics of the standard orthodox theory, For instance, just about anyone can see that, logically, if distance is time, then the ticks of a clock which, relatively to us, marks distance as well as time are more widely spread-out than when the clock stands there and ticks only time. So if we watch a pair of identical clocks, one of which stays still while the other travels some distance away from us, we should expect to find that the travelling clock, due to its ticks being spread-out or rarefied by the feeding-in of the extra distance-time, has visibly slowed relatively to the other. That is no mystery. Indeed, given the starting-premise that distances and times are geometrically composite, it would be a mystery

[7] The objection to this use of Pythagoras, which was expressed at the outset will be dealt with in due course.

[8] This was written in 1994. Discussions since then have revealed that there are some significant factual implications which are described in subsequent publications.

if that time-dilation didn't happen. And, of course, the use of Pythagoras in calculating that time-dilation follows as a matter of course.[9]

But isn't that time lost by the travelling clock regained if the clock reverses its outward direction of travel and returns to base? Well, certainly, reversing the outward motion and returning the clocks together subtracts the intervening distance-time. This answers to what is classically known as the Doppler effect, and it *would* compensate exactly for the time lost by each party to the motion relatively to the other *if* it were not for the fact, which just about anyone with any maths at all knows, that squaring a negative makes it a positive. So no matter whether *s*, in formula (1) is positive or negative (*i.e.*, outward or inward, respectively), the squaring of *s* in that formula makes it uniformly positive. That is to say, for any non-zero value of *s*, regardless of its direction, and regardless of what Doppler effects it produces, the formula always expresses a lengthening, never a shortening. So in returning to base, the travelling clock does regain some of the time it lost on the way out, namely, the distance-time over which it has travelled. But there is still the difference t_R minus t to be accounted for, according to the formula, and whether this is added or subtracted depends, not on whether the motion is outward or inward, but on which party to the motion takes the reversing action (This is explained in the Appendix. See also, Footnote 6). It is that difference between the times registered by the moving object and by the observer at the conclusion of the round trip which answers precisely to what physicists call 'relativistic time-dilation' (or 'relativistic time-contraction' of course, for the non-reversing participant).

Part Two: Implications for Physics of this Ideal Intuitive Approach

Simply looking, then, at the way things are placed, how they change, move and so on, in one's visual field, reveals that time does not go on at the same rate for all objects (clocks) in that field – which, of course, is what Relativity is all about. For instance, suppose I see a number of travellers leave some starting-point together and then, having travelled all sorts of different distances in the meantime, rendezvous back at the same spot. When this happens I will see that when they all meet up they will have aged differently, not only relatively to me but also relatively to each other, those which have aged most being the ones which have moved slowest relatively to me and vice versa. So any idea that these differences in ageing are only apparent and that behind them marches some single overall time which goes on everywhere, not only among objects but also in the spaces between, is scotched by the fact that all those travellers properly applying the same Pythagorean formula [10] will concur as to how much they have aged relatively to each other and to me. For how can there possibly be

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9 This automatic use of Pythagoras has been challenged on the grounds that, as an objector put it, setting them at right-angles to each other is the convenient way of representing two independent variables. But that, he says, doesn't mean that the length of the hypotenuse is significant. An instance, he gives is that of an economist setting out GNP against years. The points along the curve are significant, says the critic, but not the lengths between them. My reply was that although this is true of independent variables, like GNP and time, it is not true of dependent variables such as, say, the height and horizontal-distance components of an incline or gradient. Similarly, when distance and time become constantly related in the ratio of units *c*, then like length-dimensions, they are not just graphically but also geometrically related. My critic now gracefully accepts this.

10 A common mistake in the use of this formula – or the Einsteinian equivalent (see following) – is to assume that when you move relatively to me, your observations and my observations of that motion are symmetrical, with the paradoxical result that when we return together each of us ends up older than the other. Whilst it is true that the velocity of something moving uniformly relative to me is symmetrical with my opposite velocity relative to it, this does not apply to non-uniform motion. For instance, if one or the other of us reverses his direction to bring us back together, that reversal will be seen by you and by me at different times. This destroys observational symmetry and decides, objectively, which of us ages relatively to which. (See Appendix, 'The Relativistic Clock Non-Paradox'.)

any single overall background-time to so many different on-the-spot ageings? It is therefore plain that these time-differences due to observed motion, far from being subjective, or 'merely apparent' are objectively real.

So although we started out discussing what is 'only apparent' we end-up with what is undoubtedly real; that is, with absolute differences in ageing between relatively moving observers. It only *seems* that there is one time for all of us, such as Greenwich Mean Time, because the speeds of human beings relatively to each other are so comparatively small. For instance, the fastest and farthest I have ever travelled is from Heathrow to Vancouver and back, which is a round trip of about 26,000 kilometres. This usually takes, by direct flight, excluding the time spent in Canada, about 19 hours overall. If I feed that data into the Pythagorean equation, (1), or its Einsteinian equivalent, equation (4) (see following), the amount I have aged less than the folks at home during that interval is one forty-millionth of a second, which is, of course, negligible for most practical purposes. This allows us to retain the impression that all life on this planet ages at the same rate, set by standard GMT. To extend this GMT to 'the universe as a whole' seems a natural step. It is only when we deal with the distances and speeds of remote astronomical bodies and microphysical particles that these ageing-differences become significant. And in those fields of study the relativistic formula is taken as standard, telling us that the single, universal time-background which persists in our traditional imaginations is nowhere to be found in nature.[11]

'Is that it, then,' says someone, 'a poor-man's reconstruction of Einstein's Theory of Relativity?' 'No,' I reply, 'What we have here is not Einstein's theory but Einstein's *formula* for relativistic time-dilation, including, of course, that formula's standard implications for the relativity of length, mass and so on. But now we have derived that same formula by different, albeit corroborative means. However, as we shall see, the consequences of this changed approach are in some ways as different from Einstein's as his were from Newton's.'

How the famous and notoriously abstruse formula of Einstein and Lorentz for the relativity of time follows from our simple Pythagorean equation, (1), can be shown very easily. Expressing that simple equation in conventional units of metres and seconds (which are related by the constant c)[12] makes it

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

And since s, in conventional Relativity, is vt_R then substituting this equivalent expression for s in (2) therefore produces

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

Simplified, this becomes

$$t_R = t/\sqrt{[1 - (v^2/c^2)]} \qquad (4),$$

which is the well-known standard formula for time-dilation in Einstein's Special Theory of Relativity, the formula from which everything else in that theory follows.

One of the main implications, then, of this direct Pythagorean or geometrical approach is not only that it corroborates Relativity in commonsense observational terms but also that in so doing it greatly simplifies our educational understanding of that theory by basing it on simple, well-understood Pythagoras rather than on the intuitively difficult formula of Lorentz and Einstein. This does not mean that it will be easier for those who are more used to the Einsteinian theory. Indeed, for them the opposite might well be the case. However, that is not a philosophical matter but a matter of expediency. From the

[11] This statement, written in 1994, would have to be modified in view of later developments.
[12] This is no longer the 'speed of light' but merely what Herman Bondi calls a 'conversion-factor'.

philosophical point of view the fact is that this intuitive theory is intrinsically simpler, because it is more conceptually economical, thereby fulfilling the criterion which academics call 'Ockham's razor'. For instance, it makes redundant the traditional notion of the 'finite speed of light in a vacuum', on which Einstein's theory is based. If I flash you a signal, then no matter how far apart you and I are, you will receive my flash as soon as I send it, that is, instantly, in the way I see those lights across the marsh. If you then directly return the signal (by mirror, say) then I in turn will also see that response instantly, in the same way. But since the distance in metres which I measure between you and that first flash, divided by the constant *c*, is a time in seconds,[13] the time I will measure between signalling to you and seeing your reply will be the sum of those two distance-times, exactly as if the signal had travelled from me to you and back at 'the finite speed of light'. It only seems contradictory to us that the signal itself is instantaneous in the two directions but takes time to cover that distance because we are not used to thinking of time in relativistic terms. But that, as we have seen, is what Relativity is all about, the differences in ageing-rates and distance-determinations for different things – in this extreme case, the signal and the observer, where the signal travels no distance and ages not at all, whilst to the observer it travels the distance 2*s* and ages to the extent 2*s/c*.

To say, then, that the distance-time ratio *c* is due to the 'absolute speed of light in space' not only adds nothing whatever to what has already been said but is also downright confusing. It is as though someone were to say that the constant ratio of feet measured vertically above the airfield to metres measured along the length of a runway (*i.e.*, 3.28 feet to the metre) constituted some strange kind of asymptote, or absolute limit, to the speeds and angles of ascent of aircraft.

Another thing to notice is this, which should be of interest to physicists of classical persuasion. The intuitive theory offers the same conditions for the immediacy of operation of classical conservation laws as was offered by Newtonian physics prior to the Relativistic fiction that no physical influence can pass between one body and another 'faster than the finite speed of light'. If that were the case, then there could be no overall balance of energy, angular momentum and so on, especially in a large system of objects such as a galaxy of stars, where many of those objects may be so far apart that they might grow old and die before they can influence one another in that or any other kind of way. This is as ridiculous to contemplate as to imagine how a child on a see-saw can continue to go up and down on one end in a balancing response to another on the other end who had long since left and gone home.

That this 'finite speed of physical causality' is a fiction can be seen if we put this so-called 'speed *c*' in place of *v* in equation (4) and then solve for *t*, the time (technically called the proper-time) of the light-signal, which comes out at zero. The intrinsic distance $s = ct$ travelled by the signal then also comes out at zero, confirming what we said at the start about there being no distance nor time involved in seeing the lights across the marsh. So it follows that nothing either can nor needs to travel faster than the 'speed of light' (at 'superluminal speeds', in modern science jargon) to maintain the overall balance of bodies at a distance in the instantaneous way that is required by the classical conservation laws. Since this follows from the Einsteinian theory it is surprising, to say the least, that this consequence has never been realised – or, at least, never properly stressed – by Relativists. This will be discussed in more detail in our Conclusion.

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[13] That is, omitting any relaying medium in between, such as air, glass. or whatever.

Let us now return to the 'Blue Anchor'. 'What you are saying, it seems to me,' says a member of The Committee, 'is that this is the theory Einstein should have written instead of fudging the issue with all that crap about "light-velocity" '. 'Yes,' I reply, 'with all due respect to Einstein, he was, after all, no more than just a guy, like the rest of us. And without knowing it, that guy over-intellectualised something which, if we were allowed to think about it democratically in the way he no doubt would have wanted, could now be seen to be a matter of more or less plain common-sense. For if time is *change* (and what else can time possibly be?) then, obviously, *time is different for all bodies changing faster or slower relatively to each other*. So where there is no change – in an atom, say, between absorbing one quantum of energy and emitting another – how can there possibly be time? As far as the atom is concerned. what difference can there be between our saying that the interval between those events is a microsecond or a million billion years? The only measure of time that can signify is the statistical measure of the changes in other things in general that we observe in between those two atomic events. To imagine that where nothing goes on. time “ticks on” in the ordinary way is nonsense.’

By the same token, any idea that microphysical particles, in between their quantum interactions with one another, have determinate space-time trajectories is also nonsense. It is the physical bodies as wholes, as objects of observation in relation to other objects, which have continuity, not their 'ultimate particles', whatever those may be. And that observational continuity cannot be anything but statistical. There is no sensible question of where an 'elementary particle' resides, what it is doing, where it is going, or whatever, in between one quantum manifestation and another.

So there is no reason why anyone should have been confounded by Heisenberg's discovery of the principle of indeterminacy. That indeterminacy of microphysical events – indeed the indeterminacy of the very existence (i.e. persistence in time) of 'microphysical particles' – is perfectly understandable and predictable on the basis of plain commonsense logic.

By this reasoning, the only influences which govern the motions and other activities of bodies are statistical ones in the form of, for example, Charles' law, the law of entropy and suchlike, which make no sense other than that applied to bodies and systems of bodies as observational wholes. The essential condition of the operation of those statistical influences, or *causes*, is that the activities of the ultimate parts are random. That is, those parts have to be free of any mechanical, electrical, magnetic, geometrical or any other monolithic kind of interlinking or binding-together and therefore free to fulfil the distributional probabilities defined by the statistical law, And those holistic probability-statistical influences, as we have seen, are instantaneous, not limited by any 'finite speed of light'.

Another way of saying all that is that the ultimate bits of physical phenomena, of matter and material processes, are *events*, not permanent particles. 'So you see,' I said to my interrogators at the Blue Anchor, 'although this intuitive theory supports Einstein's Special Theory of Relativity in every important respect, the differences between them, so far as physical and philosophical implications are concerned, are far from trivial.'

'Are you going to publish that?' asks one of them.

'It'll never get past the censors!' says another.

Conclusions

'All the difficulties in understanding this,' someone says, 'boil down to two things. One is having to abandon the age-old idea that behind it all there is just one overall, "cosmical" time

in which all these events, all these differences in ageing and so on, are measured.[14] The other is having to accept what you said at the start about those lights across the marsh – the light from the hill, the stars or whatever – that without forming patterns of distribution in our observational fields there would be no distance in those lights. Although I accept that Relativity confirms all this, [15] it is difficult to conceive that there can be no distance nor time in light-contacts between bodies which are, in some cases, light-years apart. Because whichever way you look at it, it seems contradictory to suggest that things can be both apart and together in the same instance.

'So although I accept the logic of your argument at every stage,' my critic concluded, 'and although I am reasonably persuaded by those who are *au fait* with mathematical physics that the consequences of this theory are significant, I still can't imagine how I'm supposed to think of the world in those terms; and on those grounds. My mind, I'm afraid, rejects it.'

'Yes,' I said, 'Perhaps that's the biggest difficulty a radical theory like this has to face, and I haven't a clue as to how that psychological difficulty can be surmounted. All I know is that if no-one can successfully fault these arguments, if these arguments satisfy all the criteria of logical consistency, conceptual economy and so on, and if in that way they reveal the redundancy of some of the central conceptions in our historical ways of thinking about physical reality, then it seems plain that those historical ways of thinking have to be reassessed. After all, the possibility that our historical interpretations of nature have gone astray somewhere is not all that difficult to contemplate. I mean, it's not as though the builders of our science-history, venerable though they undoubtedly were – and will undoubtedly remain – were divine beings. They were men, and men are notoriously fallible.

'So the approach I take,' I told him, 'is what academics call the *empirical* one. That is to say, although I cannot presume to say what, in the end, "The Truth" of all this might be, I am at least convinced that it is not what we customarily imagine it to be, either in common-sense or in science. So you could say I'm adopting the stance of the typical scientific adventurer, or explorer, who simply follows his logical and mathematical nose into areas which are there for the discovering. That these areas will be strange and unfamiliar is no more than a tautology. Once you embark on discussions of this philosophical sort, some loss of familiarity is only to be expected.

'I realise, of course; I added, 'that not everyone is happy to cast off, as it were, from a continent of familiar ideas with no guarantee nor even any immediate prospect of anything but remaining philosophically 'at sea' for a very long time, perhaps indefinitely. Most people might therefore, and quite properly, settle for philosophical familiarity, no matter how much contempt (or content) it might breed in them, rather than "sail so far abroad". Indeed, in the end, to choose familiarity might well prove the wiser course! (After all, "curiosity," as they say, "killed the cat.") So I am by no means suggesting that everyone should be prepared to cast himself adrift in that philosophical fashion, far less be "press-ganged" into such a venture by the likes of myself – as though that were even remotely possible!

'But on the other hand,' I continued, 'neither can I accept that *everyone* should settle for philosophical familiarity. If everyone did that, there would be no philosophical progress and our civilisation would undoubtedly stultify. So there have to be people,' I suggested, 'who are prepared to "give it a go" and who are prepared to forego the usual guarantees of success. You guys are free agents,' I said, 'and, of course, you follow or stay, as you please.

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[14] See above, Footnote 4.

[15] Present at one of the meetings had been two French visitors, a Professor of Physics and a Professor of Mathematics, both of whom had confirmed to the satisfaction of the company the validity of the mathematics and the relevance for Physics of some of the conclusions drawn.

'So although, obviously, I can't define that "unknown continent" towards which I feel these discussions are taking us nor even guarantee its existence, as a prelude to setting out – the very suggestion of which is ridiculous when you think about it – I may still be able to provide at least some presentable justification for the undertaking.

'For instance, let's take a good look at those "difficulties" you speak of. The first one you mention is simply the standard difficulty of having to change one's habitual ways of thinking, from thinking of time as absolute, to thinking of it as relative. But that isn't insurmountable. It's something to be conquered personally, like learning to operate a computer or ride a bike. Nor is the second difficulty any difficulty really, for there simply is *no contradiction* in things apart being also together. For instance, think of the words and letters in a written sentence, which are all separate in the length-dimension of the sentence but are all collapsed together when the sentence is seen endwise on. Since there is no contradiction in that, then why is there a contradiction in saying that those objects which are separated in the distance-time dimension which is spread out across one's field of vision are all collapsed together when viewed directly along the line of sight? That line-of sight dimension in which the objects are "collapsed together" is the proper-space-proper-time dimension of the illumination itself, signified, as I say, by putting v equal to c in the relativistic formula (4), solving for t and then expressing the *proper* distance, s_P of the signal as ct, which collapses everything down to zero. The other dimension, in which objects are separated, is the *relative* distance-dimension of that same illumination, signified in the same way by again putting t equal to zero in the relativistic (Pythagorean) equation, solving for t_R. This gives $t_R = s/c$, which is the observational distance-time separations of objects and events whose intrinsic distances apart (in the dimension ct) are zero.'

'I'll take your word for that,' said my interrogator, 'But I still can't say I understand it.'

'Not the maths, no; but that is no more than corroboration of what you can actually see in front of you, with your own eyes. You look along a "light-ray", so to speak, and you can see that there's no distance nor time in it, just like those lights across the marsh. But in the way those lights are spread across your field of vision there are both distance and time, as experiments show. So there you see it, *distance-and-time* and *no-distance-and-no-time*, together in the very same objects and without any contradiction whatsoever.

'A prime example of this,' I suggested, 'is Michelson's famous toothed-wheel method of determining the so-called "velocity of light". In that apparatus the lamp is at some position in my visual space and the screen is some distance s away from the lamp. The distances from me of the lamp and the screen can be ignored because they take no part in the experiment. So for that purpose, all that matters is that from some point on the screen the source-event is "seen" immediately, with no distance and no time in it, whereas from the point of view of the experimenter the source and the screen are separated from each other by the known distance s. The ratio between that known length s and the measured time t_R between the emission-event at the source and the absorption-event at the screen is then the value of c which the experiment determines. To call this the "speed of light" is, as I say, logically unnecessary.'

'The experiment, then, simply measures the constant c. not the "speed of light"?'

'Precisely!'

To the group I pointed out an interesting tie-up between this new theory and Newtonian physics, which is that like the latter it provides an absolute determination of universal simultaneity. For instance, it is a tautology of relativity theory – both this intuitive one and Einstein's – that the proper-time t between a pair of distance-separated events, whether it be zero or non-zero, is the same from the standpoint of any observational frame of reference. This fixes unambiguously (that is, absolutely or invariantly), the present moment

everywhere; that is, a 'universal' time-zero for every seen event, precisely as in pre-relativistic physics. So if I observe a supernova I can subtract, from my time of seeing it, its distance from me divided by the constant *c* to allocate to that event a cosmical time-zero of some thousands of years ago, confident that all other observers of that same event, calculating their own different distance-times from it will concur. So for every event that I see there is a whole spherical distribution of events which everyone agrees were once 'now' at that point in history. And by the same token, associated with every event that occurs to me, here and now, there is a whole three-dimensional sphere of simultaneously occurring events which are all now in that same absolute sense. So, on the grounds of the conservation of energy, angular momentum and so on, if I were orbiting the earth in a space-suit, any adjustment 1 might make to the balance between my orbital angular momentum and that of the earth – by operating my rocket-pack, let *s* say – will be felt immediately throughout the whole solar system and beyond, as classical physics requires. That action-reaction 'jolt' is proper- time-instantaneous and reciprocal. So I can say without absurdity that in rising from my chair I am instantaneously shifting the balance of the earth and all other objects to some disappearing extent all over, which, by instantaneous reciprocal reaction is what makes it such an effort to rise and prevents my fourteen-odd stone from zipping about all over the place, as it undoubtedly would if the balance of momentum and so on between me and all those other bodies were not conserved.

This, however, is where all similarity with classical physics ends, because between any one such instant and the next, proper-time is not the same for all observers, as it is in classical theory. As we have seen, the proper-ageings of things which move relatively to one another may end-up 'scrambled' all on the same spot. So although the simultaneity, or now, of things is the same as in classical physics, the time-*flow* is different for different things. And that's where the essential difference lies between the relativistic way of thinking and the classical way: there is no chance of establishing an absolute or cosmical GMT by means of that absolute simultaneity, because any such synchronisation is completely destroyed between one instant and the next.

Another consequence of this new – what we may call 'discrete' – theory of relativity is that there is no need to think of the causal linkings of distance-separated bodies as mediated by 'waves' in any wave-conducting ether or field, far less by any 'pure vacuum', or void. This, as we have seen, is because the emitter and absorber of quantum energy are in immediate proper-time-instantaneous contact. In the well-known double-slit 'wave-interference' experiments of the sort carried out by Thomas Young, the emitters at the source and the absorbers at the screen, in the line-of-sight dimension of the signal, are therefore sympathetically connected 'ahead', as it were, of the time it takes the signal to get there in the ordinary transverse dimensions. In those transverse dimensions, the paths for the signal ‘to take or not to take’ at the so-called ‘speed *c*’ seem to be 'pre-ordained'. That is to say, if all routes from the slits to the screen (in ordinary geometrical terms) are traced out in units equal to the so-called 'wavelength' of the source-energy, then *the paths in themselves*, with no question of anything travelling in them, ‘interfere’, constructively or destructively, with one another. That is, the paths from the slits, intersecting at the points on the screen, are *themselves* geometrically 'in phase' or 'out-of phase', according to the ‘wavelengths’ involved, thereby distinguishing those areas of the screen where the statistical probabilities of energetic interactions with the source are most and least, respectively.

This solves the age-old mystery as to how photons (conceived in the classical way as travelling particles) seem to ‘know’ at the start which routes to take and not to take, so as to fit that typical ‘landing-pattern'. It is simply because in proper-space and proper-time terms (that is, in the line-of-sight dimension) they are 'there' as soon as they 'start out'. [Link with

Relevant Publications 36. 2001. 'The Tantalising Two-Slit Experiment' in *Recent Advances in Relativity Theory*, Vol. 2, *Material Interpretations*, eds. M.C. Duffy and M. Wegener, Hadronic Press, Florida, USA.]

Besides, there is nothing in the 'wave-propagation' explanation of interference phenomena that cannot be explained at least as adequately – though far more economically – in terms of pure proper-space-proper-time *geometry* (that is, *proper* four-dimensional geometry, or 'kinometry', as we might call it). For instance, wave-propagation cannot explain that immediate and sympathetic, seemingly 'telepathic', connection between the sources and sinks of quantum energy which physicists call 'action-at-a-distance'. In physics conferences and journals, nowadays, the mysteriousness of this phenomenon (due to the persistence of our classical precepts of we-propagation') is a burning issue. [Link here to the Swansea Workshop.] The fact that light itself is intrinsically instantaneous therefore not only dispenses with any need for wave-theory in respect of light – or indeed any other form of quantum transaction. It also dispenses with any need for those proliferating explanations of action-at-a-distance which assume that there are 'spooky superluminal' influences connecting things before the theoretical 'waves' or 'wave-particles' can propagate between them. What remains, when these mysterious 'superluminal' influences are removed, is what might be called an overall-conserved *pure potential*.[16] This is like classical absolute space except that instead of being continuous, like Euclidean geometry, it is *quantised*. That is to say, instead of bodies influencing one another continuously, as in classical physics and General Relativity, they do so only in discrete, immediate and reciprocal quantum jumps of action, angular momentum, 'gravitation' or whatever. So I cannot move or do anything without immediately affecting other things and they cannot move or do anything without immediately affecting me – the phenomenon classically called 'inertia'. This 'inertial' connection with other things, however, is not monolithic but takes place in discrete quantum amounts. That overall balance of action-at-a-distance, in all its forms, is no less conserved for being maintained in shuttle-like successions of proper-time-instantaneous quantum transactions than in the traditionally assumed 'continuous' or monolithic way. But instead of thinking of those quanta (called 'photons', 'gravitons' or whatever) as little particles' travelling in a pre-existing space and time we now think of them simply as the immediately irreducible informational bits into which observational space and time may be analysed, as in some super fine-grained video scenario. [Link here to 'The New World Synthesis' Relevant Publ. No. 7.] In that way, as a theory of nature based observer-processed quantum-information, relativity truly comes into its own.

Appendix: The Relativistic Clock Non-Paradox

There are still critics of Relativity who claim that there is a 'paradox' in the theory. If motion is relative, they say, then any motion of A relative to B is symmetrical with that of B relative to A. This (they say) implies the absurd consequence that at the end of their out-and-back motion, each ends up older than the other.

Here we examine this claim by looking specifically and in detail how the motion actually appears to the participants. For this we employ geometrical diagrams depicting the exercise as witnessed by each participant in turn. These diagrams are drawn to an exact scale of 1 vertical unit = 3×10^8 metres/c to one horizontal unit, that is, all in units of seconds. The arrowed 45 degree dotted lines, where they intersect the baselines signify the moments, in each case, at which these events are observed at the customary 'speed of light'.

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[16] This answers, in essence, to what David Bohm has named 'quantum potential', except that here we no need of Bohm's recourse to neo-classical 'spooky superluminal' explanations of its occurrence.

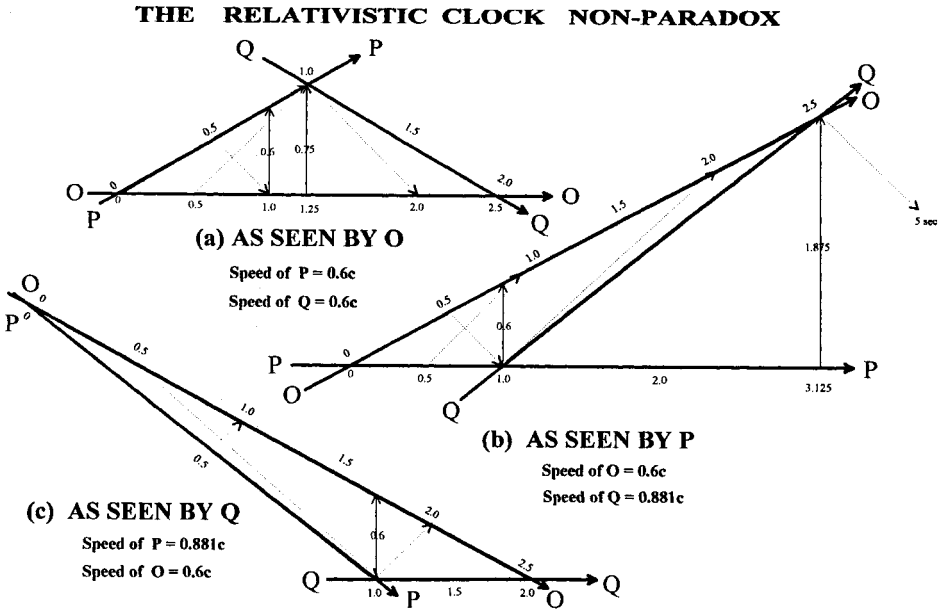

Figure 2. The Different Ageing-Rates of Relatively Moving Objects

In these diagrams, P is an observer passing close to another observer, O, at a very fast but uniform speed of, let us say, $v_{PO}/c = 0.6$, relative to O. (Note that the suffix PO means 'of P relative to O', and likewise for all other suffixes.) As O and P pass each other they together zero their time-readings. Let us now suppose that on the way out from O, after one second according to his clocks, P passes another observer, Q approaching O from the opposite direction, at that same speed relative to O of $v_{QO}/c = 0.6$. (See Fig. 2(a).)

As P and Q pass by each other let Q synchronise his clock with that of P, so that the time-reading of Q's clock, on arrival at O will be the same as if P had gone all the way, with a magical turnaround at point PQ. There is thus no physical acceleration involved in the motion. Let us now see how this exercise will be viewed by each of the participants in turn.

As seen by O (Fig. 2(a))

By standard Special Relativity, P's velocity v_{PO} on the way out from O gives a time-dilation From the Einsteinian formula (4) – see above – of P relative to O of value

$$t_{P0} = t_{OO}/\sqrt{[1 - (v_{P0}/c^2)]} = 1.25t_{OO} \qquad (4a).$$

This means that one unit of time t_{PP} on P (= 1 sec) will be $t_{PO} = 1.25$ units of O's time, and in that time P will have travelled from O a distance $s_{PO} = v_{PO}t_{PO} = 0.6c \times 1.25$ units = 0.75 units.

At that distance from O, P encounters Q, which event is witnessed by P after just one second of *his* time from 'go' and by O after a time $t_{PO} + (s_{PO}/c) = (1.25 + 0.753)$sec = 2 sec (see fig.). So here we have the first break in the symmetry: O and P *do not experience that change-over event at the same instant*.

Now in that same encounter, O sees Q passing P and travelling towards him, O, at speed $v_{QO} = 0.6c$ to arrive reading a total of P's and Q's time $t_{PP} + t_{QQ} = 2$ sec. This is in a time relative to O of $t_{PO} + t_{QO} = 2 \times 1.25$ unit = 2.5 units, as shown in the figure.

As seen by P (Fig. 2(b))

As seen by P, O whizzes past him at the speed $v_{OP} = 0.6c$, the same as that (v_{PO}) with which he whizzes past O. So far – and so far only – their motions are symmetrical. After a time t_{PP} of 1 second he then sees Q whiz by him, even faster, on the way towards O. The distance that O has travelled relative to him, P, in the meantime, is $s_{OP} = v_{OP}/c \times t_{PP} = 0.6$ units (see fig.).

Now we already know that when Q arrives at O the time read by his (Q's) clock will be 2 seconds, and the time read by O's clock at that same meeting will be 2.5 seconds – see again Fig. 2(a). That 2.5 seconds of O's, however, will be dilated relative to P to

$$t_{OP} = t_{PP}/\sqrt{[1 - (v_{OP}/c^2)]} = 2.5/\sqrt{[1 - (0.6)^2]} = 3.125 \text{ sec} \qquad (4b).$$

The distance of that meeting-point QO from PQ is, of course, the same as the distance of that same event from point PO. This is the distance $s_{OP} = v_{OP}/c \times 3.125 = 0.6 \times 3.125 = 1.875$ units, as shown in Fig. 2(b).

The speed of Q, therefore, relative to P is 1.875/(3.125 – 1) units = $0.881c$. Note that this is not the same as the speed of Q relative to O or of O relative to Q. This is further proof of the asymmetry of the participants' descriptions of the relative motion.

As seen by Q (Fig. 2(c))

As seen by Q, the situation is the same as for P but in reverse. That is to say, as he passes near P, at the intersection PQ shown in Fig. 2(c), his clock reads 1 second and at that same moment he sees O's distant clock read 0.5 seconds (dotted diagonal). Eventually, when he meets O at point OQ in the figure, he sees O's clock read 2.5 seconds, as compared with his own clock-reading of 2 seconds. So both Q and O, at their meeting-point concur that as a result of the motion from OP to PQ and back to QO it is the distance-time-track which P has relayed to Q that is dilated (stretched), not O's.

These detailed geometro-temporal projections make it plain that there is no symmetry between any two of the three viewpoints. There is therefore no question of a 'paradox' since all three participants clearly concur, at the end of the motion, that the ratio of the time-reading of Q to that of O will be 2.0/2.5, or 0.8 as given by the time-dilation formula. These results are the same if we make P go all the way there and back without relaying his time via Q. In that case, we may think of P as a super-hard and super-elastic golf-ball bouncing off a super-rigid 'wall' at PQ, so that the time taken for its acceleration-corner, or motion-reversal at that point would be negligible in comparison with the times overall.

It is interesting to note, that in these deductions, the time-dilation is the same regardless of whether we make the reversal of the motion dynamical or purely kinematical. It is concluded, then, that there is no 'Clock Paradox' for relativity to answer. Q.E.D.

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