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The Relativism of Theories of Relativity

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The theories of relativity and the theory of quantum mechanics have each given weight to the destabilization of modernism as a positive twentieth century enlightenment of classical thought and method. These theories taken from the perspective of natural philosophy have contributed with a much wider field of disciplines leading to an outcome of global post-modern naturalism. Yet these theories themselves have remained fairly sacrosanct and unassailable as archetypal and protected within a twentieth century fortress from the movement they helped to create. The twenty-first century however has seen the stirring of two particular sleeping giants who may well be starting to undermine the foundations of that fortress.

One giant is Kurt Gödel whose full significance for the understanding of the nature of scientific theories we are only just beginning to grasp in 2006 this the centenary of his birth [Franzén, 2005]. It appears that most scientists including many mathematicians, and even Gödel himself, either did not understand or failed to appreciate the full ramifications of his theorems [Grattan-Guinness, 2006]. For while Gödel was able to show that first order predicate logic is complete, nevertheless any system beyond first order that relies on axioms and on arithmetic is undecidable. Addition is actually within the bounds of first order but not multiplication. The main focus of the interaction between Gödel and Einstein is usually restricted to their personal rather than their professional lives together at Princeton [Dawson, 1997]. This may well be that a popular interest in time travel has concentrated attention on Gödel's alternative Universe.[Yourgrau, 1999, 2004]. Of much greater scientific significance is the relative status of Einstein's theories when subjected to Gödel uncertainty. The Special Theory may just be acceptable within the bounds of first order predicate logic as derived in a Minkowskian space-time with a Galilean type coordinate system but the General Theory of Relativity is certainly not the contents of first order logic as the solution of partial differential field equations. Repeating the mathematical trick of Minkowski but with the use of Riemannian geometry and the stress-energy tensor is really pushing first order logic beyond its limits in order to cope with the gravitational theory. On the other hand the accepted version of quantum mechanics uses different mathematical tricks (like statistical probability) to bring it within a first order predicate logic but with different assumptions and therefore a different first order logic to those of relativity. To relate the different first orders of relativity and quantum mechanics requires therefore a higher order logic which by Gödel's theorems is undecidable. Therefore the present versions of relativity and quantum mechanics can never be reconciled if we are to accept Gödel's famous theorems.

Another sleeping giant to stir this millennium is Alfred North Whitehead because of the revived (although for many it's the first time around and hardly a revived) interest in process philosophy. Whitehead of course is one of the few with a full alternative theory of gravitation and electromagnetism in a gravitational field [Whitehead, 1922] and which fifty years ago was held by Synge [1956, 1960] to be roughly of equal value with Einstein's general theory. Recently Coleman [2005] has attempted to rehabilitate Whitehead's theory, dismissed (according to Coleman) with 'faint praise' by a 'sacred college' of Misner, Thorne & Wheeler [1970] relying on a 'coup de grace' (but with an effect more like a *coup d'état)* of Clifford M Will [1971, 1993] that Whitehead's theory gave a motion out by two orders of magnitude from that observed in the oceans. Apparently Fowler [1974, 1975] found from a process viewpoint that errors could be demonstrated in both Will's philosophy and physics and now that Fowler's arguments are further reinforced from the possibility of dark matter, Coleman urges that a complete independent review is called for of Synge, Will, Fowler, and Misner & Co in the light of Whitehead's original trilogy [1919, 1920, 1922] that was not properly examined by Will.

A connecting bridge between Gödel and Whitehead is the newer mathematics of category theory which subsumes algebra, geometry and topology but goes much further in that it escapes the clutches of Gödel's undecidability both in substance as well as from its symptoms and sources like impredication. Historically category theory has developed as an axiomatic system with a natural number category grafted on to it. By applying Whitehead's *process* approach to the interpretation of the categorial arrow, it is possible to work in a process category theory free from axioms and free from arithmetic. Category theory provides a 'logical ether' or dynamical version of space where the matter of physics can process. If the Universe is a topos then different models of relativity (and quantum mechanics) are possible subobjects which are not mutually exclusive but which can be classified for creativity as monads or for character as co-monads. Unfortunately Whitehead was too early to exploit category theory and his philosophy of process is only couched in informal language but clearly some such formal notion or potential idea led him to fasten on Grassmann's work on a general calculus for vectors to present a Universal Algebra as early as 1898 before the collaboration with Russell on their *Principia*.

Modern cosmology suggests that we have a multiverse [Tegmark, 2003] rather than a single Universe but the difference (in principle) is quite trivial in category theory which well represents the self-reflective recursive form of the generalised fractal. A category is always just a type. The subobject classifiers for a multiverse topos would distinguish the different type of physics for each respective universe. The multiverses taken together in the big topos as well as each universe like ours would have both an intensional logical as well as an extensional material form. The topos together with its subobjects is a cartesian closed category with limits and exponentials as might be expected from the observations of our Universe. The co-limits are the elementary particles except that these are not elements as we are outside the category of sets. The co-limits have co-ordination but are not in disjoint union on physical grounds. Theories are subobject classifiers but are neither mutually exclusive nor monic.

We should not be surprised to find different theories all with varying significance. It is well established that the relationship between intension and extension is given by two opposing adjoint contravariant functors [Lawvere, 1969]. The unit of adjunction gives a relative measure of the creative value between theories and the co-unit of adjunction compares their characters. This demonstrates formally and both quantitatively and qualitatively the comparative relativism between the theories of relativities. To be more accurate it is a relativistic comparison rather than a relative one. For 'relative' is a comparison within one level while 'relativistic' is across levels. Theories of relativity are not therefore right or wrong. Some of the discarded theories have partial truths which have outlasted the theory that derived them, for instance 'gauge invariance' in Weyl's theory [1929] and the compacted dimensions beyond space and time from that of Kaluza [1921] have continued to attract respect.

Without the formal tools of category theory to represent this relativistic truth of theories, Coleman resorts to an old metaphor of the blue-print for physical laws contending that there is not one master blue-print locked away in a filing cabinet with all other blue-prints declared as forgeries. For he asks, can it be a coincidence that Whitehead (as Eddington [1924] originally pointed out) can reach the same Schwarzschild form from a simple expression for a particle in a field without having to solve a set of non-linear partial differential field equations as in Einstein's theory. Apparently Whitehead himself criticised Einstein's inconsistent theory of measurement which produces the concept of distance as a solution of his field equations although this was already relied on as a notion in the initial conditions. Coleman therefore wants to replace the master blue-print in the filing-cabinet with scientific theories ' viewed as statues or models of which there may be several representing one thing but definitely man-made and subject to rejection, destruction, modification and cannibalisation'. He also cites the observational evidence. Whitehead's theory not only satisfies the usual tests of the perihelion precession of Mercury, the sun's gravitational deflection of light and the spectral red shift in a gravitational field but also Halm's 'limb-effect' [1961-1963] on the solar spectrum which is explicable in Whitehead's but remarkably not Einstein's theory.

Coleman's comparisons between the two theories well bear out the categorial concept of partial or relative truth realisable from a pre-order. This is relativistic natural truth. What is the moral of this tale of the two sleeping giants, Gödel and Whitehead, with their respective theories of undecidability and relativity? It is that all theories should be examined carefully for their merits not damned just on their demerits. Failure on some particular predictive test in the result of a physical observation is not of itself necessarily fatal. There are quite a few researchers around the world who seem to want to show Einstein to be wrong. They should not be ignored. This is not because Einstein is wrong or might be wrong but because of the relativism of relativity. If we may paraphrase a quote of Whitehead:

Einstein's is not the last word on Einstein.

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