

CREATIO EX NIHILO

= // =

Based on a short paper presented to the conference "Einstein, God & Time" held at the Ian Ramsay Centre for science & religion in the University of Oxford, Sept. 2005.

= // =

ABSTRACT

Christian Faith assumes that the universe is created by God. But does the belief in a Divine Creator make any sense? If we have to accept Einsteinian cosmology as providing the final map of our universe, it certainly does not. The contingency of a created universe is totally incomprehensible without that absolute simultaneity which characterizes a cosmic time. But do we have to accept Einstein's cosmology? Not at all! In fact, there is a much neglected British school of relativistic cosmology that vindicates the Newtonian idea of a cosmic time. Granted such time, the idea of *creatio ex nihilo* can even be analysed formally in terms of the logic of tenses.

1. DEUS CREATOR MUNDI

The Christian Tradition is unanimous with respect to its understanding of God as the Creator of heaven and earth, and of the creation as an act of God whereby, on His command, the becoming of something follows pure nothing. Although the Biblical evidence is spurious, creation has in any case been interpreted as a *creatio ex nihilo* since the times of St Augustine (354-430). The problems of time, creation, and eternity, are discussed at length in *Confessiones*, book xi; and in *De Civitate Dei*, book xi, ch.6, his views on these topics are summarized.

In the *Bible*, probably the only hint of *creatio ex nihilo* is found in the prologue to the *Gospel according to St John*: *In the beginning was the Word, and the Word was with God, and the Word was God. This one was in the beginning with God. All things through that became; and without that became not one thing which has become.*

The last passage may also be read: *All things were made by him, and without him became nothing of that which is*. Rendered thus, it is a statement of the contingency of created beings, and indeed of the entire world. Therefore, if it pleased God to withdraw his spirit from the creation, it would fall apart into dust and ashes, returning to that state of "nothingness" from which it originated *in principio*.

Now a state of "nothingness" is not easily defined or explained, and therefore the idea of creation poses a serious logical problem - in fact so serious that not only logicians, but even theologians, have held it to be insoluble and considered belief in creation to be an instance of *credo quia absurdum*. But is it true that the first article in the Christian confession of faith is impenetrable to reason and common sense, being accessible solely to the *sancta simplicitas*? No, definitely not! A Christian believer does not need to make the ultimate intellectual sacrifice and just bow in humility to the supposed wisdom of scientists. It is still possible to defend the faith in creation by rational means without accepting the doctrine of double truth, and without recurring to some outdated form of creationism with divine design and blueprint.

2. PLATO'S MYTH OF CREATION

It is natural to compare the Greek idea of creation as a change of *cháos* (disorder) to *kósmos* (adornment) with the Christian idea of creation as a making of the world out of nothing. My example is Plato's myth of creation as presented in his late master-piece, the *Timaios*. Philosophy, in its antique origin, began by separating *mythos* from *lógos*. So it is striking that, in his treatise on physics, Plato deliberately called upon myth!

As a philosopher Plato paid serious attention to the limits of rational thinking. His deepest ideas, if stated, were always expressed indirectly - often in mythical form. For Plato, to explain anything was to describe its origin, and physics from the beginning involved the origin of the universe, so his cosmology was inseparable from cosmogony. In the *Timaios*, Plato invented his own myth of the *demiourge* (craftsman, mastergod) who, by transforming *cháos* to *kósmos*, also created the old gods of the *panthéon*.

This deity, symbol of *philosophical monoteism*, is abruptly introduced in an otherwise sober lecture discussing the most probable explanation of the *genesis* (becoming) of the world: *Timaios*, having first separated being and becoming, goes on to derive the principle of causality; then, as a matter of course, he alludes to the presumed fact that "what the *demiourge* produces with his gaze steadily directed towards the eternal *paradeígma* must of necessity be beautiful". The tacit assumption is that only *one* can be thought of as having created the universe, viz. God. The godhead, craftsman or mastergod, is the world's *poietés kaí patér* (maker and father).

It is furthermore interesting that, in order to explain the act of creation, Timaios distinguishes between cause and reason: God himself being its cause, his motivating reason was goodness (Plato's God is free of envy, not disposed to revenge - compare *Old Testament & Al Q'uran!*). For the very same reason God wanted that his creation should imitate himself as much as possible; hence, bringing order into our whole mess of confused sense impressions, he produced the universe as a being gifted with beauty and plan, ordering the lesser gods to serve this purpose. First-born among the created gods were *Oúranos* (Heaven) and *Chrónos* (Time); to Plato, these two are inseparable! Only then followed *Gaía* (Earth), *Hélios* (Sun), and *Zeus* ...

3. ARISTOTELIAN METAPHYSICS

The philosophical problem of creation would seem to belong to the discipline called metaphysics, which is the name attached to the *próte philosophía* of Aristotle. Traditionally, metaphysics is divided into two parts: (A) *metaphysica generalis*, which studies Being as such, and (B) *metaphysica specialis*, which discusses God, World, and Man (the human soul) as fundamental varieties of Being and which, accordingly, is subdivided into these disciplines: (i) *natural theology*, (ii) *speculative cosmology*, (iii) *rational antropology*, or *psychology*. From this point of view metaphysics is, by definition, *ontology*, and the tradition is thus basically Aristotelian.

What is the error of Aristotelianism? The triadic theme: God, World, Man, is fine. But its misapprehensions are also triple: 1) It is an error to elevate ontology to the status of philosophical dogmatism: therefore it is misleading that the tri-partitioning into themes is made subordinate to the general idea of Being, for by this move the three topics are changed into substances, or entities, and then degraded to mere "regions" of the universal "ocean" of Being: 2) It is a mistake to construe ontology in line with a subject-predicate logic where the subject is representing a substance under the name of "thing": so it is misconceived that all parts of Being, all essences taking part in Being, are as a matter of course conceived of as entities, or "things". 3) It is a miscalculation to expect too much of pure reason and too little of probed experience: thus we should not give primacy to metaphysics in neglect of empirical inquiry.

Modern science has only succeeded in eliminating the latter prejudice - it has not yet had the fortune to do away with the other errors. It is often objected, however, that these only relate to pure reason, whereas scientific research aims at the correct interpretation of experience. Even then it is generally overlooked that the modern conception of Reality, as a rule, is nothing but a simplistic variety of the traditional concept of Being, the basic elements of reality being interpreted as material objects.

But such material objects constitute just another sort of simple "things". The ghost of Aristotelianism, here in materialistic disguise, has still not been laid to rest.

All this issues a warning against the vitiation of modern science with metaphysics. Science as Ontology, the Metaphysics of Being, is nothing but a relic of bygone ages!

4. ST ANSELM'S PROOF FOR GOOD

Let us now analyze St Anselm's proof for God. This proof is not ontological, but dialectical! Making use of the ancient *via negativa*, it constitutes a *reductio ad absurdum* of the atheist. Taking over most of its premisses from the repudiation of a divine reality, it argues *ad hominem* by showing that if his denial is meant to comprise *Deus sive quo maius nihil cogitari potest*, then the atheist is captured in his own pitfall: either he does not know what he is talking about, or he contradicts himself by implying that something can be thought to be greater than that-*than* which-nothing-greater-can-be-thought. In either case the atheist shows himself to be a fool.

The proof, assuming a real God to be greater than an imagined one, poses the distinction between *reality* and *illusion* as the *tertium comparationis* between the faithful and the infidel. The being-thought-of is common, and the 'greater' is made apparent by the conjunction 'and': that which is both *in intellectu* and *in re* is greater than that which is solely in intellectu. Anselm's proof demonstrates that God cannot be denied what it is greater to be than not to be. The conclusion is that God cannot be thought not to be, i.e., God's "existence" cannot be denied. The atheist's only escape is to discard the principle of double negation - a risky affair!

Anselm's proof, not predicating existence but only the modifications of existence - real or imaginary, necessary or contingent - makes itself immune to Kantian criticism. God is necessary, i.e. it is necessary that God is; and since it is greater for a necessary being to be unique than merely to be one of a kind, God must be the one and only necessary being. Everything else is contingent, i.e. it can be thought to be and not to be, but, on pain of contradiction, cannot be thought both to be and not to be simultaneously. This shows time to be essential, the point being that contradictory predicates cannot be attached to the same subject-variable unless they are not attached simultaneously.

Already Plato in his *Parmenides* showed that, if the *ONE* is, nothing can be said, and silence reigns; on the contrary, if the one really *IS*, then everything can be said, including contradictions, so nonsense reigns; however, if the contradictories do not hold simultaneously, but are mediated by the flow of time, words may begin to make sense.

5. THE PRINCIPLE OF CAUSALITY

The founder of German "Geisteswissenschaft", W. Dilthey, once described the antique principle *ex nihilo nihil fit*, from nothing nothing comes, as the basic principle of metaphysics. He might have illustrated his point by referring to Plato who let his spokesman Timaios make this statement: "Everything that becomes must needs have a cause as it is impossible that something can emerge without cause", the silent condition being that if it could, then something could emerge from pure nothing.

It is worth noticing that the causal principle in this, its classical form, is immune to the criticism presented by Hume. Firstly, his famous billiard example problematized the inference forwards in time, from cause to effect, but not that backwards in time, from effect to cause. Undeniably, the inference forwards in time yields the foundation for the predictions of science but, on the contrary, it is the inference backwards in time that forms the basis of metaphysics. Secondly, Hume hit himself by the equally famous argument, that it is impossible to produce any impression upon our senses which can explain the assumption of a necessary connection between cause and effect. What reason did he present that the idea of necessary causal connection, in order to be legitimate, must be reproducible as a sense impression? Solely the hypothesis that only ideas which originate from sense impressions can be recognized as representing reality. In order to depict reality, our ideas must be produced to our experience by reality itself. How, and in what way, produced, if not causally? The answer seems to indicate that Hume, in order to refute the principle of causality, exploited what he intended to refute. Maybe the causal principle has a stronger foundation than Hume was prepared to admit! Kant claimed that. But Hume saw a way out: why not drop the *ex nihilo nihil fit*?

This seems to open up for transforming the principle to: *ex nihilo fit ens creatus*: from nothing comes the created being - and that was hardly Hume's intention! Neither is it mine, for there is no point in being dogmatic. So we may give up the inference that the contingency of our universe, if it is contingent, necessarily entails the existence of a first cause or *causa sui*. But that one *can* argue from contingent to necessary being, if one feels it mandatory, is obvious! Kant, after having thoroughly demolished any metaphysics illegitimately pretending to possess *der sicheren Gang einer Wissenschaft*, said something similar in his **Prolegomena**:

Wir halten uns aber auf (die erlaubte) Grenze, wenn wir unser Urteil bloss auf das Verhältnis einschränken, welches die Welt zu einem Wesen haben mag, dessen Begriff selbst ausser aller Erkenntnis liegt, deren wir innerhalb der Welt fähig sind ... Wir .. vermeiden dadurch den dogmatischen Anthropomorphismus .. aber erlauben uns einen symbolischen Anthropomorphismus .. der in der Tat nur die Sprache .. angeht

... *Und so kann uns nichts hindern, von diesem Wesen eine Kausalität durch Vernunft in Ansehung der Welt zu prädicieren und so zum Theismus überzuschreiten.*

Before leaving the principle of causality, it is pertinent to consider briefly its relevance to modern science. I must frankly admit that I find its significance to be highly over-estimated. In fact, it is so hard to offer a general definition of causality which in a reasonable way covers all presumed instances hereof that one may prefer instead to recur to the concept of natural law. I therefore adopt the so-called "covering law" view and discard alternative views, irrespective of whether they are founded upon the truth of counterfactual statements (as proposed by D. Lewis) or they are based upon a procedure of "marking" (as suggested by H. Reichenbach).

Personally I believe that causality, in the strict sense, is better understood as the law-like connection between successive states within a well-defined energetic system. Whether it is acceptable to treat the universe *in toto* as a closed energetic system still remains to be proven. If it is, the structure of any earlier world-state may determine the structure of any later one, and the past may be "pregnant" with the future (Leibniz) - if only there is going to be a future! Anyhow it is clear that the concept of succession brings the notion of time into play. So I take time to be prior to causality.

6. SOME ATHEIST GRUMBLINGS

It has become a favourite pastime of atheists to expose the impossibility of theology. But this ambition has already been facilitated by the reflections of modern "atheist theologians". Theology does not speak *to* God, but pretends to speak *of* God, they say. Doing so it does not make use of the proper language which is a religious one, instead it uses the language of reason which is incommensurable to such elevated theme; hence its project seems doomed to failure. As a consequence, when our language is attempting to speak of God it invariably ends up in a mess - and if it does not do that, the explanation seems to be that it does not speak of God at all!

In fact, the idea of God puts a limit to human knowledge and understanding (Kant), hence the word 'God' may be compared to the letter *X* representing an *incognito* (Kierkegaard). The theological axiom "God created the world" or "The world has been created by God" implicitly appeals to human reason. However, God understood as Infinite Being is impossible to define. Indeed, the predicate 'infinite' is negative and abstract and, if we attempt to make it positive or concrete, it turns out that the only examples that can be offered must be taken from that world which, following the axiom, must be assumed entirely different from its creator, God.

Because all predicates of our language receive their connotation from the world we know, we are unable to predicate anything of God without predicating something

wholly different, i.e., something which is not God. In this way the word 'God' turns out to be wholly empty, the atheists say. Neither can one point to any real denotation. Only pretending to refer, it has no real referent. Thus it represents nothing at all, it is all feigned. The proposition "God has created the world" can therefore be translated into "Nobody has created the world", just as the similar proposition "The world was created by God" is translatable into "The world was not created"!

The "createdness" attributed to the world by theology, its character of being a work of creation, is in no way an observable fact. It is nothing but a theory, just like the opposite theory: that the world was never created, but emerged by itself and now simply is there, as a brute fact. According to that other theory we are left over to ourselves in a world without a trace of God. This theory, which currently enjoys great popularity, probably appears so natural to most people that it would hardly seem to be in need of any proof. The onus of proof seems to rest entirely upon the shoulders of anyone who dares to defend the outdated theory of creation.

Instead of defending the theory of creation in any direct way I prefer to do it indirectly by attacking the other theory, supposed to be its opposite by denying all traces of "createdness". My point is that if the theory sketched above is in fact the opposite of the theory of creation, then that opposite theory must be equally empty! Conversely it also holds that if the supposedly opposite theory makes any sense, then the theory of creation itself must be equally meaningful! Even a mediocre logician must concede that if an assertion is true then its contradictory is false; likewise, that if an assertion is devoid of meaning it makes no sense to contradict it.

Most people will take the following assertions to be stating the same simple fact: "The universe is indisputably real", or: "It is indisputable that the universe is real". These assertions may be interpreted as expressing a tautology, just like the assertion: "A rose is a rose is a rose", but in that case, of course, both assertions are meaningless from an empirical point of view. One might, however, suspect that adherents of the second theory will disagree, insisting that their theory is perfectly sensible and rational. But how can that be, if it does not communicate any prior understanding of the world besides what we perceive as immediately given?

What does the term 'the world' denote besides what we perceive as directly given? What do the assertions "The world is undeniably real" or "It is undeniable that the world is real" connote besides "What is real is undeniably real" or "It is undeniable that what is real is real"? Naturally, these assertions are as undeniable as they are indisputable; but what do they tell us? Nothing at all! But would it not help us to learn, e.g., that 'the world' is "the sum total of facts" or "the very totality of what is the case"? Not at all - at least not as long as we are not informed about the *structure* of that totality; and were

we thus informed, the information would probably give rise to all sorts of disagreement, unless we agree to let science settle the issue.

So, what can science tell us besides heaping up facts that do not have much in common? Maybe it could provide us with some information concerning the order and structure of facts. This is important enough, even essential. However, such enterprise has its own narrow limits. Science can tell us nothing about the World, or Universe, as it is "in itself", i.e., as "Ding an sich". But it can give plenty of information about the many "Dinge für uns" - i.e., the models, or universes, we fabricate in trying to get a glimpse of the great *X* behind what we perceive.

7. THE LOGIC OF TENSED TRUTHS

A logic of time is needed to analyse the problems of contingency and creation. What is logic? It is simply the *organon*, or instrument, for all reasoning and rational discourse. Its aim or task as an intellectual discipline is to investigate the conditions for the transferring of truth-value from given premisses to valid conclusion. However, by making use of intensional operators, tense logic - like modal logic - is irreducible to ordinary truth-functional semantics.

Already Leibniz attempted to explain modality by reference to *possible worlds*. In line with this, what is *necessary* is what is true in all possible worlds, what is *possible* is what is true in some possible world, and what is *actual* is what is true in a privileged possible world, viz. that unique world which we ostensibly point out as being our own. However, we do not want to imply that such possible worlds really exist. For this reason we shall make an attempt to reduce modalities to tenses.

The starting point of tense logic, which was founded by A.N. Prior, is the classical contrast, due to McTaggart, between an *A-term analysis* and a *B-term analysis* of time. McTaggart distinguished the absolute *A-concepts* of *past*, *present* and *future* from the relational *B-concepts* of *before*, *during* and *after*. According to Prior, all real existence is present, and only present existence is real, the past being no longer real and the future being not yet real, just as facts are true statements, and statements, if true, are true *now*, at that very instant when they are uttered or read.

The aim of tense logic is to systematize our reasoning with tensed propositions. The subject matter of standard tense logic consists of temporally indefinite statements, the definite statements being those that are omnitemporal, those that signify an absolute beginning or ceasing, and those that are unique in the sense that they are true just *now*, but neither true in the past nor true in the future. With tense logic the verb can no longer be understood as atemporal, but should instead be interpreted as referring to the present: it is *now* the case that so-and-so. It is usual to underline the *transparency* of the present:

if anything is *now* the case, then it is *now* the case that it is *now* the case, and *vice versa*. Another peculiarity of the present is its *elasticity* of duration which is context-variable: what we call *now* may be the present instant, the present day, or the present century. This was pointed out by St. Augustine, who spoke of "the shrinking now".

Now, given some present fact, what can we infer concerning its past and future? You are now, at this very instant, reading a paper treating the idea of *creatio ex nihilo*. From this fact you can infer not only that, from now on, it will always have been the case that you were reading this paper, but that it is now unpreventable that it will have been the case. However, you cannot infer that you were always already destined to read this paper. What you can infer is merely that it was hitherto possible that you would some day read a paper, and even that only on the condition that such possibility was always statable (in the stone age it was certainly not).

We conclude that the sum of statable truths is steadily increasing, due to the fact that assertions which were not hitherto statable become statable in the course of time. Being now statable, we may surmise that such statements remain statable forever after. On the contrary, propositions feigning departed individuals to be present are just false. Taking the possible as that which is not inevitably not the case, possibility is directed towards the future, implying that possibilities are lost forever, as time is passing by. But this loss of possibility is more than compensated by a gain of statable truth.

It should be noticed that our new logic, by making sense of the idea of temporal flux, thereby also lends a unique direction to the arrow of time. More than that, by not implying that it is possible to speak of unspeakables, but by opening instead for the possibility that it may become possible tomorrow to speak of what we cannot speak of today, it makes sense of the Christian idea of *creatio ex nihilo*. Further, by separating what was predestined of eternity from what is now inevitable, it solves the conflict between divine omniscience and human freedom: God knows everything knowable: but we contribute to the divine production of future facts!

With tense logic we can still construe a Leibnizian monad as a maximal set of consistent assertions, just as we can construe a Leibnizian world as a maximal set of compossible monads. What is interesting by this construction is that the structure of such monads, or possible worlds, remains the same, irrespective of whether we agree to assume their actual existence, or not. Indeed, as was pointed out by Prior in his *Worlds, Times & Selves*, the logical structure of instants, individuals, and universes, is very similar. Even God, if personal, must be an individual! Yet a difference persists: only God is necessary, everything else being contingent.

8. **THE "SPATIALIZATION" OF TIME**

It seems to be elevated beyond any reasonable doubt that natural science has a triple task, or purpose: 1) to *describe* the facts, 2) to *predict* what is going to happen, 3) to *explain* what was the case. Science thereby presupposes that tri-partitioning of time into *past*, *present* and *future* which makes it meaningful to speak of the *passage* of time, hence also of time's *direction*.

So, if a great physicist says that time is an illusion, and that all talk about time's passage or direction is lacking a real foundation, he should be dismissed with the message that not only has he not done his job properly, but his claim is at variance with the basic premisses of science! For the same reason it is unacceptable if his followers obstinately persevere in claiming the legitimacy of results which are obviously incompatible with their own scientific foundations! This criticism is expressly pertinent with respect to Einstein's two theories of relativity.

Four branches of physics are particularly relevant as regards the problem of time: 1) *thermodynamics*, 2) *quantum mechanics*, 3) *relativity theory*, and 4) *cosmology*.

Thermodynamics says that: 1st Law, the energy of an isolated system remains a constant; 2nd Law, the amount of disposable energy - that part of it which can be made useful for work - steadily decreases at least from the point of view of statistics. The second statement, also called "the law of entropy", is very often assumed to provide time with a direction ("time's arrow"); however, as was stressed by I. Prigogine in his *From Being to Becoming*, this is not quite correct. Although thermodynamical statistics allows us to distinguish between two directions of time, thermodynamics alone cannot tell which one of these points towards the future, and which other one towards the past. Thermodynamics simply lacks the relevant principle of selection. It is interesting that tense logic is able to provide physics with precisely that principle!

Quantum mechanics is a queer theory - exceedingly effective from the point of view of experimental practice, but theoretically incomplete, as it seems; not for the reasons adduced by Einstein, Podolsky & Rosen, which were refuted by the Aspect experiment, but because it does not possess any means of parametrizing the so-called "wave function collapse". I have no wish to get involved in the intricacies concerning a correct interpretation of standard quantum theory. I only want to point out that what the theory is unable to solve for one universe is hardly solved by invoking an infinity of "parallel universes" separated by successive instants of bifurcation. The celebrated "many-worlds" interpretation of Everett & Wheeler, if not just a joke, may be rebuked as a naïve misunderstanding of the possible worlds semantics of modal logic.

It is a source of abiding surprise to me that the scientific establishment prefers hazardous extravagancies to modest generalizations guided by the classical principle of correspondence, such as the highly ingenious "covering" theory of classical and quantum mechanics presented by T.E. Phipps jun. in his monumental *Heretical Verities* (1986), as well as in numerous papers. What is particularly interesting about this is that Phipps claims to have provided a *mechanical description* of the recalcitrant concept of temporal irreversibility (synonym for "time's arrow"). In the same book Phipps also directs a penetrating "hard-core" criticism against the Einsteinian view of relativity which is well worth studying for its profundity and originality.

Einstein devised two theories of relativity: the special (SR) and the general (GR). SR, which may be seen as the closure of classical mechanics (CM), entails a correction of CM with respect to time: whereas Newton viewed simultaneity as being absolute, Einstein claimed that it is relative - viz. to the point of view of the observer or, rather, to his so-called "reference frame". As a consequence, Minkowski announced the welding of time and space into space-time, and Einstein later declared it to be his ambition to reduce everything in physics to "space-like concepts". The French philosopher Bergson rightly scorned this as a program for "the spatialization of time".

It should be noticed, however, that the French mathematician and philosopher of science H. Poincaré in 1905, shortly before Einstein, published a paper where he, giving a slight correction of what he termed the Lorentz transformations (LT), validated their group properties and introduced the constant $i = \sqrt{-1}$ as a means of obtaining a perfect time-space symmetry. Nevertheless, this did *not* restrain him from approving Lorentz's "ingenious idea of local time" as a means of avoiding the relativization of the classical concept of a universal time! For that very reason he was reproached by A. Grünbaum who interpreted his mature prudence as a hesitation which refrained him from taking the decisive step towards revolution in science, in contrast to Einstein who at once saw what was needed: viz. a clean break with tradition.

Grünbaum is quite right that the relativization of simultaneity and the ensuing repudiation of the classical concept of universal time is the distinctive hallmark of the Einsteinian revolution. Apart from this, however, Poincaré's 1905-theory is practically indistinguishable from the 1905-theory of Einstein, except that the former is more elegant and the latter suffers from flaws. But it is precisely the revolutionary ambition which makes Einstein's theory so fatal to physics. In political theory it has long been realized that revolutions can be disastrous to society: more often than not they have just instigated a debasement, and the same may easily have happened to science. In fact, *the relativization of simultaneity is the most fatal blow ever given to realism in science!* Fortunately, it can be countered with a whole series of weighty objections:

- 1) It is a tacit premiss of physics that atomic clocks of the same construction under the same circumstances keep the same rate - NB: without being causally connected! *This is but a physical analogue to the pre-established harmony of Leibniz!*
- 2) Given two particles in collinear motion it is always possible to construct their midway particle and, relative to this, the motion of the two first is perfectly symmetric. Thus LT (Lorentz-trf.s) is transmutable to GT (Galileo trf.s) for all pairs of observers!
- 3) The relative retardation of clocks by collinear inertial motion follows from the fact that, whereas the slave-clocks fixed in the frame of an observer are synchronized to his master-clock by taking *the arithmetic mean* of the epochs of emission and absorption of a reflected radar-signal, the synchronization of the master-clock of one observer to that of another is effected by taking *the geometric mean* of the epochs of a like signal; cf. the "*k*-calculus" of H. Bondi. But that the master-clock of an observer in passing some slave-clocks fixed to the frame of another appears delayed relative to these does *not* prove the master-clocks themselves to be "mutually delayed"!
- 4) That clocks appear retarded when exposed to the work of gravitational potentials, cf. the Cern meson experiments, is *not* a counterinstance to the idea of a true time!
- 5) There are classical equations of motion describing the motion of planets with the same precision as Einstein's GR; so the tensor apparatus of that theory is redundant!
- 6) Granted that the structure of the universe is fixed by a system of observers subject to *cosmic isotropy* (no preferred directions), a *cosmic time* is always definable!

9. SOME COSMOLOGICAL RIDDLES

It has been pointed out that cosmology provides physics with an indication of "time's arrow" which, with regard to importance, is on a par with that furnished by thermodynamics. If, as suggested by current evidence, the universe is evolving from an origin of infinite density, the successive stages in this evolution may be interpreted as an objective measure of its age. Other beginnings still remain possible, but so do other means of estimating the age. That the universe seems to exhibit the traces of a temporal evolution is not very surprising. If we take into account the concordant results of sciences like astrophysics, geology, biology, and history, it would be more surprising if it did not. Nevertheless, there is a peculiar science - physics - which, dominated by the charisma of one person, would mock these results.

The outcome of "Einstein's Revolution" is precisely to erase all temporal vestiges from science. Few have faced the consequences, e.g. that Einstein makes nonsense of Darwin. Now that Einstein is wrong does not by itself turn Darwin right. Let us instead consider the evidence that can be adduced from cosmology to support the definability of a cosmic time. In fact, the two most impressive scientific discoveries of the 20th century

relate to cosmology. They are: 1) the discovery by E. Hubble of the so-called "redshift" of the light received from distant galaxies, which is traditionally interpreted as showing that such galaxies are receding from us with speeds increasing in proportion to distance; 2) the discovery by Penzias & Wilson of the 3K "cosmic background radiation" (CBR) which, due to its "black body" spectrum, is broadly considered as lending support to the famous "big bang" (BB) hypothesis of Lemaître & Gamow. This would imply that the universe originated in something like a cosmic explosion.

That conclusion, however, would presuppose that a "black body" spectrum cannot be explained otherwise than by BB. What the observations *prove* is that the two discoveries in unison are supporting a uniform distribution of energy in all directions; thus space seems to be isotropic. As a consequence we are faced with two possibilities: α) the first is that we (our own galaxy) are placed near the center of the entire universe; ω) the second is that our position is not that privileged, but that the same would be the case also for observers situated in other galaxies. According to the latter theory, space is not just locally but even globally isotropic, which means that any observer who is at rest relative to the general distribution of matter and energy will see himself as situated at the center of the universe, thus fulfilling the principle of cosmic isotropy. Cosmological modesty would then induce us to prefer the second of these possibilities.

Granted that the universe, as indicated by Hubble's observations of the cosmic "redshift", is in a state of "expansion" (a misleading expression for the supposed fact that the contents of the universe is subject to dispersion) what can be said about its fate? According to GR, gravitation acts as a brake hampering the dispersion of the universe. Most modern cosmologists would therefore predict that its dispersion is decelerating. To Einstein, however, the universe had to be finite, without boundaries, and static. Accepting that the force of gravity is universal, he invented a new force, represented in his field equations by a constant, to counteract it and to ensure that the universe is static. He might have taken a different stand, had he known Hubble's observations. Likewise, the interpretation of GR suggested by Friedmann and Lemaître might have made him realize somewhat earlier that his preferred first world model was unstable.

Recent observations of supernovae indicating that the dispersion is accelerating instead of decelerating, as had been commonly expected, the only way of explaining this acceleration on the basis of standard GR was to recur to the cosmological constant which Einstein himself had abandoned a long time ago. So this is what the cosmological establishment did - rather than questioning their premiss, GR - and without admitting, nor even realizing, that their procedure was *ad hoc*. However, this is not the only example of *ad hoc* reasoning exhibited by the vast majority of standard relativists being characterized by possessing the right herd instinct.

For instance, supposing that the universe started with a bang (a big one, indeed) and assuming that causal influences cannot be propagated with velocities exceeding the limit c , as "predicted" by SR, it is difficult to explain how the universe can appear so homogeneous and isotropic as, in fact, it does on a cosmic scale. To the purpose of solving this so-called "mix-master" problem the orthodox cosmologists have invented an extraordinary solution postulating that the space of the early universe during some tiny fraction of a second underwent a tremendous "inflation" (exceeding the speed limit c). This implies space-time to have been partitioned in a strange way at an early stage.

That the Universe, after the first BB, further inflated into a major "multiverse" - comprising an infinity of relatively minor "universes" separated from each other by horizons which are detectable in principle if an observer is situated close to the border region but which, fortunately, can be assumed to be so distant from the vast majority of observers that it is observable to only a few of them - is a minor drawback, of course. That, however, may easily be turned into a major advantage if one is ready to fancy with L. Smolin, ignoring the clear incompatibility of Darwinian and Einsteinian science, that something similar to a Darwinian selection has been operating on the multitude of smaller "universes", favouring an evolutionary development towards higher intelligence in just an infinitesimally small percentage of the minor universes. This bright idea would ensure a pre-established concord with the notorious anthropic principle which states that intelligence could only develop in a universe adapted to that purpose.

But there are other striking examples of dysfunctional "reasoning" in cosmology. Having exploited inflation as an insurance (but only from a statistical point of view) that our tiny universe (but not the great multiverse) at least in the vast majority of its regions is subject to isotropy and homogeneity, it suddenly occurred to cosmologists that they might have proven too much, so that they were now in need of another explanation - viz. of the fact that the universe, after all, shows such a clear and definite structure, i.e., so much inhomogeneity and anisotropy. They therefore turned to astronomy for help, and - *heureka!* - they found what they sought for, viz. some tiny "ripples" in the CBR, showing that the early universe was not *that* homogeneous, thereby issuing a convenient opportunity to fuse relativity with quantum mechanics.

For those who are doubtful of the blessings promised by Einstein's "revolution", and are sick and tired of such wavering, there is still hope. In fact, relativity theory did not start with Einstein, it began with Poincaré; cf. E.T. Whittaker (1953, vol.II, ch.ii: *The relativity theory of Poincaré and Lorentz*) - and as noticed by J.D. North (1967, p.49): "Had the general sympathy not been so emphatically in favour of a field theory of gravitation, Poincaré's memoirs might well have been a turning point in the history of the subject". One cosmologist who did not buy GR, but preferred to invent a theory of

his own, was the mathematician and cosmologist E.A. Milne of Oxford. He devised his *Kinematic Relativity* (KR) expressly as an alternative to SR & GR.

Milne's aim was to construct a cosmology by deduction from a few assumptions. Generalizing SR to a full cosmology, his world model was based on uniform dispersion. His colleague A.G. Walker developed KR further to become a mathematical technique on a par with with GR and, like GR, applicable to a whole range of world models, viz. all those obeying the principle of cosmic isotropy (the "cosmological" principle). Although the principle (like so much else) is often ascribed to Einstein, it was first formulated by Milne & Walker. As already mentioned, an universal time is definable for any universe fulfilling the principle. The famous *Robertson-Walker metric* (RWM), which is a formalization of the principle of cosmic isotropy, has long been generally acknowledged as the standard metric of relativistic cosmology.

Milne's method for the construction of his relativity theory was based on radar- or signal-functions, and his solution to the paradoxes of time can be boiled down to two points: 1) Two observers have congruent clocks if their signal functions are symmetric. 2) The clocks of an infinite set of observers are congruent if all signal functions are mutually commutative. The latter point implies that even though the mutual distances between the observers may be changing, in accordance with a universal scale function, their relative angles will be preserved. Milne claimed that the general structure of the universe is determined by a privileged class of observers, *the substratum*, constituting a universal frame for the description of rest and motion. All angles in the substratum being preserved, the substratum is subject to cosmic isotropy.

One of the most conspicuous differences between the cosmologies of Einstein and Milne is that, whereas Einstein and his adherents take gravitation to act as a brake on the universal expansion, Milne and his followers see gravitation as a spontaneous consequence of the universal dispersion. Stated in other words: the difference is that, whereas Einstein in agreement with Mach's principle tried (in vain) to explain inertia by reducing it to gravity, Milne attempted (with success) to explain gravity by deducing it from inertia, thus turning Mach's principle upside down!

A. Mercier has stated his qualms regarding the program of "spatializing" time by suggesting that "*space-time*" should be re-interpreted as "*time-space*", or "*supertime*". With respect to gravity, he even expressed the startling opinion: "*Gravitation is Time!*" Maybe time has come to reconsider the joint venture of Einstein, Minkowski & al.?

10. TIME AS CREATIO CONTINUA

According to Plato there is one world, "*and it is and remains the only one*" (*Timaios*). Leibniz agreed: we can conceive of an infinity of possible worlds, but only one of these is real. Now, what is real is also conceivable in the sense that it does not lead us into inconsistency. However, a world wherein nothing ever happens is not a conceivable world. Whatever happens we call incidents or events, and events undeniably take place in time or, rather, they constitute time. All possible worlds, including that which is the only real one, must therefore be described as so many series of events in succession, so many temporal processes. The concepts of time and world cannot be separated, but may be identified with the concept of process as a succession of events. So, for each possible world there is one, and only one, world-time.

The decisive difference between God and world, creator and creation, is reducible to that between two kinds of existence: necessary and contingent. For the Christian, this in the last resort would be equivalent to the difference between divine perfection and human imperfection. However, this is an essay in philosophy, not in theology, so we shall concentrate on contingency in contrast to necessity, since contingency is what must designate a world which is created. Taken in separation from the concept of time, it is hard to see how the concept of contingency can be ascribed a precise meaning or significance. But if the world is identifiable with its time, we can define contingency as the impossibility of explaining the occurrence of a future world-state by reference to the occurrence of a past one. Causality is impotent to that purpose.

Causality can *never* guarantee that we are going to experience any future at all! What causality *can* predict, given the structure of a past world-state, is the probable structure of a future one. All this, of course, would presuppose that it makes sense to speak of a world-wide simultaneity. If not, the idea of *creatio ex nihilo* will finally have been refuted. Hence the idea *can* be refuted. So it makes sense, contrary to the claims of the atheist. But this shows it to be vulnerable too. It can be true, or false. Maybe the idea is false? How should the world be, to make it false? Simply as Einstein imagined! If *Einstein's unfinished revolution* could be completed, if it were true that *the end of time* had come close, this would also finish all talk of creation.

But Einstein's revolution is a theoretical disaster, and will be recognized as such. The *warfare of science against religion* will then turn out to be the most spectacular instance in history of an unsuccessful attempt at falsification. So we may conclude that science is not the only source of truth. In particular, religion need not hamper reason. As A.N. Whitehead wrote in his *Science and the Modern World*:

Mogens True Wegener

Faith in the possibility of science, generated antecedently to the development of modern scientific theory, is an unconscious derivative from medieval theology.

Christianity teaches us that the omnipotence of God manifests itself in the act of creation whereby something, viz. the universe, is called forth out of nothing and kept alive; moreover, that the wisdom and mercy of his providence manifests itself in the creation of man as *imago dei* with freedom of will, and in foreseeing the fall and our ensuing evil deeds as well as his own decision to save us by sending his son and spirit. So far, there is no contradiction in this tale. Contradiction lurks, however, if creation is explained by the speaking of unspeakables, and if divine providence is construed as sempiternal foreknowledge of the truth of future contingents.

But why should God's work of creation be predestined to repeat his eternal truth? Should God be unable to create spontaneously without using a preconceived blueprint? If he is a supreme artist then he indubitably works "bottom-up" as easily as "top-down"! However, God must be a perfect mathematician: can we not imagine him as an infinite and infallible intelligence calculating everything in advance, as suggested by Leibniz? God has no need of any brain, of course; but if he decided to make use of one, how big would it have to be? One less than the universe itself would hardly do; and if that holds, even God would have to wait and see, making his calculation in "real time"!

Instead of continuing these speculations, I shall follow Kierkegaard by taking the relationship between eternity and time, the creator and his creation, to be an absolute paradox. What transcends time and world defies all rational understanding, leaving logic with aporias. But could we not view God's act of creation as a divine experiment? Viewed that way, the reason why God does not know the truth of future contingents is because he has chosen not to do so. The final reason why God produced a world whose future is only predictable in general terms may well be that he wanted to convey *spontaneity* and *freedom of will* to man.

11. A CHRISTIAN COSMOLOGY

*Nicolas of Cusa (1401-64): theologian, philosopher and cosmologist, Catholic cardinal with ecumenical engagement, a pious believer who yet inspired the teachings of Giordano Bruno, prophet of infinity and freedom, burned at the stake 1600 A.D. Major works: **De Docta Ignorantia**, **De Conjecturis**, **De Non Aliud**, **De Visione Dei**.*

In his *De Docta Ignorantia* Nicolas follows Plato, describing time as a moving image of Eternity which he interprets as undivided Oneness. In itself, time is nothing but an ordering of the present: the present infolds past and future, just as past and future unfolds the present. Nicolas' point is that the now, being of variable duration, includes both the past as a having-been-present and the future as a going-to-become-present.

Oneness, itself beyond time, must perceive changing things in an unchanging way. Divine Providence encompasses everything which has happened, is happening, and will ever happen, perceiving that which is possible in time as being actualised of eternity.¹ The universe, like everything created, had a beginning, though not within time, and may be called eternal in the sense that there was no time before the universe. World and time emanated together, and are still emanating, from their only possible source: Eternity. Eternity, not time, reigned ahead of the creation of heaven and earth.

The *De Docta Ignorantia* is tripartite:

Pars I treats of *God* as that *Oneness* which is *coincidentia oppositorum*, being at once *maximum absolutum & minimum absolutum*. This idea is then elaborated by means of geometric analogies which in important respects anticipate insights peculiar to non-Euclidean geometry. We can interpret Nicolas' idea by describing God as *actual infinity*.

Pars II treats of the *World* as that *Wholeness* which is the union of the infinitely many, *maximum contractum et minimum contractum*. To describe the second idea Nicolas uses another geometric analogy, namely that of a sphere which has its center everywhere and its periphery nowhere:²

Unde erit machina mundi quasi habens undique centrum et nullibi circumferentia, quoniam eius circumferentia et centrum est Deus qui est undique et nullibi (ch.xii).

This idea stems from the Hermetian writings where it is applied to God. Nicolas, who very probably knew it from the *Itinerarium Mentis in Deum* of St. Bonaventure, brought it to bear on the created universe. With the quoted passage he in fact anticipated the cosmological principle of Milne and Walker. Rejecting both a geocentric and a heliocentric world, his intuition of an astrocentric universe of *potential infinity* led him to intimate that all the stars are heavenly bodies similar to our Sun, that no heavenly body can make up a perfect sphere because perfection is a prerogative of God, and that innumerable globes are populated with living conscious beings like ourselves!

Pars III describes *Man before the fall* as *deus creatus*, the union of creator and creation, absolute and contracted magnitude, and *Man after the fall* being exposed as a corrupt and stained nature, depending for its salvation on that mercy of God which is obtainable solely through faith in our mediator, Jesus Christ. Anticipating the crucial *sola fide* doctrine of Martin Luther, Nicolas expressly insisted:³

Humanitas in Christo Iesu omnes omnium hominum defectus adimplevit ... Non est iustificatio nostra ex nobis, sed ex Christo ... quem cum in hac vita per fidem formatam attingamus, non aliter quam ipse fide iustificari poterimus ... (iii.6).

Nicolas was inspired by the great mystic, Johann Eckhart. According to Eckhart, "The eye whereby God beholds me is the very same as that eye whereby I behold God. It is all one eye, one sight, and one love!" He also said: "If God could depart from truth,

I would follow truth and skip God!". These words, expressing the essence of modernity, might have been utilized as a maxim for the development of science in modern times.

They need an important addition, however. What Eckhart really intended to assert was in the effect nothing but a simple *suppositio ex impossibile*. In fact, as he added: "God cannot separate himself from Truth, for *God is Truth!*".

Nicolas' own ideas were not condemned, and his books were never put on *index*. Some researchers have charged him with the accusation of pantheism, a serious heresy, but he can be defended by citing from his *De Deo Abscondito* (a gem of a dialogue):⁴

Gentilis: *Mira affirmas Deum, quem adoras, nec esse nihil, nec esse aliquid ...*

Christianus: *Deus est supra nihil et aliquid, quia ipsi oboedit nihil, ut fiat aliquid. Et haec est omnipotentia eius qua quidem potentia omne id quod est aut non est excedit.*

FOOTNOTES TO §11

1. This is the medieval view of omniscience. For a modern solution, cf. §§7&10!
2. *Hence the world system is as if it had its center everywhere and its periphery nowhere, since its periphery and center is God who is at once everywhere and nowhere.*
3. *Humanity in Jesus Christ makes satisfaction for all the defects of mankind ... Therefore our justification is not from ourselves, but from Christ ... to whom we adhere by faith in this life, since we cannot be justified except by faith alone ...*
4. Pagan: *You claim ... that the God you adore is neither nothing nor something ...?*
Christian: *God surpasses both nothing and something since nothing obeys his command so that thereby something is made. This is God's omnipotence that by his very power he exceeds everything, both that which is and that which is not ...*

REFERENCES

1. St Anselm (1033-1109): *Proslogion*.
2. Aristotle (384-322): *Metaphysics*.
3. St Augustine (354-430): *Confessiones, De Civitate Dei*.
4. J. Barbour, 1999: *The End of Time*, Phoenix.
5. St. Bonaventure (1217-74): *Itinerarium Mentis in Deum*.
6. N. Cusanus (1401-64): *De Docta Ignorantia*.
7. P. Davies, 1995: *About Time: Einstein's Unfinished Revolution*, Penguin.
8. W. Dilthey, 1883: *Einleitung in die Geisteswissenschaften Bd.1*.
9. R. Gale, ed., 1968: *The Philosophy of Time*, McMillan.
10. A. Einstein, 1920: *Relativity* (Methuen 1952).
11. D. Hume (1711-76): *Inquiry Conc. Human Understanding*.
12. I. Kant (1724-1804): *Prolegomena zu einer jeden künftigen Metaphysik ...*
13. G.H. Keswani, 1964-65: *Origin and Concept of Relativity*,
Brit.Jour.Phil.Sc. 15.p.286 & 16. pp.21&273.
14. S. Kierkegaard (1812-55): *Philosophical Fragments*.
15. G.W. Leibniz (1646-1716): *Monadologie*.
16. A. Mercier, H.J. Treder & W. Yourgrau, 1979: *On General Relativity*, Akademie-Verl.
17. E.A. Milne, 1951: *Kinematic Relativity*, Oxford.
18. E.A. Milne, 1952: *Modern Cosmology & the Christian Idea of God*, Oxford.
19. J. Narlikar, 1980: *Non-Standard Cosmologies*, *Fund.Cosm.Phys.*6, 1-186.
20. J.D. North, 1967: *The measure of the Universe*, Oxford
21. T.E. Phipps, jun., 1986: *Heretical Verities*, Class.Non-Fiction Libr., Urbana, Ill.
22. T.E. Phipps, jun., 2006: *Old Physics for New*, Apeiron.
23. Plato (427-347): *Parmenides & Timaios*.
24. H. Poincaré, fr.1905: *The Value of Science*, Dover Bks.
25. I. Prigogine, 1980: *From Being to Becoming*, Freeman.
26. A.N. Prior, 1967: *Past, Present & Future*, Oxford.
27. A.N. Prior, 1977: *Worlds, Times & Selves*, Duckworth.
28. S.J. Prokhovnik, 1967: *The Logic of Special Relativity*, Cambridge.
29. A. Rae, 1986: *Quantum Physics, Illusion or Reality*, Cambridge.
30. A.G. Walker, 1936: *Milne's Theory of World Structure*, *Proc.Lond.Math.Soc.*42, 90.
31. A.G. Walker, 1940-43: *Relativistic Mechanics 1-3*,
Proc.Lond.Math.Soc. 46,113f.&135f. 48,161f.
32. M. Wegener & P. Øhrstrøm, 1996: *A New Tempo-Modal Logic for Emerging Truth*, in:
Faye & al. eds.: *Perspectives on Time*, Kluwer (the axiomatics has later been simplified).
33. M. Wegener, 1999: *Towards a New Metaphysics of Time and Creation*, in:
M. Wegener, ed.: *Time, Creation and World-Order*, Aarhus Univ. Pr. (ISBN 87-7288-804-0)
34. M. Wegener, 2000: *Ideas of Cosmology: A Philosopher's Synthesis*, in:
Duffy & Wegener: *Recent Advances in Relativity Theory I*, pp.255-74,
Hadronic Press, POBox 1577, FL 34682, US (ISBN 1-57485-047.4).
35. M. Wegener, 2004: *The Idea of a Cosmic Time*, *Found.Phys.* 34,11, pp.1777-179.
36. A.N. Whitehead, 1925: *Science and the Modern World* (Mentor).
37. G.J. Whitrow, 1961: *The Natural Philosophy of Time* (Oxford 1980²).
38. E.T. Whittaker, 1953: *A History of the Theories of Aether & Electr.* 2 (Harper 1961).
39. J. Winnie, 1970: *Spec.Rel. without One-Way Assumptions*, *Phil.Sc.*37, pp.81&233.