

MATERIALIST THEORIES OF TIME

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*Tempus item per se non est,
sed rebus ab ipsis consequitur sensus* —Titus Lucretius Carus

NOTES: (1) Aristotle needs to be included more as essentially the founder of the time as accident of motion (Leslie Kavanaugh). (2) while Hobbes's phantasm theory is in the Aristotelian tradition, you have argued that Leibniz is not really in that tradition. That is the problem with his theory of time: it does not connect properly to spacetime. This should be a bigger point in the Elimination of Time paper. (3) Spinoza is more nearly Platonistic than materialistic in regarding time as a kind of false appearance of duration—at any rate he is somewhat problematic, as Peter pointed out; the connection with Leibniz would have to be made explicit à la Riesterer; and (4) you should include particularly Foucault as an example of the Feuerbachian trend: mental illness as an entity created by projection is a better way of seeing it than as a social construction (perhaps cite Hacking).

I —HISTORICAL VIEWS

What would constitute a materialist theory of time? A first thought might be that, if matter is what exists in space and time, then time should be an existing something within which matter can undergo its changes.

According to Aristotle, some of his predecessors thought of time as a container in a quite concrete sense, and others identified it with the motion of the heaven.¹ Thus Pherecydes of Syrus (a contemporary of Anaximander), whom Aristotle regarded as a “hybrid” thinker who wrote only partly in a mythical vein, began his book: “Zas [i.e. Zeus] and Chronos [Time] always existed, and so did Chthonie; and Chthonie acquired the name Earth when Zas gave her the Earth as a bridal gift.”² (Over)interpreting, perhaps, matter existed even before Zas/Zeus gave it form, and it existed in time, which thus also existed. Of course, it is difficult to know just how to interpret such early texts written in a quasi-mythical vein, and one cannot simply take the personifications to signal literal belief in them as entities. Anaximander, who was one of the originators of prose writing in philosophy, nevertheless regarded time as a kind of arbitrator adjudicating the claims of competing tendencies,³ whereas Pythagoras is reputed to have called it the soul or procreative element in the universe.⁴ Presumably neither of these personifications of time are supposed to be taken literally, but they are consistent with a world view in which time (Chronos), being an uncreated principle, was regarded as divine.

¹ Aristotle, *Physics* 218a 33-218b 9, 218b 12-14; Barnes, *op. cit.*, p.370-1. Aristotle also argued that “all changes may be faster or slower, but not so time; for fast and slow are defined by time, ‘faster’ being more change in less time, and ‘slower’ less in more.” (*Physics*, 218b 14-16); an argument which Leibniz was to try some two thousand years later against Newton’s “equable flow of time” in his controversy with Clarke, but without much success.

² Pherecydes, Barnes, 1987, 58.

³ Anaximander: “It is necessary that things should pass away into that out of which they came into being. For things must pay one another penalty and compensation for their injustice according to the ordinance of Time.” [Simplicius, *Commentary on the Physics* 24; Kirk and Raven 1957, p. 107; Barnes p. 75].

⁴ Pythagoras: Whitrow, *Time in History*, p. 39.

But there are other indications that these early thinkers thought of time as something quite concrete. Ancient commentators described Pherecydes' Chronos, for instance, as a kind of receptacle: it is that in which the things that Zas (the creative element) has created out of Chthonie (the matter) exist.⁵ Again, one surviving line of Empedocles appears to refer to time as the revolving heavenly sphere: "In turn they come to power as time revolves."⁶ Similarly Plato (like Empedocles, much influenced by Pythagorean thought) explicitly identified each planetary orbit as a time, and called time itself a "moving image of eternity".⁷ According to these latter formulations, then, time seems to be a concrete thing or motion: either the revolving heaven containing all, or the revolutions of the planets: the month, the year, the years of the various planets.

Antiphon was perhaps the first to emancipate himself from this conception of time as a *concretum*. In one of the surviving fragments of his thought, he says "Time is a thought or measure, not a substance."⁸ This is in keeping with the general tendency of the thinkers Plato dismissed as Sophists to see things which their predecessors had thought of as "by nature" to be in reality "by custom". By the latter half of the fifth century, when Antiphon was active, the conventional element of time measures would in any case have been made more obvious by the various problems with the calendar: Meton had introduced his calendar reform in 432 B.C. At any rate, the idea of time as a measure is taken up by Aristotle, who followed Antiphon in making time conceptual, dependent on a soul to count its measures. He dismissed the conception of time held by Pherecydes and Empedocles—the sphere in which everything happens—as a reasoning too naïve to be worthy

⁵ Freeman, *Companion*, p. 39.

⁶ Empedocles [B 17.39], Simplicius, *Commentary on the Physics* 1183-4; Barnes 177. Also suggesting time as a container is "As they [Love and Hate] were formerly, so also will they be, and never, I think, shall boundless Time be emptied of these two." DK 16; Freeman, *Ancilla*, p. 53.

⁷ *Timaeus*; Whitrow p. 19.

⁸ DK 9; Freeman, *Ancilla*, 145.

of challenge, and went on to reject Plato's identification of time with process, arguing that whereas movement or change is confined to the particular changing thing and the place it is in, "time is present equally everywhere and with all things."⁹

Now, even though I have suggested that there is evidence among Aristotle's ancient Greek predecessors for what one might call a naïve materialist theory of time, where time is regarded as a concrete thing—a material container, perhaps, or a kind of heavenly clock—nothing in my presentation hangs on this. The main point I wish to make from this consideration of ancient views is that there is a long tradition for conceiving time as ontically prior to the existence of matter and its changes. This goes all the way back to Pherecydes, at least on the interpretation of his words given above, who asserted that time must always have existed since matter existed even before Zeus gave it form, and it existed in time. At any rate, after citing Pherecydes' view Aristotle remarks: "It is just this that enables Democritus to show that all things cannot have had a becoming; for time, he says, is uncreated".¹⁰ On Democritus' view, then, not everything that exists is material: matter exists in the void, and both exist in uncreated time. Thus for the first systematic materialist, time is ontically prior to change, even if it is not a material being. This, as we shall see in due course, is in marked contrast to the Epicureans, for whom time is an accident of motion, which in turn is an accident of body, yielding a status for time as "an accident of accidents". This is the second major type of materialist theory of time, about which I shall have more to say later.

Democritus' conception, rather than Epicurus's, was taken up by the Stoics, who form an important bridge from ancient conceptions to the seventeenth century. For

⁹ Aristotle, *Physics* 218a 33-218b 9, 218b 12-14; Barnes, *op. cit.*, p.370-1. Aristotle also argued that "all changes may be faster or slower, but not so time; for fast and slow are defined by time, 'faster' being more change in less time, and 'slower' less in more." (*Physics*, 218b 14-16); an argument which Leibniz was to try some two thousand years later against Newton's "equable flow of time" in his controversy with Clarke, but without much success.

¹⁰ Aristotle, *Physics* VIII, 251b 15-17; Barnes, *The Complete Works of Aristotle*, p. 420.

them time is an infinite container analogous to the void. Apollodorus, for example, defined time as an *infinite interval*,¹¹ in which respect he followed Chrysippus:

... It is in Time that everything moves and exists. ... Just as the void in its totality is infinite in every respect, so time in its totality is infinite on either side; for both past and future are infinite.¹²

The significance of the Stoics in this connection is that this notion of place and time as infinite intervals was taken up by Pierre Gassendi in the seventeenth century, and, as I have shown elsewhere (1995), Gassendi's views were a major source for Newton. Now, Gassendi was a thorough-going materialist —or, at least, as thorough-going a materialist as a man of the cloth in seventeenth century France could be.¹³ He maintained the materiality of the soul, at least the vegetative and animal ones, exempting only the rational soul. Celebrated as the chief reviver of Epicureanism, he promoted a naturalistic ethics that in many ways anticipated the utilitarian theories of Mandeville and Helvétius. But on space and time he chose to follow the Stoics rather than Epicurus. After commending Chrysippus for his comparison of time with the void “especially with regard to their infinity,” he attempted a “more explicit explanation of the matter” as follows:

As Place as a whole is unlimited, so Time as a whole has neither beginning nor end, and as any moment of Time is the same in all places, so any part of Place is in all times. Likewise as Place persists immobile whether anything exists in

¹¹ Apollodorus: Time is “the interval of the world's motion, infinite in just the same way that the whole of number is said to be infinite”. Long and Sedley, *The Hellenistic Philosophers*, vol. 1, Cambridge University Press, 1987; pp. 304-305.

¹² Stobaeus 1.106,5-23 (SVF 2.509); partly quoted from Sambursky *op. cit.*, *COST*, pp. 160, 161; partly from Long and Sedley, *op. cit.*, p. 304.

¹³ Despite his friendship with Hobbes and his outspoken defence of the ancient atomists, and his having among his protégés such libertines as the swash-buckling Cyrano de Bergerac, Gassendi was sufficiently careful not to have to flee his country, as did Descartes, Bayle, Hobbes and Locke. For a reading of Gassendi as a thorough-going materialist, see Olivier Bloch, *Gassendi*.

it or not, so Time flows with an equal tenor whether anything endures in it or not, whether anything is at rest or in motion, whether it moves faster or slower. (*op. cit.*, p. 199.)

Pursuing this analogy with space or void, Gassendi quotes Seneca on Plato's distinction of all entities into six classes, the sixth of which (in Walter Charleton's translation) "contains only those things which have *as it were* a being, as INANITY and TIME: which we thus expound, *Space and Time are things more General then to be comprehended under the Categories of Substance and Accident.*" Or, as Charleton says more colourfully in his heading for this article, "Time, nor substance, nor Accident: but an *Ens* more General, and the Twin-brother of *Space.*" (*Physiologia*, p.75). Newton amplifies this same Platonic theme:

"Concerning extension, perhaps it may now be expected that I should define it either as a substance, an accident, or else nothing at all. But by no means, for it has a certain mode of existence proper to itself which is fitting for neither substances nor accidents. It is not a substance; on the one hand because it does not subsist absolutely *per se*, but, as it were, as an emanative effect of God, and a kind of affection of every being; and on the other hand because it is not among the proper affections that denote substance, namely actions, such as thoughts in the mind and motions in a body." (*Newton's Philosophical Writings*, p. 21).

On this interpretation, space and time, although neither substances nor accidents, exist independently of the matter in them. We may note in passing that it therefore seems to be a mistake to classify Newton's view as "substantialist", as is usually done; that is a label perhaps more apposite for the early physicists referred to by Aristotle. In fact, it might have been more accurate to call this an "existentialist" account, if Sartre had not appropriated the term. For, as Newton continues:

“Space is an affection of a being insofar as it is a being. No being exists or can exist which is not related to space in some way. God is everywhere, created minds are somewhere, and body is in the space that it occupies; and whatever is neither everywhere nor anywhere does not exist. And hence it follows that space is an emanative effect of the first existing being, since if any being whatsoever is posited, space is posited. And the same may be asserted of duration: for certainly both are affections or attributes of a being according to which the quantity of each individual’s existence is denominated with respect to amplitude of presence and to persistence in its being.” (25)

As we have seen, this view of time as uncreated and coeval with God goes back not just to the Stoics, with their view of the void and time as uncreated, infinite intervals, but to Democritus and even to the ancient Ionians.

In modern times, however, most materialist accounts of time have proceeded in a diametrically opposite direction to that taken by the Stoics and Gassendi. Epicurus, as we have seen, held that time is an accident of motion, itself an accident of material beings, and I shall have occasion to return to this below. Hobbes took an even more radical view, holding that time is a “phantasm of motion”. On the one hand this is a result of his nominalism: abstract ideas like space and time are formed by abstraction from, or reflection on, particulars. On the other hand, though, the term ‘phantasm’ is of course a term of art for Hobbes. In his psychologized epistemology, the phantasm of space —“out-thereness”, Kant’s “form of outer sense” — is formed in the brain as a reaction to the endeavours (another term of art) that are imposing themselves on the sense organs from without. It is a physical reaction, a counter-endeavour by the organs (particularly the eyes), subjectively apprehended. (This is part of Hobbes’s ingenious double-aspect solution to the mind-body problem, that so enthused the young Leibniz. The same endeavour that is (taken objectively) a vanishingly small motion of the subject towards or away from an object, is (taken subjectively) an appetite or aversion for that object.)

Similarly, the passing of time is a phantasm in the brain caused by the phenomena of motions themselves, another counter-endeavour, subjectively apprehended.

Hobbes once remarked (approvingly) of Spinoza that “he has out thrown me a bar’s length” —although we have no record of the bar in question— “for I durst not write so boldly”.¹⁴ This was in reference to Spinoza’s theology and politics,¹⁵ although it also perhaps applicable to their views on time, where Spinoza goes beyond Hobbes in stressing the derivative nature of time. In Spinoza’s view, it is duration that is fundamental. One could argue that he inherits this from Descartes, for whom time is a *quantity*, whereas duration is something only conceptually distinguished from existence. Newton, as we have seen, equates duration with quantity of existence in respect of something’s persistence in its being.¹⁶ In so doing he collapses the Cartesian distinction, regarding duration as another name for time. Spinoza, on the other hand, upholds the distinction, but demotes time to a lesser status, that of a *being of the imagination or mode of thinking*. It arises, he explains, when we try to abstract quantity from substance and “separate duration from the way it flows from things eternal.” Thus time is the result of the attempt to abstract quantity from duration, the abstraction being a mental operation that he regards as intrinsically flawed. So we see in Spinoza the kind of nominalistic trend we found in Epicurus and Hobbes, but with an anticipation of Hegel: time is an abstraction from a divine attribute, eternity, which is the mode of being of substance, but abstraction is a kind of falsification.

II — MATERIALISM

So far, dealing with the history of philosophy, I have been able to take for granted a certain rough and ready notion of what materialism is. Now I want to say

¹⁴ A remark of Hobbes’s reported by John Aubrey (Aubrey, 1898, 1: 357).

¹⁵ For an analysis, see Edwin Curley’s “Religion and Morality in Hobbes”.

¹⁶ It has been argued in a very recent article by Steffen Ducheyne that another significant influence on Newton here is Spinoza’s contemporary van Helmont, although that is a matter for another time.

something by way of characterizing it. In the twenty-first century materialism is usually equated with physicalism, as in this dictionary definition:

MATERIALISM (PHYSICALISM): everything that exists is made of matter and the various forms it takes; all existing things, processes and phenomena can be explained as manifestations or results of matter.

This definition is reasonable enough as a first pass, allowing some license in the definition of matter and in what it means to be a result of matter. In this sense, materialism is not so much a theory with precise and refutable content, but is better regarded as a research programme, in Lakatos's sense. It is a set of background assumptions (the "hard core") that lies behind most scientific research and guides it as to what hypotheses are reasonable to make. It is not considered refuted, for example, by the discovery that electromagnetic and other fields can exist in empty space without modifying some material ether, or by the interconvertibility of matter and energy discovered by Einstein, or by the unexplained existence of dark energy: rather, the definition of matter is revised to accommodate such counterexamples. Provided this can be done in a progressive way rather than by post hoc counter-moves, the defence of materialism as a research programme is viable.

But without further elaboration, the above definition makes it still a mechanistic or Cartesian materialism, of the kind entertained by Descartes' disciple LeRoy (Regius) and also in the following century by La Mettrie. On that philosophy, matter is merely passive, defined in opposition to active spirit; such a materialism is therefore vulnerable to the objection that it is extremely hard to see how active things —minds and spirits— can "result from" matter that is passive, merely *acted upon* by other bodies and not *acting* in any authentic sense. It was the inadequacy of this conception that opened the door to the idealism of Fichte and Hegel. As a matter of historical fact, such objections (already made by Bishop Bramhall to

Hobbes and Bishop Wilberforce to Locke, as well as by Bishop Berkeley) were countered by conceptions of matter as *inherently active*: Toland in Ireland, Priestley and Hartley in England, and Buffon and Diderot in France. I believe that this was an essential movement of materialist thought in clearing the ground for Darwin, although I cannot make that case here. In any case, it seems to me that the definition of materialism as physicalism is deficient in that it requires supplementing by some reference to the inherent disposition of matter to act—in a sense that goes beyond its merely being set in motion, for that would seem to require an external agent. Otherwise the emergence of higher order forms by evolution is left without adequate grounding.

(ACTIVE MATTER SUPPLEMENT TO THE DEFINITION OF) MATERIALISM: all existing things, processes and phenomena can be explained as manifestations or results of *the actions and interactions of material things, with these actions and interactions having their origin in matter's inherent disposition to act.*

But I would also dispute the adequacy of the physicalist definition for a different reason: it does not capture another important strand of materialist thought, that initiated by Ludwig Feuerbach and extended by Engels and Marx. Marx Wartofsky, in his excellent study of Feuerbach (1977), comments on this very eloquently. After noting how Feuerbach's anthropological materialism is typically represented as reducible to his epigram "Man is what he eats", and Marx's historical materialism likewise dismissed as an economic reductionism, he writes:

The question "What is materialism?" goes beyond ... such simpleminded formulations... To talk of "material human existence" is to talk of neither atoms and molecules, nor blood, cells and organs (including the brain); rather, it is to talk of social and historical human existence. But in what sense is this "material"? Is the metaphysical extension from physical "matter" inevitably reductive? Does emergentism provide anything but the pious accommodation of

a programmatic materialism, and cover up rather than reveal the problems raised by the claim for continuity and unity between the natural, the social and the mental? (Wartofsky 1977, xii)

I am not going to attempt to try to resolve such questions here, but I do think one can identify a commonality between these various forms of materialism that goes beyond the minimal physicalist core.

Let me begin with Darwin, with whom one finds a quite self-conscious commitment to materialism in his early notebooks: “It is an argument for materialism, that cold water brings on suddenly in [the] head a frame of mind analogous to those feelings which may be considered as truly spiritual.” (9) “[A]ffections [are the] effect of organization, which can hardly be doubted when seeing Nina with her puppy ... [T]hinking over these things, one doubts [the] existence of free will[. E]very action [is] determined by hereditary constitution.” (10) “To avoid stating how far I believe in Materialism, say only that emotions, instincts[,] degrees of talent, which are hereditary, are so because brain of child resembles parent stock.” (16) “Now is it not a little remarkable that the fixed laws of nature should be universally thought to be the will of a superior being, whose natures can only be rudely traced out. When one sees this, one suspects that our will may arise from as fixed laws of organization...” (14)

The tendency of all these speculations is to give naturalistic explanations of things previously attributed to non-material agencies: affection and other emotions and free will as attributes of the mind, divine will as an attribute of God. In this, Darwin is basically following the model inaugurated by Epicurus and Hobbes, in which materialism has an essential liberating and political component in freeing people from a belief in entities by which they have been held in thrall. This aspect of materialist thought is well described by Douglas Jesseph in the course of making the case for Hobbes’s materialism as committing him to atheism:

Hobbes held that one of the main goals of the true philosophy is to overcome our ignorance of the world's workings—a process that involves discarding many of the entities invoked by earlier generations to explain the phenomena of nature. (23)

Thus a distinctive characteristic of materialist thought is a certain kind of *nominalism*, in which entities mistakenly thought to exist independently of us and our “temporal” activity are seen instead to be artefacts resulting from interactions among material things, organisms, or people. In so identifying nominalism as a central component of materialism, I follow Engels and Marx; although where they see traditional medieval nominalism as “the first form of materialism”, I rather see a certain form of it as the engine driving materialist thinking.¹⁷ Now nominalism in its general acceptance denotes a position arising in a medieval dispute over abstract terms or universals, such as “humanity”. A nominalist would deny that it is necessary to posit the existence of entities corresponding to such terms, “universals”, over and above the individuals or particulars that exemplify the property in question. I am extending the meaning of this entity-skepticism to things other than abstract terms, to any universal non-material beings that are thought to be the sources of actions affecting us: Eros and other divine powers, the faculty of free will, a designer God, and so forth. But it is not to be thought that the effects so described are unreal, just that they are wrongly attributed to general, non-material entities, rather than particular material individuals. I would gladly cede the term nominalism to its normal meaning, if I could find a better word to express this kind of philosophical tendency. But for want of a more apposite term, from now on when I say “nominalist”, I mean the tendency I have just described, rather than the position usually associated with Willard Quine and Nelson Goodman.

¹⁷ Thus in *The Holy Family*, Marx quotes Engels from the introduction of his *Socialism: Utopian and Scientific*, pp. 10-12 (International Publishers, NY): “Nominalism, the first form of materialism, is chiefly found among the *English* schoolmen” (158).

One can see a similar nominalist trend of thought in Feuerbach (1804-1872), who was an exact contemporary of Darwin's (1809-1882). As Wartofsky reports,

Feuerbach sees the concept of an absolute Will as the creation of human imagination, and as an incursion upon the principle of reason. In this respect, says Feuerbach, Spinoza is the true founder of modern philosophy, in that he explicitly rejected such a notion and systematically explained its origin in human feeling and in the imagination as an anthropomorphic projection of human will and desire. (115)

It is in this systematic explanation of entities such as the Will as anthropomorphic projections that Feuerbach's materialism goes beyond that envisioned by Darwin and Hobbes, where materialism simply *discards* these entities. This notion of anthropomorphic projection is further developed by Feuerbach in his analysis of God:

Man — this is the mystery of religion — objectifies his being and then again makes himself an object to the objectivized image of himself thus converted into a subject (GW 5:71; EC 29f).

Religion is man's self-estrangement: man posits God over against himself as a separate being.... It must therefore be shown that this opposition, this dichotomy of God and man, which is the starting point of religion, is a dichotomy within man, of man with his own essence. (VI, 41; S: I, 81; W 293)

As is well known, this Feuerbachian analysis of religion was hugely influential on Engels and Marx, who applied a similar critique in economics. As Engels wrote, "Economics deals not with things but with relations between persons, and, in the last resort, between classes; these relations are, however, always *attached to things*

and *appear as things*.”¹⁸ Marx, for instance, applies a parallel argument to Feuerbach’s in his doctrine of the fetishism of commodities, which are experienced as entities with their own values, but according to Marx instead arise out of material, social relations that are then objectified and treated as governing our behaviours.

I will not go any further into the history of materialism (which is another, ever-deferred project of mine). But perhaps I have done enough to suggest that missing from the equation with “physicalism” is everything that has made materialism a dangerous doctrine to subscribe to: its theological and moral subversiveness, and consequent political radicalism. This missing ingredient I identify, following Engels and Marx, is a species of nominalism: entities mistakenly thought to exist independently of us and our “temporal” activity —whether souls (la Mettrie), religion-based moral law (d’Holbach), fixed biological species (Diderot, Darwin), gods (Feuerbach), or commodities (Marx)— are revealed to be artefacts resulting from interactions among material things, organisms, or people; and in certain cases these entities can be revealed to be objectifications of human, social relations that are then posited as existing apart from us and governing our lives.

(NOMINALIST SUPPLEMENT TO THE DEFINITION OF) MATERIALISM: all existing things, processes and phenomena can be explained as manifestations or results of the actions and interactions of material things, with these actions and interactions having their origin in matter’s inherent disposition to act. *Entities mistakenly thought to exist independently of us and our “temporal” activity are revealed to be artefacts resulting from interactions among material things, organisms, or people; and in certain cases these entities can be revealed to be objectifications of human, social relations that are then posited as existing apart from us and governing our lives.*

¹⁸ Friedrich Engels, “Karl Marx’s *Contribution to the Critique of Political Economy*”, in (1941, 80).

Armed with this take on materialism, let me now return to the topic of time, with an eye now to contemporary theory of time.

III —THE “ELIMINATION OF TIME”

Today one of the strongest new initiatives in understanding time has come from an investigation into the deep metaphysical obstacles to erecting a theory of quantum gravity. The problem, in a nutshell, is a deep-rooted tension between the way time is treated in each of the revolutionary theories of the early twentieth century. To put it very crudely, in relativity theory spacetime is fundamental, and time is as it were, a mere aspect of this structure. Both are warped by high concentrations of mass-energy. But according to quantum theory, for sufficiently small times the mass-energy spread is exceedingly large, so that —given the warping of spacetime by mass— the concepts of spacetime location and duration will lose all determinateness. A second notable problem is that whereas time and spacetime are dynamic in General Relativity, and tied to the distribution of mass-energy, in Quantum Theory time appears as a mere parameter. The upshot of this situation is that most theorists agree that a search for a viable theory combining the two —a theory of quantum gravity— will likely involve a profound revision of classical ideas about space and time, going beyond even the revolutionary changes in our understanding of time wrought by Einstein’s relativity theories.

In recent years new life has been injected into the quest for a theory of quantum gravity from an unexpected quarter: an independent researcher, Julian Barbour, working outside the academy (and supporting himself by translating Russian) wrote a massive tome tracing the debate between absolutist and relativist conceptions of motion, supporting the relativist line taken by Leibniz and Mach.¹⁹ Against Newton’s conception of motion relative to absolute space, Leibniz had objected that if one supposed the world and everything in it, while maintaining the

¹⁹ Volume 1 alone of Barbour’s *Absolute or Relative Motion* numbers 746 pages, and he does not even get to Leibniz or Mach!

same mutual spatial relations, were moved in a straight line relative to such a space, there would be no way even in principle to determine the supposed change, making the supposition of an absolute motion “chimerical”: “For two states indiscernible from each other are the same state, and consequently ’tis a change without any change.” (Leibniz, 4th paper, §13). But this concerns only unaccelerated motion in a straight line, which Newton had acknowledged would be undetectable. Leibniz does not address Newton’s contention that absolute motion could nevertheless be discerned in the centrifugal effects seen in a rotating bucket of water. It was left to Ernst Mach to counter Newton’s contention that this is evidence for absolute motion: “Newton’s experiment with the rotating vessel of water simply informs us that the relative rotation of the water with respect to the sides of the vessel produces *no* noticeable centrifugal forces, but that such forces *are* produced by its relative rotation with respect to the mass of the earth and the other celestial bodies.”²⁰

Now if Barbour were just another proponent of the relativist cause on philosophical grounds, this would be no cause for celebration. But following on his historical research, he was able, in collaboration with Bruno Bertotti, to supply a mathematical demonstration of Mach’s claim (which Mach had made on purely epistemological grounds) that inertial motion could be represented as a purely relative motion without presupposing Newton’s absolute space and time: “Just as Mach had suspected, the phenomenon that Newton called inertial motion in absolute space could be shown to arise from motion relative to all the masses in the universe” (EoT 114). What is more, Barbour and Bertotti showed that a similar approach, based on only relative motions, could be taken in General Relativity, but that when they did this, surprisingly, they recreated Einstein’s theory by another route. The effect of this was to give an arsenal of ammunition to those who were

²⁰ Ernst Mach, *The Science of Mechanics* (1893), quoted from Nick Huggett, *Space from Zeno to Einstein*, 176-177.

not convinced that the lesson of General Relativity was that spacetime had to be treated as an entity in its own right.

The connection of all this with time is given by another Machian dictum: “It is utterly beyond our power to measure the changes of things by time. Quite the contrary, time is an abstraction, at which we arrive by means of the changes of things.” (EoT 67). In order to give this idea flesh, Barbour and Bertotti define time in terms of what they call the “Machian distinguished simplifier”, a kind of average of all the changes occurring in the universe. Barbour concludes: “Time is change, nothing more, nothing less.” (120). This relativist perspective has paved the way for a similar relativist approaches to General Relativity by leading quantum gravity researchers such as Lee Smolin and Carlo Rovelli. They interpret time not as an aspect of a pre-existing spacetime structure, but as a concomitant of a purely relational dynamics from which time and spacetime emerge as results.

Now Barbour and Rovelli both express this conception as resulting in the “elimination of time”, while Barbour and Smolin identify Leibniz as their chief inspiration. There are two main points I wish to make about this situation, which will occupy the remainder of this paper. First, to me Barbour's Machian initiative seems squarely in the tradition of materialist thinking on time, even though some of the specifics of his views are Platonic. Second, I agree about its Leibnizian provenance, with the result that Leibniz, perhaps surprisingly, appears as the crucial link here between Spinoza and Hobbes on the one hand, and the materialist conception that I see in Barbour's Machian relativity on the other.

First, on the status of time, Rovelli expresses himself unequivocally as follows: “The disappearance of physical time is the second characteristic feature of the relativistic revolution.” (2006, 32); “I consider the viability of a foundation of our understanding of the world in which space and time play no role.” (ibid., 25) His editor, Dennis Dieks, perhaps to protect him from idealist misconstrual, explains

that “[what Rovelli] means is that space and time no longer enter as independent entities, on top of what is already determined by all the coincidence relations between the dynamical fields” (Dieks 2006, xii).

If Dieks is right (and I think he is) then Rovelli’s position seems much more like the position we have encountered in Epicurus, Hobbes and Spinoza. Time is not an existing entity, rather it is an aspect of motion and change. This is also in keeping with Mach’s dictum quoted earlier, “time is an abstraction, at which we arrive by means of the changes of things.” And in fact Barbour himself writes: “Time does not exist. All that exists are things that change. What we call time is—in classical physics at least— a complex of rules that govern the change” (EoT 137). But this is not just a view that is in agreement with some materialist thinkers—others have taken the view that Rovelli and Barbour are opposing, as we have seen— it is in keeping with the kind of nominalist tendency that I have identified as the engine of materialist thought: entities that were thought to be self-existent turn out, on a deeper analysis, to be aspects of relations among things, relations which were previously mistaken for relations between that entity, taken as self-existing, and its manifestation in those things.

This is not, however, how Barbour situates his own theory. He sees the materialists as typically espousing absolutism about space, time and motion, and relativism as being the preserve of idealists.²¹ Moreover, for him the elimination of time is also the elimination of becoming and change, in agreement with the Parmenidean idealist tradition: “I also think that Plato was right when he said that Being ... is real, and Becoming is an illusion... Platonian is the arena that I think must replace space and time. ... The points of Platonian—the Nows—are worlds unto themselves. No thread of time joins them up.” (45)

²¹ In his (1989) Barbour notes that “broadly speaking, the materialists (or realists) were identified with the absolute (Newtonian) approach to motion, the idealists with the relationals (Machian) conception, although there were notable exceptions” (p. 15).

Naturally, Barbour also takes this to be consonant with his debt to Leibniz. For just as Leibniz denied that absolute space is an entity, so he also denied the same of time: “space in itself is an ideal thing like time” (to Clarke, 5th Paper, §33; 1976, 701). But about time Leibniz also says:

Nothing of time ever exists except instants, and an instant is not even a part of time. Anyone who considers these observations will easily comprehend that time can only be an ideal thing (To Clarke, 5th Paper, §49; 1976, 705).

This is interesting in that Barbour’s brief for the elimination of time is that the world (his “Platonia”) is best conceived as being simply the collection of all possible “nows” or instants. And these instants are conceived, as by Leibniz, as orders of possible co-existents, configurations which he also calls “time capsules”:

[Lee Smolin and I] met several times in the next few years, and collaborated on an attempt to formulate Leibniz’s philosophical system, his ‘monadology’, in mathematical form... Certain aspects of our work together were decisive in my own elaboration of the notion of time capsules and my conviction that the ultimate and only truly real things are the instants of time. (1999, 240)

Barbour is explicit in proposing a nominalistic basis for this view: space and time are not basic entities, but derived from more basic things:

We have been exploring Leibniz’s idea that only things exist and that the supposed framework of space and time is a derived concept, a construction from things. If it is to succeed, the only possible candidates for the fundamental ‘things’ from which the framework is to be constructed are configurations of the universe: Nows or ‘instants of time’. They can exist in their own right: we do not have to presuppose a framework in which they are embedded. In this view, the true arena of the world is timeless and frameless —it is the collection of all possible nows. (1999, 177)

Now it is beyond the scope of his paper to give an adequate exposition of the whole of Barbour's argument for this position, or even an analysis of the profound problems besetting any philosophical position that denies the reality of change. But I do want to address the debt to Leibniz, for here I think that Barbour has matters the wrong way up. For instants are precisely not *things* for Leibniz, but rather abstractions from relations among things. And although Leibniz does not at all follow Spinoza in seeing abstraction as falsification, but sees it rather as a necessary condition for doing mathematics, still, an abstract entity does not need to be posited as an existing thing. At the basis of Leibniz's nominalism is a deep commitment to individual substances: these are his "true things". On the other hand, his monads are not changeless Platonic forms, but instantiated individuals whose changes are manifested in the changing phenomena resulting from them. Leibniz is explicit on this point in his correspondence with De Volder in 1703:

You doubt, distinguished sir, whether a single simple thing would be subject to changes. But since only simple things are true things, the rest being only beings by aggregation and thus phenomena, and existing, as Democritus put it, νόμῳ not φύσει, it is obvious that unless there is a change in the simple things, there will be no change in things at all (1976, 531).

Thus all things change, and composite things (phenomena) change because of the changes in simple things from which they result. Instants, meanwhile, are abstractions from sets of changes of state that are happening simultaneously, while the relation of simultaneity is further analyzed in terms of the compatibility of the states of the substances. The ideality of instants, like that of parts of time and place, applies to them as abstractions from these changes:

The parts of time and place, considered in themselves, are ideal things; and therefore they perfectly resemble one another, like two abstract units. But it is

not the same with two *concrete ones*, or with two *real times*, or two places *filled up*, that is to say, truly *actual*. (To Clarke, V, §27: 1976, 700)

Places and times, that is, can be *concreta*, if they are instantiated by actual things and their changes. With regard to space, Leibniz gives a thorough account of this form of nominalism in his Fifth Paper to Clarke (§47), explaining the difference between *concrete space*, which he later (§104) describes as the “order according to which situations are disposed”, and *abstract space*, which is “that order of situations when they are conceived as being possible,” and which “is therefore something ideal” (*ibid.*).

On the other side of this coin, Leibniz’s substances always have a situation through the phenomenal body of which they are the entelechy or soul:

Every change, spiritual as well as material, has its own seat [*sedes*], so to speak, in the order of time, as well as its own location in the order of co-existents, or in space. For although monads are not extended, they nevertheless have a certain kind of situation in extension, that is, they have a certain ordered relation of co-existence with others, namely, through the machine they control. I do not think that any finite substances exist apart from a body, so that they would lack a position or an order in relation to the other things co-existing with them in the universe.

That is, because substances are individual things that act, and the actions are only instantiated in the orders constituting (concrete) space and time, Leibniz’s monads are necessarily embodied. This is a very far cry from the world as conceived by Barbour, where not only space and time but even individual, acting things are none of them part of *what is*, but are all, in some difficult sense, resultants of the nexus of possibles and the way we experience it.

Thus insofar as Barbour, along with Smolin and Rovelli, wants to treat time not as an entity, but as an aspect of reality deriving from motion and change, he is proceeding in keeping with Leibniz —and with the philosophies of Epicurus, Hobbes and Spinoza. But the moment he goes beyond this with his philosophy of the instants of time as “the ultimate and only truly real things”, he has completely departed from the kind of nominalism that Leibniz espouses, and gone to Platonism.

IV —LEIBNIZ AND MATERIALISM

We have seen that Leibniz is committed to a certain realism about material bodies and their changes, so long as they are actualized by the monads responsible for their acting. Because of the dominance of idealistic interpretations of his thought, this feature of Leibniz’s philosophy has not been widely recognized. Leibniz’s commitment to a kind of body realism was the subject of a joint paper by Peter Loftson and myself published earlier this year, in which Peter suggested a different interpretation of this body realism than the one I am suggesting here. But in closing I want to turn to a consideration of Leibniz’s relationship with materialism. For although Leibniz is opposed to the kind of Cartesian materialism I outlined earlier, it should not be thought that he advocated in its stead a pure immaterialism. As he writes to Sophie Charlotte,

When it is said that there are immaterial substances, one means by this that there are substances which include other concepts, namely, perception and the principle of action or change, which cannot be explained either by extension or impenetrability... Hence if anyone says that force and perception are essential to matter, he is taking matter for the complete corporeal substance which includes form and matter, or the soul along with the organs. This is the same as if he had said that there are souls everywhere. This could be true, yet not at all contrary to the doctrine of immaterial substances.

(1976, 551-2)

Thus we might say with Feuerbach, Leibniz's idealism is "compromised" by a materialism that has not been properly eradicated. Although what exist are immaterial substances and their forces and perceptions, these forces can only manifest themselves in bodies, and perceptions are likewise of bodies and depend on bodily organs. Material substances are necessary concomitants of (an infinite plurality of) immaterial ones.

My mention of Feuerbach in this connection will help me to close the circle of my argument. For Feuerbach gave a very perceptive critique of Leibniz in 1837, at a time when he was still an enthusiastic Hegelian idealist. He lauds Leibniz for his recognition that matter cannot be purely passive, but must contain principles of activity. (As Wartofsky says, Feuerbach is always opposed to Cartesian materialism.) But in the course of penning the critique he begins to convert himself to materialism. The key thing he learned from Leibniz in this transformation, by his own account, was the existential primacy of the individual —situated in its own particular setting— over the abstract. According to Wartofsky, the two shortcomings Feuerbach identifies in Leibniz's idealism are the "mere" individuality of substances and a compromising materialism in that the monads are only able to perceive each other imperfectly through the "veil of matter". As Wartofsky notes, this is ironic, in that "Feuerbach chooses precisely these two elements that he criticizes in Leibniz as the cornerstones of his own later empirical materialism" (103).²²

So this is my concluding suggestion: it is these same features of Leibniz's thought that set Feuerbach on the right road to materialism that explain how Leibniz's theory of time could be a bridge from Hobbesian and Spinozist materialism to the materialist theories of time being entertained in the search for a theory of quantum gravity.

²² I think this is no accident, but stems from his recognition that Leibniz's conception of activity is effete, alienated. But that is another story I will not go into here.

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