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The Final Splendor of Ancient Rhuthmos - (3rd century BC - 1st century BC) - part 2

- Recherches

- Vers un nouveau paradigme scientifique ?

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Rhuthmic Dialectic - Lucretius' *De rerum natura* (1st cent. BC)

Let us stick though to the positive part of Serres' contribution which allows to elaborate further the meaning of this conceptual kinship. We will see below, when we deal with Lucretius' theory of knowledge, that in Book 4 Lucretius famously opposes any skeptic stand by deploying a self-refutation argument. Our senses never lie, only our interpretations of their data. To deny that we have access to knowledge through the senses its only possible entry route is a philosophical stance that disqualifies its own adherents by depriving them of any possible grounds for its assertion (4.469-522). But Serres' reading of this passage emphasizes a different aspect of Lucretius' argument which stages a building built on inaccurate and *deviating* lines that represents reason if "the senses from which it arises are false." Serres summarizes verse 4.513 to 522 as follows.

Take a building. To begin with, if the measuring-stick is false and the square inaccurate thanks to a deviation from right angles (in the plural, of course, and not only for the particular case of the verticals), if the level (of a plum-line or water level) is off one way or the other (either by the angle of the line or a deviation of the bubble), then by virtue of this defect and this inclination everything will be built leaning, askew, sloping to the front, pushed backwards, discordant; the building already seems to want to collapse, it collapses, betrayed by errors in the initial judgment. And so it is that reasoning is necessarily false and irregular when the senses [*sens*] from which it arises are false. End of quote. (Serres, 2000, trans. Jack Hawkes, p. 44)

According to Serres, apart from his argument against skepticism, this example was chosen by Lucretius to suggest that any human artifact and more generally any natural being are *naturally* "in danger of collapse" due to the constant and unpredictable swerve of atoms.

Every concrete Latin term that reproduces the deviation from equilibrium, the angle of asymmetry, or the inclined slope, around the $\hat{\alpha}$ - *canôn*, the canonical, the rule of the Epicurean mason, is here brought together all at once. [...] The earth shakes and the house falls. All conjunctive tissue is sapped by the void. Nothing is full but the heart of the atom, that is to say the atom. And only the void is immortal, like particles. Death is this return to particular clouds, the crumbling into dust and for dust. [...] So if these buildings, which is to say all of nature, are in danger of collapse, it is simply because they were, at the manifold dawn of times, erected, built, on a deviation of equilibrium. (Serres, 2000, trans. Jack Hawkes, p. 44-45)

But the metaphor bears another meaning that appears if we contrast it with Vitruvius' architectural concept of *eurhythmy*, which we will soon have to deal with. As a matter of fact, in the very next line Lucretius' argument is reversed to show that, although the *clinamen* is always destroying existing beings, buildings do stand up, living beings do live, things do have shapes, at least for a certain period of time *that depends on the magnitude of the "original declination."*

Their duration even increases as the angle grows smaller. [...] Consequently, the model is compatible with the canon. Nothing crumbles except by pronation and supination, by original deviation. [...] The canon, far from suppressing declination, requires it, and requires that it be small and original. (Serres, 2000, trans. Jack Hawkes, p. 45)

Everything was born from a vortex but any vortex depends for its ephemeral existence both *on its rotation and an infinitesimal angle that sustains it*. Buildings do stand stiff not because they are symmetrical, well balanced and built according perfect verticals "eurhythmic" in a Vitruvian sense but because they integrate tiny angles, are dynamic centers or kinds of cone where myriads of fluxes reach for a time equilibrium.

Now underground rivers erode the earth, hurricanes tear off the roof. The wall threatens to give way, it leans, it is going to fall. No, the flow, reversed, soon straightens it and pushes it back. By the unevenly starred wind rose, it slowly describes a very small solid angle. [...] This small differential cone saves the building from collapse. It marks the bordered, limited space, in which such an aggregation is temporarily removed from the universal legislation. (Serres, 2000, trans. Jack Hawkes, p. 75)

To hold on in equilibrium needs a tiny disequilibrium. Any regular or symmetrical figure rests on an infinitesimal irregularity or dissymmetry.

Why does it hold? Simply because it does not hold completely. Every case will be a minimum degree [out of plumb] [*il faut un minimum de faux aplomb*]. There has to be a minimally open solid angle. (Serres, 2000, trans. Jack Hawkes, p. 77, my mod.)

According to Serres, atomists, especially Lucretius, did bridge with this peculiar concept of *equilibrium by disequilibrium* the divide between Heraclitus and Parmenides, flow and form, without depending for individuation on Plato's solution by "participation to ideal Forms."

Physics, at this time, seemed to have to chose between the mobility of Heraclitus and the base of Parmenides. At least Plato formulated the problem this way. And resolved it otherwise. The atomists founded, and for all time, the science of things themselves, in the absence of dynamics, by saying yes to both sides: everything flows, there is a *canôn*. By a rigorous statics of movement. By a canonic of fluency. (Serres, 2000, trans. Jack Hawkes, p. 45)

Infinitesimal declination thus provides the generative concept that allows to synthesize rest and movement.

Declination is a tremendous physical and mechanical discovery. It breaks with the common antithesis of rest and movement, of Parmenides and Heraclitus, much more completely than Plato did. [...] Through declination, it is movement that is stable, in the path of its flow, in its general direction and its passage point by point. It is what ensures the most profound and exact invariance, although tradition down to the present day has seen only paradoxes there. For it is the condition of a great synthesis between statics and dynamics. (Serres, 2000, trans. Jack Hawkes, p. 129)

But one could add that Lucretius' synthesis is also at odds with Aristotle "hylomorphic" solution. Whereas Aristotle claimed that any being is the result of the action of a form that allows, essentially by providing an end, the potential of a certain amount of matter to actualize itself through its in-formation, Lucretius strongly denies the existence of such forms. Forms do appear by themselves through stochastic gatherings of atoms in vortices. (4.823-857)

[...] All such interpretation

Is aft-for-fore with inverse reasoning,

(*De Rerum Natura*, 4-832-33, trans. William Ellery Leonard)

Serres notices that Lucretius' theory of becoming and individuation is much closer to current physics than Hegel's dialectic ontology.

Two hundred years of philosophy have accustomed us to different arrangement. It seems clear to us that movement is produced by being and non-being, as though by thesis and antithesis. Now, moving has nothing to do with being or nothingness; the idea reflects a crucial confusion between mechanics and something else. Or rather, it is the admission that everything is projected onto kinematics. Ontology conceals itself behind the theory of movement. This is an outdated thesis: all of physics reduces to mechanics. (Serres, 2000, trans. Jack Hawkes, p. 60).

But I think we can safely argue that Lucretius' theory is also providing a much more precise and accurate ontology than Hegel's. His way to insert a principle of movement and change into the being does not resort to such massive principle as the Hegelian negation. It consists only in an infinitesimal angle that deviates the atomistic flow and creates the turbulences that we observe in nature and history.

We may even think, since there is for Lucretius no distance between thought and reality, that the logic that supports reasoning as much as nature is itself a turbulent or rhythmic dialectic in which classical logic based on syllogism and law of excluded middle is not replaced by a Hegelian dialectic articulating, through time, being and non-being, affirmation and negation, truth and error, but by a whirling play between matter and void, arguments curling back upon themselves from some tiny original deviation and truth winding around error.

Serres then recapitulates Lucretius' theory of individuation. By clearly specifying the concepts of *clinamen* and *turbo*, he gives a better comprehension of that of *rhuthmós* or maybe I should write now: that of *rhuthmos* as well. Something quite significant for rhythmology is introduced here for the first time: the possibility of a physics of rhythm which would not be based on Plato-style concepts of repetition, periodic movement, oscillation, but on fluxes, declinations and vortices, i.e. on *rhuthmoi*.

Let us return to the cataract. It rains down universally, everywhere and all the time. Declination is the minimum solid angle that introduces a change in the general movement. [...] An instant later, turbulence forms a pocket in the three-dimensional flow. A local pocket where the flows, adrift, go back upon themselves. In this place of singularity, these flows change their direction, their force, their volume. And this exchange can be, by chance and temporarily, homeorrhetic. The world as we know it, for example, is such a pocket. [...] This pocket, this seed, this island, this turbulence, holds a certain time before disintegration, before being carried away by the cataract, the current of atoms that wear it out and break it. (Serres, 2000, trans. Jack Hawkes, p. 76-77)

Rhuthmic Physics - Lucretius' *De rerum natura* (1st cent. BC)

Serres identifies in Lucretius' physics two kinds of original chaos, two kinds, so to speak, of *turba*: the "streaming-chaos" and the "cloud-chaos." At first, he argues, the process of ordering these two different kinds seems the same; it results from the *dînos* - vortex.

Lucretius describes two forms of chaos: the streaming-chaos, the laminar flow of elements, a parallel flow in the void, drawn out like fibered space; the cloud-chaos, a disorganized fluctuating, Brownian mass of dissimilarities and oppositions. [...] [but] the solution is unchanged, the original figure and movement remain the same, it is the Democritean *dînos*. The vortex is thus the pre-order of things, their nature, in the sense of nativity. Order upon disorder, whatever the disorder may be; the vortex arises by a *fluxion* in the first hypothesis, which is that of chaos-flow, and by *fluctuation* in the second, which is that of fluctuating chaos. There are indeed no stabilities except in a universe in which everything flows, unstable. (Serres, 2000, trans. Jack Hawkes, p. 31)

But on a second thought, he feels that those two concepts of chaos will eventually lead to two very different traditions in physics: a classical tradition ending in positivism; a repressed tradition which I propose to call "baroque" by analogy with other sciences and arts in the same period (Michon, 2015) which bravely addressed the problems of "chaotic multiplicity" and "order by fluctuation" and anticipated "our problems."

Yes, the solution is the same; yet, it is not the same, neither for epistemology nor for the history that will follow. The first of these hypotheses opens a classical knowledge, in which disorder is minimized: it is the path which leads from Archimedes to Pascal and Newton, mechanics and hydraulics, and an infinitesimal calculus, the science of fluxions. Here, coherence is preserved between the local and the global. During the course of this history, which goes up to Laplace, and up to a dominant positivism, the second hypothesis is dormant. Today, it is reawakening, out of some of Leibniz' dreams and from the other side of Laplace, where chaotic multiplicity slept. Order by fluctuation has become our problem, and our world has become that in which the local and the global no longer harmonize. (Serres, 2000, trans. Jack Hawkes, p. 31)

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I won't discuss this claim because it would need more than a few lines and take us too far from our current argument. But it is certainly an important suggestion that we will have to remember. Let us focus on Lucretius' physics. Serres distinguishes three layers in its construction. The first is "local and original" and starts with a *clinamen* which triggers a vortex.

The first model is local and original. It simply simulates the look of a fluid . Atoms cascade in a laminar flow down an infinite channel without banks. The void is a generalized hollow body. Inclination, then, imposes itself, the precursor of turbulence. It is produced, as experience shows, in an aleatory manner, at indefinite times and places. Every nascent object is initially a vortex, as indeed is the world. (Serres, 2000, trans. Jack Hawkes, p. 50)

The second is "global" and accounts for the "duration" of the things that have been generated in this way despite their essential dynamism and impermanence.

The second model is global. It takes the whole path into account. To the inclination, defined as minimal, there necessarily corresponds a maximal descent. The law of formation, the law of the duration of things and of the world. (Serres, 2000, trans. Jack Hawkes, p. 50)

The third, which is a theory of the "*natura naturata*," i.e. a physics of the world as it is, is proposed by Serres to synthesize the first two, which account for the "*natura naturans*," i.e. for the metaphysical dynamism that makes the world and the things appear, become and disappear (p. 51).

By insisting on this "third model," Serres wants to show that Lucretius' was quite close to our most recent model of nature as complex and open system. Lucretius does not content himself with the model of the atomic cascade, the *clinamen* and the vortex; he contemplates a much larger and more powerful model of the world as "vortex of vortices, interlacings or networks of waves."

Let us now construct the third model. Every object, naturally, emerges like Aphrodite from a flux of elements. By the above-mentioned models. Born from this and, as soon as it is born, complex, twined, twisting its long thick hair, it begins to transmit, in floods and in all directions, a star of flow: its wear and its time. It radiates various waves: heat, odors, sounds, simulacra, subtle atoms. In the same way or inversely, it receives the flow emitted around it, from the vicinity and the edges of the open universe alike. [...] At birth the singular cascade is transformed: no longer here and there, in and for some local object, but integrally and for its global flow, in a multiplicity of rivers, streaming by all paths, transverse, diagonal, intersected, complex. The summation of the dispersed inclinations in space and time in the cataract produces, in the maximal descent, a complex weave of flows that begin from the unified nappe. The world is a vortex of vortices, interlacings or networks of waves. (Serres, 2000, trans. Jack Hawkes, p. 50)

Nature is thus a complex system whose elements never stop moving and changing. It is, so to say, fluent but not entirely liquid. It is composed of crisscross intertwined fluxes which generates things and living beings that last a certain amount of time before disappearing again. All vortices are in relation with one another. All rhythms are

interacting with each other.

If nature, that is to say an ensemble of linked things, not an incoherent or chaotic ensemble of objects, but a communicating ensemble that functions as outlined, is to exist, *it is absolutely necessary that these vortices [tourbillons] be in relation one to another*. It is necessary that, in a certain manner, they be chained together or lead to each other. (Serres, 2000, trans. Jack Hawkes, p. 94)

Since Lucretius uses the theory of the four elements and establishes between them a cycle of transformation, he seems to support the view of a global equilibrium. Nature seems thus "an equilibrium in the midst of the fluencies" and a "fluency through equilibrium." *Adsidue quoniam fluere omnia constat - In constant flux do all things stream* (5.280)

In general, nature seeks an equilibrium in the midst of the fluencies, and seeks fluency through equilibrium. We would say today that there are fluctuations, homeostasis [tendency towards a relatively stable equilibrium between interdependent elements, especially as maintained by physiological processes], then homeorrhesis [steady flow, term introduced in the 1940s by Waddington]. (Serres, 2000, trans. Jack Hawkes, p. 56, my clarif.)

But this re-use of the four-elements physics should not be over-interpreted. The concept of system which is presupposed by Lucretius is actually different from the Stoics' because it does not entail any "hierarchy" or "tight order."

Invariance is global. Physics describes a system, but not one that is hierarchic, deductive, or tightly ordered [*monté serré*], as in the series of the Stoics: it is a set [*il est ensembliste*], its general equilibrium a balance sheet that takes account of the stochastic. (Serres, 2000, trans. Jack Hawkes, p. 58)

It is also different from the most common concept that has been popularized in some disciplines in the 20th century according to a kind of late Platonic worldview as closed system in perfect equilibrium. Here, at least two reasons make perfect equilibrium impossible. There are always new *clinamen* that stochastically introduce disorganization as well as new constructions and orders. Moreover, there is always entropy, loss of energy that provokes change, wear, decay and death. After a certain amount of time, each local vortex as our world's global vortex itself fade away.

Nature, that is to say birth, that is to say death, is the line inclined by the angle that produces a global vortex, which the wear of time brings back to the straight. (Serres, 2000, trans. Jack Hawkes, p. 58)

This is the reason why the circulation of fluxes in nature never occurs as "perfect circles" and rather follows spiral and vortex patterns.

If these circulations are perfect circles, then the movement finds its equilibrium, the world is immortal, it proceeds to eternity. This is the stroke of genius in atomist physics: there is no circle, there are only vortices. No exact rounding off, no pure circumference, [only] spirals that shift, that erode. The circle winds down in a conical helix. (Serres, 2000, trans. Jack Hawkes, p. 58, my clarif.)

The Final Splendor of Ancient Rhuthmos - (3rd century BC - 1st century BC) - part 2

This conclusion explains why Serres glimpses in Lucretius a theory of time that is clearly at odds with Plato's which considered in the *Timaeus* time as "an image of Eternity moving according to number" and with Aristotle's which, in his *Physics*, defined in turn time as "number of motion in respect of 'before' and 'after'." Given the crucial role played by the *turbo* in Lucretius' ontology and physics, time may be defined, Serres suggests, as "fluctuation of turbulences."

Turbulence is the functional figure of constitution and formation, everything happens as if it integrated declination. This is the *dinê* of Democritus. It then becomes the global figure of transformation in general, as the *clinamen* was its minimal or local operator. Things, and so nature, are formed by atomic conjunction in and through this very vortex; but, what is more, they exist and continue in and through it; finally, they destroy themselves, come apart, as if it were dwindling to nothing. Time is the fluctuation of turbulences, which make time, maintain it in their implications, set it going and finally allow it to disappear. (Serres, 2000, trans. Jack Hawkes, p. 91)

One basic assumption of the Platonic/Aristotelian paradigm, which tends to equate rhythm with meter (in the sense of measure and number), is then replaced by a much more supple conception of time. The latter is not any more considered as a completely regular and numbered course reflecting eternity or only measuring movement, but already as a turbulent flow providing accelerations, decelerations and returns, generations, stabilizations, mutations and disappearances. Time is "implicated" in the various ways of flowing, the *rhuthmoi*.

Another feature of the Lucretian theory of time is that the latter is "irreversible" whereas modern Newtonian time is, at least theoretically, "reversible."

Newtonian time, reversible, is the mark of resistance to the irrevocable. It is absent from this physics, and this is why our forefathers could not imagine for a single moment that there might exist a Lucretian physics. (Serres, 2000, trans. Jack Hawkes, p. 125)

According to Serres, who is aware of contemporary research on "irreversibility" Ilya Prigogine won the Nobel Prize in 1977, the same year *The Birth of Physics* was first published Lucretian time is thus closer to a "Bergsonian thermodynamic time."

Pardon me, but the clock that Lucretius sets right in the middle of nature cannot tell Newtonian time; because it [*elle* - the clock] is the whole of things, between their birth and their collapse, it records a Bergsonian, that is to say a thermodynamic, time. An irreversible, irrevocable time, pointing like the endless flow of atoms, flowing, rushing, crashing towards fall and death. (Serres, 2000, trans. Jack Hawkes, p. 125)

Parallel to this new conception of time, Lucretius develops, argues Serres, a new conception of space whose originality we better understand if we compare it with that common in 17th century science. Classical physics simplistically opposed, Serres notices, "space" as an abstract and empty room and "figures" as limited and "metred and masterable" entities furnishing this empty and neutral space. Lucretius' physics instead considered form as "simplex" and space as "rich in complexities." Exactly as time, space is not homogeneous and uniformly measurable. Space is not metric. It is clearly *rhuthmic*.

Form, here, is a simplex; space is rich in complexities, it is divided, it bifurcates, it is filled with knots and confluences, it is the conjunctive web of the topology and of the *ars combinatoria*, it is the tattered strips of the *ars coniectandi*, of the event, of circumstance. (Serres, 2000, trans. Jack Hawkes, p. 51)

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The metrical space, exactly as the Platonic rhythm when it is applied to space as we shall see very soon in Vitruvius, depends on an "algebra of proportions." From Euclid to Descartes, this is the same concept of space. Euclidean geometry is consistent with metrics and opposed to rhythmic.

The Cartesian figure refers back to Euclid's geometry, it is a metrics, dominated by algebra of proportions. [Measurable, mastered] [*métrisable, maîtrisée*]. The master and possessor of nature metricates his space. (Serres, 2000, trans. Jack Hawkes, p. 51, my mod.)

Even if it still lacks the concept of force and any consistent dynamics, ancient atomist physics suggest a combine *rhuthmic* conception of time and space, what Serres prudently calls a "vectorial space," which anticipates them both by more than two thousand years.

Atomist physics is based much more upon a vectorial space than on a metric space. (Serres, 2000, trans. Jack Hawkes, p. 62)

As far as we are concerned, thanks to Serres' analysis, Lucretius' physics appears clearly as an expression of a rhythmological or better yet, *rhuthmological* perspective and at the same time it enriches it with new concepts such as intertwined fluxes, interacting *rhuthmoi* and open systems as well as new concepts of time and space.

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