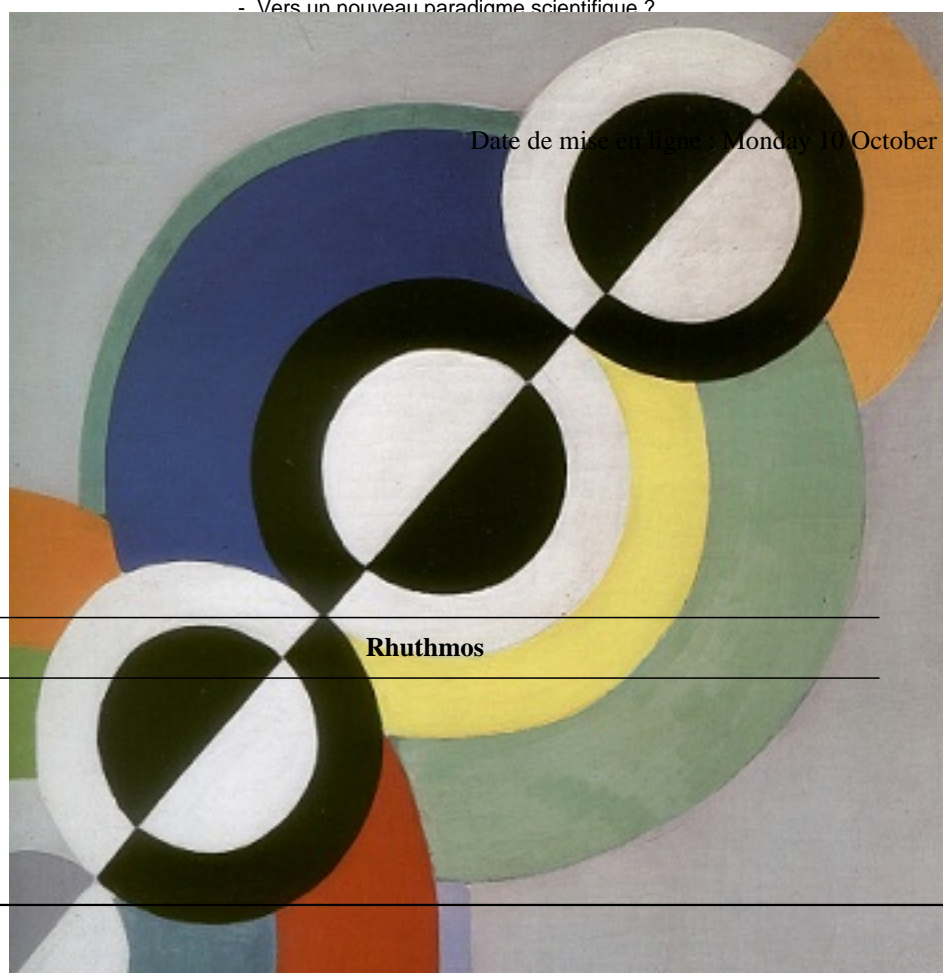Extrait du Rhuthmos

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

- Recherches

- Vers un nouveau paradigme scientifique ?

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**Rhuthmos**

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# *Rhuthmic* Epistemology - Lucretius' *De rerum natura* (1st c. BC)

At the juncture point between ontology and epistemology, there is the soul. According to Lucretius, the soul consists of two parts: the *animus*, located in the chest, which commands intellectual operations and will, and the *anima* which is spread throughout the body, receives perceptions and transmits in turn the impulses of the command center. The soul in both aspects can be shown to be corporeal (3.94-416). To make it short, anthropology can be reduced to physics and the human beings to *turbines*. I will come back below to this point which is not without raising questions.

In Book 3 and again at the beginning of Book 6, Lucretius compares the body with a vessel which contains the soul as it would a finer fluid. But, Serres notices, this metaphor does not bring us away from the flowing nature of things. This vessel leaks while being necessary to the concentration of the soul. Body and soul are necessarily co-existing.

> So the vessel is porous, the basin crazes. It is, very precisely, an open system. Very superior, in its complexity, to an automaton in an interior medium. By the channels that it has left free the animated fluid flows and escapes. Effusion: it leaves; diffusion: it spreads. It loses its concentration, it spills everywhere, it takes up the volume available to it. From the locally open to the globally open. Everywhere and at random, the soul returns to the word and to chaos. It is therefore mortal, by a physicalist death, aleatory diffusion; it cannot exist without the body, that basin which ensures its concentration, at least for a while. It would spill it were not constrained. (Serres, 2000, trans. Jack Hawkes, p. 69)

Body and soul, if we may call them so, constitute a unitary complex that is "stable for a time" and "postpone, for a little while, the end anticipated by the law of dissolution" because it consists in an "open system" which is " the seat of an exchange of flows."

> *But the vessel itself is a flow*, although thicker and more complex. [...] The vessel and its fluid leak. But they are stable for a time. They can postpone, for a little while, the end anticipated by the law of dissolution. [...] This is his stroke of genius: the body, an open system, is the place or the seat of an exchange of flows; they enter, they leave. But these flows are, unitarily food and drink, Eros or perception, and intellectual information. (Serres, 2000, trans. Jack Hawkes, p. 69)

As one may know, Lucretius believes that among the various fluxes that penetrate the body-soul, one is particularly important since it allows knowledge of the world: that one composed of the *simulacra* that are emitted by the multitude of things composing our environment. These *simulacra* are atom-thin and lightning-fast "images," that stream from the surfaces of solid objects (or sometimes form spontaneously in mid air) and enter the eyes or mind to cause vision, visualization and dreams. In this theory of knowledge, Serres emphasizes principally four aspects.

 1. The *simulacra* stream in all directions like "a spray of chreodes" as "an optimal form of the volume occupied by an object" from the *"sur-face"* of the "body" *(summo de corpore).*

> There is a flux given off by things. By things taken as limiting cases [*de manière extrémale* - as limits in mathematical sense]: *summo de corpore* (surface of the body), used eight times in forty lines (IV, 40 ff.). The surface is the summit, it is an upper face. I said a moment ago an ultrastructure. The simulacrum detaches itself as the optimal form of the volume occupied by an object, as a *sur-face [*super-ficie*]*. [...] In the vicinity of its banks, the object is no more than a spray of chreodes. (Serres, 2000, trans. Jack Hawkes, p. 39-40, my expl.)

2. They stream the same way atom do in the primordial cascade.

> If the model of perception is materialist, if the simulacra are formed of atoms and if their flow is governed by the general laws of propagation, then one model is reducible to the other. (Serres, 2000, trans. Jack Hawkes, p. 42)

3. Contrary to skeptics' claim, they convey the exact shape of the object, provided they do not unexpectedly swerve, "here is the formation of turbulence," or encounter obstacles or other flows of atoms.

> This river never ceases to flow. Here is the formation of turbulence: *liquidissima caeli tempestas, perquam subito fit turbida foede - ... just when the climate of the skies is clearest, it turns most suddenly dark and foul.* (4. 168) (Serres, 2000, trans. Jack Hawkes, p. 42)

4. We are ourselves both constantly emitting fluxes and immerged in "a space of communication" which is crossed by "fluxes of fragrance, of voices flying in the wind, of heat and cold, spume and bitterness" and "dense with waves."

Everything flows, objects are springs. *Fluunt, fluviis, undis aequoris, fluenter, fluendi.* Waves and fluxes of fragrance, of voices flying in the wind, of heat and cold, spume and bitterness. The perceptual space is dense with waves. All things are transmitters *[émettrices]*, without interruption and in every direction; our senses ceaselessly receive. We are plunged into the space of communication. (Serres, 2000, trans. Jack Hawkes, p. 49)

Thus perception is an encounter, a collision or an obstacle, one of many intersections on the way. The perspective subject is an object of the world, plunged into the objective fluencies. Receiver, in its place, transmitter form every point of view. (Serres, 2000, trans. Jack Hawkes, p. 49)

This theory of perception and the larger theory of knowledge that it supports, which has been so many times mocked and ridiculed, are actually, Serres argues, closely related with the progresses made in mathematics thanks to Democritus and Archimedes. Coming back to the method of exhaustion presented above, he concentrates on the shrinking serrated space between the curve, the circle or the solid of revolution one tries to measure and the "broken polygonal path" with its "infinite increase in angles" that tops the "square turned myriagon" or "the pyramid that has an increasing number of faces" (p. 102). This extremely thin and irregular space is, according to him, the real as much as the intellectual source of the *simulacra* which are conceptualized in the poet/philosopher's mind and generated in reality from this infinitesimal space.

> Now this operation [of exhaustion], strictly speaking, both has and does not have an end. In the vicinity of the smallest, we must decide. It is the passage to the limit. The curve precisely envelops this broken polygonal path. The surface is a boundary. It is an infinitely thin garment, cast upon this complex conjunction. A replication, as it were, though more of an application. Now observe the fluctuating muddle that separates and unifies the border and the conjunction, the limit surface and the infinite increase in angles. Literally and without metaphor, this space is fluent. It is the mobile deviation of a fine fidelity. Here, quite simply, is *the genealogy of the simulacra*, of these motile idols emanating from the surfaces, of the limit of the *µ6´¿Â - eîdos*. (Serres, 2000, trans. Jack Hawkes, p. 102)

Serres compares Lucretius' theory of perception to Leibniz's theory of small perceptions and find it much more precise because it takes account both of "the shape at the limit frontiers of atomic constitution" and of "the fluctuations of the phenomenon."

> It is an *anologon*, on the same model, of the Leibnizian theory of small perceptions. Even richer, it would seem, more complete and better constructed, since it takes account through its borders of the appearance of the shape at the limit frontiers of atomic constitution, and of the fluctuations of the phenomenon. (Serres, 2000, trans. Jack Hawkes, p. 103)

Although it certainly sheds a new light on the theory of *simulacra*, this suggestion has triggered discussions among specialists. But, as far as we are concerned, it illuminates a question that we crossed already many times: the atomist particular theory of shape which supported the definition of the Democritean concept of *rhuthmós* and Plato's and Aristotle's critiques against it. Through the streams of *simulacra*, which faithfully transmit "bit by bit," in a finer sense than that of computer science, all points constituting the constantly changing envelop of an object, that shape is finely transposed into the sense of view. The *rhuthmós* is transmitted as the integral sum of the *simulacra*.

> The flying wraps are the fluctuating edges, and the surfaces [are] limits. *Summo de corpore*. The simulacra peel away from things as when addressed via infinitesimals. [They are as numerous as you like.] Each object becomes the source of an infinity of envelops. [...] Every form is enveloped by an infinity of adherences, sliding infinitely from the virtual to the actual. (Serres, 2000, trans. Jack Hawkes, p. 103)

In other words, Lucretius provides a theory of perception that is perfectly adequate with the rhythmic aspect of atomist ontology. What the *simulacra* convey is *the invisibly changing and impermanent shape* of the things. But this

theory is also consistent with another conclusion of our previous study of the concept of *rhuthmós* before Plato. The simulacra convey *eurhythmically* precisely in the sense of Xenophon *the shape of any observed thing*: because of their infinitesimal nature, they *most perfectly fit* the upper surface of the body, the exact limit of the atomic cluster, the ultimate envelop of the thing, exactly as the eurhythmic armor fitted well the warrior's body (see chap. 2). Lucretius' theory of knowledge, which is naturally larger than his theory of perception, is based on eurhythmic transfer of information.

# *Rhuthmós* *vs* Rhythm - Lucretius' *De rerum natura* (1st cent. BC)

Serres' meditation on Lucretius provides the elements of a most convincing critique of the Platonic rhythm paradigm and, if I may say so, a powerful *rhuthmical* theoretical alternative.

As for physics, Serres notices, Plato did not draw out enough information from observation. For instance, when in the *Republic* he reflected on the spinning top (436d *sq.*), he completely failed to notice the very peculiar nature of this toy. He did not realize that such a simple artifact could open entirely new paths to physics particularly by tightly coupling rest and movement.

> Plato has no notion here of rest in and by movement itself: the axis of the top sways around a position of balance, there is an invariance by variation. (Serres, 2000, trans. Jack Hawkes, p. 29)

But Plato's main problem was maybe more theoretical than empirical because, as we saw, he did not lack spirit of observation. Plato's very speculation, Serres argues, has been limited first by the primacy he granted to geometry upon theory of numbers and, in the latter, to rational upon irrational numbers. In contrast, Lucretius' physics obviously benefited from the elaboration by Democritus, maybe, and Archimedes, more surely, both of a new geometry and a new arithmetic.

> Lucretius, and atomist physics, covers these areas abandoned by Platonic geometricism, covers the temporily metastable leaning and whirling, the concrete contradiction, the turbo of the top, unstable, immobile and mobile. (Serres, 2000, trans. Jack Hawkes, p. 29)

With Democritus and Archimedes, the Pythagorean mathematical paradigm that irrigated Plato's thought and resulted in Euclid's *Elements*, was subtly challenged. A "local mathematics, or, as it will be called, a differential geometry" opposed a "global mathematics."

In the three cases listed, the indivisible [tangent and atom], declination [*clinamen*] and contours [with the theory knowledge through perfectly fitting *simulacra*], we are concerned with a local mathematics, or, as it will be called, a differential geometry, an ultra-precise analysis of proximity, which in every place repeats the question: what happens as close as possible to the singularities? They are all different from the recognized Greek tradition, the one leading straight from Thales or Pythagoras to Plato. Strictly, they are also contrary to each other. Democritus takes for his subjects what for Platonists is an accident, and what for Pythagoreans was a disaster. They may be contrasted as a local and a global mathematics, as a science of idols and a science of ideas. [...] To the eyes of a Platonist the mathematics in question is false; for an Epicurean that of the *Timaeus* or of the dominant tradition is false. By true or false I mean these values with regard to the chosen system. (Serres, 2000, trans. Jack Hawkes, p. 103)

One of the main stakes of this mathematical divide was the concept of form and subsequently that of rhythm: its Platonic definition as heavenly, eternal, abstract and "global-mathematical," i.e. "rational" entity (as much as its Aristotelian more empirical version) *versus* an earthly, ephemeral, concrete and "local-mathematical," i.e. "differential" one. Whereas the former was based on the concept of "Idea" and reached directly (or indirectly through observation) by the intellect, the latter mobilized that of "idol" or *simulacra* and was first to be observed through the senses then elaborated by the mind. In other words, Archimedes and maybe Democritus provided the necessary mathematical and physical devices to give plain meaning to Democritus' particular concept of form, i.e. *rhuthmós*. They elaborated for the first time genuine *rhuthmic* mathematics and physics.

> *The ideal forms of geometry are not transparent, invariable and empty, they are dense and compact*, full almost to saturation, of a complex tissue, *and covered, around the edges, with invisible veils which yet allow them to be seen*, infinitesimal limits that nonetheless are there. Differential robes that glide over the shapes. [...] Hence the two opposing theories of knowledge: idols and ideas. (Serres, 2000, trans. Jack Hawkes, p. 103-104)

Ontologically speaking, there are no perfect, permanent, eternal and fixed Forms. These, mostly circle, triangle, rational numbers and proportions, are to be replaced by an Archimedean paradigm of helix, vortices and irrational numbers and infinitesimal calculus.

> The Pythagorean or Platonic circle becomes the Archimedean helix. In other words, nature is not endowed with perpetual motion. (Serres, 2000, trans. Jack Hawkes, p. 58)

Physically speaking, forms are constantly in "nascent state," they never stop appearing, changing and melting. Forms produces new forms which produces in turn another generation of forms.

> What is nature, if not the aggregate of objects, these forms that are in a nascent state and which transform this form? Thus the open circulation of the flow in general, the indefinitely broken cycle of spirals. Pseudo-solid volumes in which implication is undone, whose resistance melts. (Serres, 2000, trans. Jack Hawkes, p. 92)
>
> Form produces forms, the productive agent and the product each causing the other. (Serres, 2000, trans. Jack Hawkes, p. 106)

Epistemologically, forms are not Platonic "ideal Forms, seen as empty and transparent" of which human beings meet only deficient replicas and which can be known, strictly speaking, only through speculation.

The mathematics of the Epicureans, emerging with Democritus and given canonical form by Archimedes, is a science of images *[idoles]*: neuter producing infinite multiplicities of form. Auto-productive forms. The thing was inevitable given the realism of the compact and the dense, a prelude to physics; it opposes point by point the realism of ideal Forms *[idéalités]*, seen as empty and transparent. Either the lucid subject and the luminous object, or the subject-object compact through and through. (Serres, 2000, trans. Jack Hawkes, p. 106)

They are not Aristotelian forms either that would be reached through observation but that would be productive and final entities driving the process of actualization of matter until completion. They are only occurring shapes, observed in reality or dream, and recognized by the transmission of the infinite number of infinitesimal points that compose the envelope of things.

> But how can we explain this physical process [of production of forms], in its turn? With mathematics. With Democritus, who revealed the atomic constitution of shapes, and the infinite process of formation of their edges. (Serres, 2000, trans. Jack Hawkes, p. 106)

According to Serres, this new physics triggered no less than "a paradigm shift" in physics.

> We would say that what we have here is paradigm shift. Science remains science and laws remains laws, what changes is the global contract. The general design of what the learned agree to call physics. [...] Epicurus, Lucretius changed the paradigm. [...] The new knowledge is aware of stochastic phenomena: *incerto tempore incertisque locis* does not signify the nullity of place and time, and thereby a passage to the soul outside the world of sensible qualities, but simply aleatory scattering [2.263]. It is informed, since Democritus by infinitesimal questions. It is inspired by hydrodynamic models and looks towards the formation of living systems. It is more physicalist, less mathematicised (since it lacks a probabilistic organon) than Platonic knowledge, more phenomenal, less metrical. But, above all, Athens is by the sea. The elective model is fluid. It is no longer crystal, or the five polyhedral solids, the body of the *Timaeus*, it is flow. (Serres, 2000, trans. Jack Hawkes, p. 112)

One could wonder why this paradigm shift had such poor sequels in Antiquity. Why on earth did Plato's and Aristotle's physics erased and replaced for centuries the Archimedean and Lucretian physics which was supposed to be largely superior to them? Such an explanation would be quite enlightening, philosophically speaking, but it would be beneficial to rhythmology too because it could help us to understand also the reasons for the disappearance of the pre-Platonic *rhuthmós* and the spreading of the Platonic rhythm and maybe those for the rise of our current interest in the former and our distrust towards the latter. Yet Serres records the fact but does not really explain it. It just happened like that, "we were the children of Plato and the Stoics" and "Epicurean nature remained marginal to traditional science."

> We understood Lucretius' knowledge very poorly because we were the children of Plato and the Stoics. Because the fundamental facts of Epicurean nature remained marginal to traditional science, which was ultimately not very Archimedean. And so we judged them irrelevant to the history of the sciences. (Serres, 2000, trans. Jack Hawkes, p. 112)

# Some Ancient and Modern Limitations of the Physical Paradigm of Rhythm

When specialists reflect on that issue, their answer has usually something to do with the overall fitness of Platonic and Aristotelian doctrines with the dominant political and religious institutions that ruled over the West for at least eighteen centuries: Monarchy and Christianity. And they are probably right even if one could find plenty of arguments against this hypothesis. In any event, I think we may leave this interpretation open for the time being because it would require a much larger and more detailed reflection than this one and also because there is another issue that seems necessary to solve previously.

 As a matter of fact, the difficulties that were met by the physical paradigm of rhythm did not only result from the exterior pressure of the idealist Platonic/Aristotelian paradigm. Not all problems come from the power which this particular perspective was obviously endowed with, by its participation in the political and religious evolution. I think we should consider also interior factors such as the lack of consistent and adequate poetics and theory of language that often burdened and still do the proponents of materialism.

 Lucretius, due maybe to his legitimate distrusts towards some aspects of Aristotle's biology and physics especially his equating of formal and final cause does not pay any attention to his *Rhetoric* and *Poetics*. Instead, he indulges in a vague Epicurean imaginative reconstruction of the origin of poetry in the idyllic time of aboriginal men. His extreme naturalistic strategy, which has wonderful critical virtue regarding Platonism, is quite limited when it comes to accounting for language and poetry.

 Men, he claims, did invent language to express their "needs," just as children do when they "point with fingers" at things and animals when they cry to express their "fear or pain" or when "they burst with joy" (Book 5, 1028-1090).

But nature 'twas

Urged men to utter various sounds of tongue

And need and use did mould the names of things,

About in same wise as the lack-speech years

Compel young children unto gesturings,

Making them point with finger here and there

At what's before them. For each creature feels

By instinct to what use to put his powers.

[...]

And what,

At last, in this affair so wondrous is,

That human race (in whom a voice and tongue

Were now in vigour) should by divers words

Denote its objects, as each divers sense

Might prompt? since even the speechless herds, aye, since

The very generations of wild beasts

Are wont dissimilar and divers sounds

To rouse from in them, when there's fear or pain,

And when they burst with joys.

(*De Rerum Natura*, 5.1028-1032 - 5.1056-1061, trans. William Ellery Leonard)

Music appeared as imitation of the "liquid notes of birds" and the "whistlings of the wind athrough the hollows of the reeds."

But by the mouth

To imitate the liquid notes of birds

Was earlier far 'mongst men than power to make,

By measured song, melodious verse and give

Delight to ears. And whistlings of the wind

Athrough the hollows of the reeds first taught

The peasantry to blow into the stalks

Of hollow hemlock-herb.

(*De Rerum Natura*, 5.1379-1383, trans. William Ellery Leonard)

And poetry in turn was born from the music played and danced by shepherds "lounging with friends in the soft grass beside a river of water, underneath a big tree's branches."

These tunes would soothe and glad the minds of mortals

When sated with food, for songs are welcome then.

And often, lounging with friends in the soft grass

Beside a river of water, underneath

A big tree's branches, merrily they'd refresh

Their frames, with no vast outlay most of all

If the weather were smiling and the times of the year

Were painting the green of the grass around with flowers.

Then jokes, then talk, then peals of jollity

Would circle round; for then the rustic muse

Was in her glory;

(*De Rerum Natura*, 5.1392-1398, trans. William Ellery Leonard)

This is all that is to be found in the whole poem on language and poetry. But this regrettable lack is also imperiling more modern contributions such as Serres'.

Around the middle of his study, Serres asks an excellent and inescapable question.

> Why is this text on physics a poem, why did Lucretius, writing it in Latin for the first time, write in verse? (Serres, 2000, trans. Jack Hawkes, p. 135)

But his answer is not at the level one could expect after reading such a brilliant essay which contributed so much to the recovery of rhythm from an obscure part of the ancient physics. Serres is not that far from his hero. He confuses poetry and music, rhythm and music. Even worse, whereas Lucretius was writing poetry and concretely elaborating poetic rhythms, Serres is Aristoxenian without knowing it. He remains on the wrong side of Aristotle, whose *Poetics* he strangely disregards and replaces by a physical and informational theory of noise to answer his own question.

> How does this music [Lucretius' poem] emerge from the chaos-noise of the background, and how does the rhythm emerge from the pitcher's flow without return? (Serres, 2000, trans. Jack Hawkes, p. 135-136)

Since he does not have the theoretical means he would need to address this issue, Serres tries to apply physics to an object that is much too complex to be accounted for by a theory of vortices emerging from the "background noise." Such an explanation could possibly accounts for the formation of articulated sounds but what about phonemes in their differences? What about words in their idiomatic variations? What about texts? What about poems? The few answers he provides to these questions are quite limited, to say the least.

Language, according to him "emerges from noise" by "declination, by drift."

> Here are words, sentences, their filtering. A signal and a meaning emerge from the noise. How? By declination, by drift. (Serres, 2000, trans. Jack Hawkes, p. 135)

Poetry is verse, parallel lines writing; rhythm is close to metrics; meaning arises from an absence of meaning by "something like a rotation."

> Now the *versus* is not only a preposition or an adverb, for questions of place. It also describes lines and ranges, oars, elms, in short more parallels; lines, writing, prose; verses, poetry, rhythm, metrics. We're there. A parallel ordering, for things or for words, is not given from the first. To form it we need something like a rotation, an angle which turns on a preexisting field which, itself, fundamentally, has no meaning, is the absence of meaning. The word *versus*, the verse, what the poet writes, what the *rhapsode* chants, describes this all at once. (Serres, 2000, trans. Jack Hawkes, p. 146)

Lucretius' poem is a vortex as any other natural production. It "turns back on itself without meeting itself."

> Lucretius' poem is written in a vortex *[est écrit en un tourbillon]*. In all, it forms a vortex *[forme en tout un tourbillon]*. It turns back on itself without meeting itself *[Il se boucle sans se boucler].* (Serres, 2000, trans. Jack Hawkes, p. 139)

This description is so vague that it could even be true. But what makes a poem different from a simple rock or an animal? How is it specifically organized? Why, for instance, the choice of a Greek genre, the didactic poem? Why the hexameter? How is the story told? How does it affect the reader or listener? What makes it still interesting, moving, valuable to us? All these simple questions, that Aristotle addressed so carefully in his *Poetics*, remain without any real answer in Serres' essay. Although he uncovers in Lucretius' poem a physics that has been forgotten for centuries, an essential part of it disappears, probably because it does not fit in well with a simplistic physical approach. His writing, his poetry, his prosody, his poetic rhythm, and the poetic *transsubject* that animates it, all these aspects that fascinated Aristotle seem irrelevant to the modern philosopher.

I think that these limitations concerning language and poetry are partly responsible, since the concept of subject I do not say subjectivity or Self depends on that of language, for the lack of convincing ethics too (for the concepts of "subject" and "transsubject" see Michon 2010a). It is quite difficult indeed to elaborate such an ethics based on human beings who are not only treated as rocks and rats but also as mute and deaf. Something is utterly lacking in this rhythmic physics: the bright side of Aristotle.

In Serres' account, Lucretius' ethics may be reduced to a naturalistic ethics, which ends up being utterly individualistic and seems only to consist in a mystical retreat from the turbulences of society, in order to identify with the world as it remains underneath the conflicts and disasters of history and "rejoin material being [...] where no ripple has yet troubled the surface of the waters."

> The soul is knotted like the world. And like the world, it is unstable, deviating from equilibrium. Physics, psychology, give an account of these scattered knots where disturbances form. [...] Ataraxy returns to the initial turbulence, before any disturbance in the straight line of the flow. The wise man *is* the fundamental world. He rejoins material being, this ground of being itself where no ripple has yet troubled the surface of the waters. (Serres, 2000, trans. Jack Hawkes, p. 127)

But this does not account for the obvious fact that Lucretius was part of intellectual and artistic circles and painfully aware of the violence of the Roman society during the dreadful times of the end of the Republic. Neither for that other fact that Epicureans explicitly rejected the Stoic ideal of the wise man, living in complete autarchy, needing nobody's company, and preferred the paradisiacal image of a pleasure shared by a circle of friends gathered together in a garden. Actually, as many other philosophers, Serres confuses what a poet says explicitly, the enunciated, *l'énoncé* his proclaimed naturalistic worldview and his way of saying it, the enunciation, *l'énonciation* his poetry, his particular use of language, and the *transsubject* he launches thanks to it through time towards us. Lucretius did *write for* his friend Memmius and for us. Hence he does not wonder if the rhythm of the poem itself could not imply another ethics, a socially and politically oriented ethics that would contaminate from within Lucretius' naturalistic discourse.

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Lucretius' *De rerum natura* shows that, in the 1st century BC, *the physical Democritean paradigm of rhythm* was still able to develop and contribute new concepts.

It had first to fight against the supremacy of the *metric Platonic paradigm* which had invaded the language. There was no word in Latin to say what *rhuthmós* meant in pre-Platonic Greek. Because it only could be termed *numerus*, rhythm was naturally associated with number. This mere linguistic fact tells us a lot about the actual balance of power between theoretical paradigms in the new Hellenistic-Roman culture at the end of the Republic.

However, despite this preliminary difficulty, Lucretius managed to elaborate a full-fledged worldview based on the concept of *turbo - vortex*, which was very close to that of *rhuthmós.* To that end, Serres convincingly argues, he could rely on the progress in mathematics triggered by Democritus (c. 460 - c. 370) and fully elaborated by Archimedes (287 - 212 BC). Thanks to the new tools provided by these thinkers, it was now possible to fully mathematize the atomic model.

In Lucretius' poem, the term *turbo* becomes the cornerstone of a dynamic physical system. It means, exactly as *rhuthmós*, an impermanent form appearing and lasting for a certain period of time in a flow, observable by human beings. It fully complies with Benveniste's definition. But it has also a few new features that make it much more precise than its ancient predecessor and that are worth summarizing here.

1. It is associated with another concept, the *clinamen - the inclination* or *turning aside* of a thing, i.e. an infinitesimal angle appearing by chance in a flow, which explains the *turbo's* generation as well as its vanishing. The *clinamen* is a necessary conceptual extension that provides to the *rhuthmós-turbo* an ontological basis consistent with the new mathematical knowledge on minimal angle between a curve and its tangent.

2. The new mathematics makes it also possible to overcome the ingenuous simplism of the older definition of *rhuthmós* based on observation at a certain moment of time which was not too clearly specified. Thanks to the possibility to think of a mobile infinitesimal limit between time-lengths, it is now possible to present a rigorous account of the concept of "way of flowing" or "mode of fulfilling a process or an action."

3. Lucretius provides a philosophical basis for the development and duration of things which does not call neither upon Plato's nor Aristotle's theory of forms. Things appear through stochastic gatherings of atoms in vortices and they last for a time, due to an original tiny disequilibrium that makes their temporary equilibrium possible.

4. Lucretius' physics provides a larger frame that extends the concept of *turbo* to nature as a whole. The latter is a *turbo* of *turbines*, a vortex of vortices, a network of interlacing fluxes. It therefore powerfully opposes the Stoic model of a hierarchical and ordered system and anticipates our present idea of a complex system. Better yet, since it takes into account the notion of decay, loss of energy, it anticipates the most recent concepts of open system and irreversibility. In nature, the circulation of fluxes never occurs as perfect circles and rather follows spiral and vortex patterns.

5. Time is not conceived any more as "an image of Eternity moving according to number" (Plato) nor as "number of motion in respect of 'before' and 'after'" (Aristotle). It is not considered as completely regular and homogeneous, it looks like a turbulent flow providing accelerations, decelerations and returns, generations, stabilizations, mutations and disappearances.

6. Space is not either an abstract, empty and neutral room furnished with figures which can be perfectly measured and mastered. As time, it is not considered as homogeneous and metric. It is endowed too with a certain turbulent quality that makes it *rhuthmic.*

7. Anthropology is also thought of according to the physics of *turbines*. Body and soul, the latter with its two parts *animus* and *anima*, make up just one single vortex of vortices plunged into the larger dynamic system of nature. They constitute an open system, a seat of an exchange of flows that remains stable for a time.

8. This conception of the human being as an mere element of nature supports a theory of perception and a larger theory of knowledge which, Serres argues, is largely based on the new Archimedean mathematics. Indeed, the concept of flow of *simulacra* is not only coherent with the atomist worldview, it is also consistent with the differential calculus of the shapes that, so to say, envelop the things. This theory of perception gives a quite powerful account of a transfer of information whose infinitesimal bits most perfectly fit the complicated surfaces of things.

9. This theory of perception allows a new theory of form. Forms are inner-worldly entities that appear by chance and that can be best described through physical examination and mathematical calculus. Since they are impermanent yet observable, they are properly *rhuthmoi*. But since their perception depends on flows of *simulacra* that perfectly fit the things which send them towards us, this transmission is also *eurhythmical* in Xenophon's sense.

I lack competence to judge whether these propositions, brought together, brings about "a paradigm shift" in physics as Serres claims. But, from a rhythmological viewpoint, they definitely outline an alternative framework to Plato's and Aristotle's. They brilliantly herald the ancient *rhuthmós* against the spreading and domination of the new concept of rhythm. Therefore they constitute a very important contribution to rhythmology.

However there are not without some limitations of which we must be conscious if we want to develop a rhythmology more adapted to our current needs.

1. These limitations may be noticed in Lucretius' as much as Serres' way to treat language and poetry. Since the former disregards Aristotle's contribution to rhetoric and poetics and the latter does not pay attention either to the posterior traditions that stemmed out of it, language and poetry are unaccounted for or only by myths. The former miraculously hatches from animal cries or natural sounds: sounds of the wind "athrough the hollows of the reeds" for Lucretius or plain noise for Serres, while the latter idyllically develops in aboriginal shepherd groups resting under trees on some river banks or, less romantically if not less mysteriously, as word vortices. In these physics, both ancient and modern, nothing accounts for the fact that human beings speak and even turn, sometimes, speech into art.

2. Another problem, which is closely related to the previous one, concerns the ethics resulting from the physicists' naturalistic premises. Serres seems finally to adopt a half individualistic half mystical stand. The wise man tries to reach  *Ä±Á±¾¯±* - *ataraxía - tranquility*, *freedom from distress and worry*, by extracting himself from the turbulences of the world and rejoining the material being. Lucretius actually proposes a little more open ethics by rejecting complete autarchy and prizing friendship and pleasure. But his view is not much more convincing than that of his modern follower. It seems a mere reflection of a troubled time, a result of the ongoing domestication of the Roman aristocracy by a building overarching power and the retreat of this aristocracy from public life into private sphere. Exactly at the same time, Cicero discusses this point at length with his friend Atticus. It is difficult anyhow to imagine how such an ethics based on retreat, that is, somehow, on an inconsistent condemnation of the *rhuthmic* nature of things, can oppose the overwhelming *rhythmic* ethics and politics set up by Plato on authoritarian basis and circulated by his followers. It would be closer to some features of the Aristotelian ethics and politics we mentioned above, but the paradoxical lack of poetics impedes any rapprochement.

3. Last problem: Serres does not realize that writing or composing poetry in a certain manner, with a certain *rhuthmós*, is in itself an ethical stand. It generates a *transsubject* that transforms in the first place the poet than the reader or the member of the audience. As a poet, Lucretius knows that *practically* but he never mentions it and makes no comment on this particular dimension of poetry in which aesthetics and ethics rejoin.

 To put it in a nutshell, Lucretius physics is a wonderful piece of *rhuthmic* philosophy that brings a lot of new insights that we certainly have to take into account but, because it lacks a theory of language and a poetics, it also lacks a credible anthropology, indulges in a simplistic naturalism and, subsequently, only proposes very poor ethics and politics. We understand now why it attracted Serres' attention: it has the same strengths but also the same weaknesses as many doctrines developed during the 1960's and 1970's, which could see him on both grounds quite legitimately as their unjustly forgotten forbear.

 Anyhow this physics, for many reasons, was too disruptive for the dominant worldviews of this period and therefore intolerable to too many people. Due to a fierce opposition by Platonist, Aristotelian, Stoic and Christian thinkers alike, it rapidly felt into oblivion and various conceptions, mostly from Platonic or Aristotelian origin, substituted the ancient *rhuthmós* with what we still term nowadays "rhythm," transforming it into a concept of limited range, restricted to aesthetics, arts and public speech. We will see in the next volume that it was plainly re-discovered in the West only by the middle of the 18th century but that this re-discovery happened this time simultaneously with the development of strong linguistic and poetic concerns before being again re-naturalized in the 19th century.