

The Birth of the Mechanistic Science in the 17th Century:

Causes, Solutions, and New Problems

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Outline of the seminar:

- I. The scientific revolution of the 17th century:
 - a. Changes in the conception of Man
 - b. Changes in the conception of the material world (comparison with the Aristotelian and Ptolemaic views).

- II. The birth of the mechanical philosophy: matter as “extension,” and dualism of the two substances
 - a. Galileo’s telescope and the new worldview it entailed
 - b. Descartes’ conception of extension (comparison with the Aristotelian conception of an individual substance as a composite of matter and form, in which various kinds of beings have different levels of souls)

- III. Problematic consequences for the question of individuation
 - a. The Ancient and Medieval conception of individuation
 - b. Descartes’ lack of a principle of individuation in the *Principles of Philosophy*
 - c. How mechanism needed to make space for dynamism in the face of the problem of individuation: the cases of Leibniz and Spinoza.

Synopsis of the themes covered:

I. The scientific revolution of the 17th century:

- a. Changes in the conception of Man

The 17th century marks a major shift in the history of ideas. In philosophy, it is the century of Descartes, who is properly called the father of “Modern philosophy” for the distances which he takes with the scholastics of the Middle Ages and the new focus on the individual subject that his philosophy provides, notably by founding a whole philosophical system on the simple, but indubitable, truth of the *cogito*.

In Geography, it is the “Golden Age” of Spain with the exploitation of the Mines of silver and gold of the “New World”, discovered at the end of the 15th century (1492) by Christopher Columbus. Throughout the 17th century, exploration of the Americas continues, and reports

about the life-styles of indigenous people contribute to relativizing morality and to broaden people's perspectives on culture and religion.

In religion, the Protestant Reformation inaugurated by Martin Luther's posting of his "95 theses" against the Indulgences on the door of the castle church of Wittenberg in 1517 led to multiple wars of religion throughout Europe for more than a century onwards. Only in 1648 did the Treaty of Westphalia end the 30 Years' War (1618-1648) in the Holy Roman Empire, and the 80 Years' War (1568-1648) between Spain and the Dutch Republic. In France, the Edict of Nantes signed by King Henry IV had assured from 1598 on a relative safety to the Protestants or "Huguenots," but as a sign of the continuous hostility that prevailed throughout the 17th century between the two confessions, let it suffice to recall the fact that Louis XIV revoked the Edict of Nantes in 1685, thus re-opening the Pandora's Box of religious non-tolerance. The Lutheran reformation triggered a reflection on what defines man in his relation to God, and particularly on the nature and scope of his freedom. These reflections had, in their turn, an immense impact on the history of ideas and on the philosophical conceptions of man and of morality in the early modern period.

In medicine, William Harvey discovered the principle of the circulation of the blood in 1628, thus invalidating the whole Hippocratic and Galenic medicine that had been believed in since Antiquity and throughout the Middle Ages. Human dissections are performed for the first time in Christianity, and become part of the University education for future physicians, as testified by Rembrandt's famous "Lesson of Dr. Tulp" of 1632.

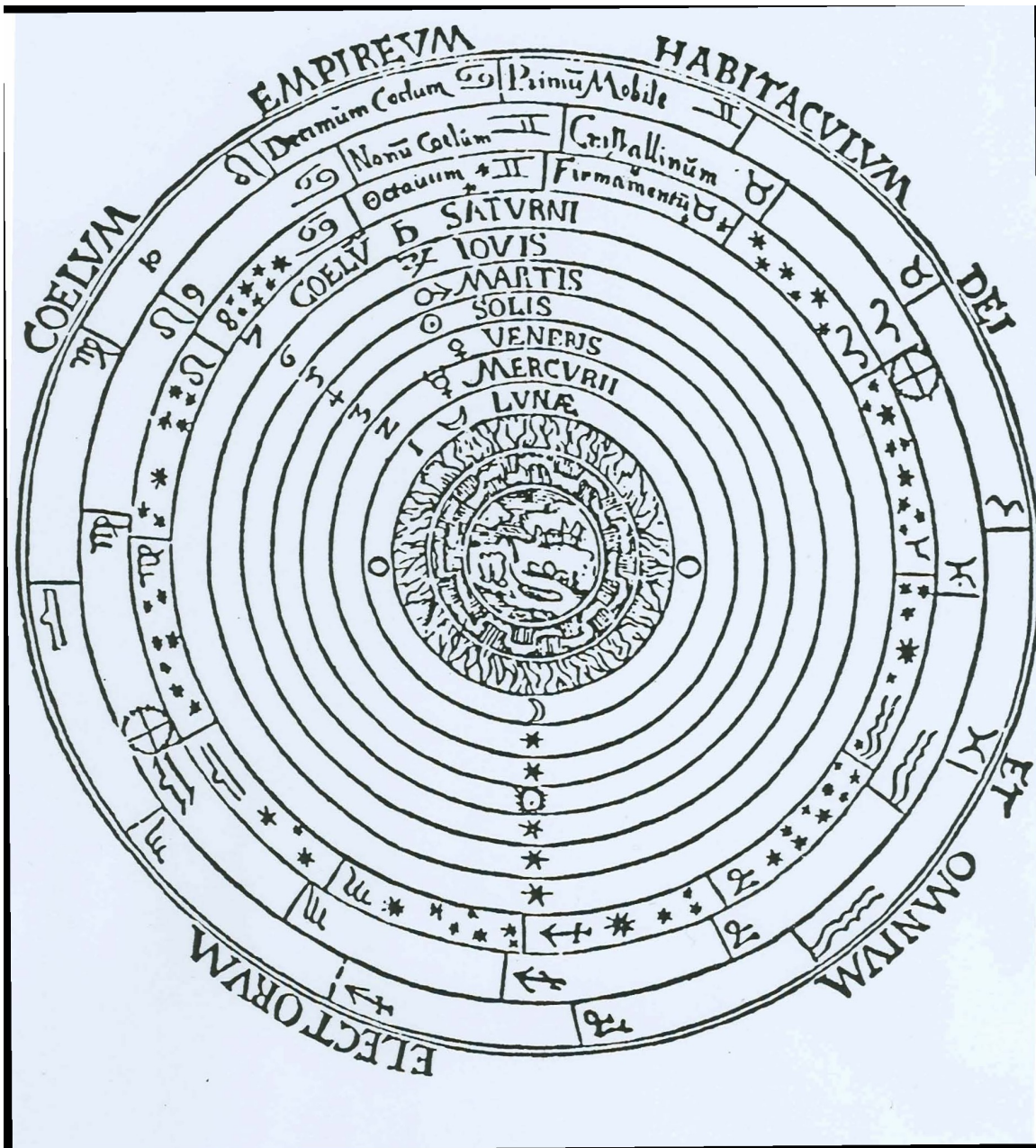
<http://www.ibiblio.org/wm/paint/auth/rembrandt/1630/nicolaes-tulp.jpg>

1.b. Changes in the conception of the material world (comparison with the Aristotelian and Ptolemaic views)

The importance of these discoveries and of the new science of man that they enabled cannot be overstated. But the "scientific revolution" which properly characterizes the 17th century also prominently concerns the areas of cosmology and of physics, whose complete redefinition in the first decades of the 17th century constitutes an integral part to the rejection of the Ancient paradigm of knowledge that made Descartes invent a new form of philosophizing.

In this section, we will look at the old conceptions of the universe of Aristotle and Ptolemy, which endured despite minor changes until Galileo totally changed the frame of understanding of the celestial heavens, thus passing, as Alexandre Koyré famously phrased it, "From the Close World to the Infinite Universe" (title of his book). As we shall see, it is not so much Heliocentrism, and the doubts it cast on the official line of cosmology, than the new definition of matter as being everywhere the same which threw Galileo and his followers into the modern times, something that Copernicus had not even spurred.

Typical pre-Copernican diagram of the universe from the 1539 edition of Peter Apian's *Cosmographia*," p. 7 of A. Koyré: *From the Closed World to the Infinite Universe*, New York and London: Harper & Row, 1958:



II. The birth of the mechanical philosophy: matter as “extension,” mechanism, and dualism of the two substances

- a. Galileo’s telescope and the new worldview it entailed

- b. Descartes' conception of extension (comparison with the Aristotelian conception of an individual substance as a composite of matter and form, in which various kinds of beings have different levels of souls)

In this section of the seminar, we will explain how the progress in optics, which explains the invention of the telescope, played a crucial role in Galileo's discoveries, which will be recalled. Then, working primarily with Descartes' mature expression of his dualism of the substances in the *Meditations on First Philosophy*, notably the second Meditation and the piece of wax example in it, we will look at the way matter, now called extension, is radically separated from the mental realm, now called the thinking substance, which gives way to the "mechanistic" framework in which most of the philosophy of the 17th century will be developed. **Mechanism** can be defined as the view according to which *every body, everywhere* in the universe, obeys the *same* laws, which are of *physical* nature.

Then, in order to explain the **dualism** that accompanied this view, we will contrast Aristotle's view of the union of matter and form in any individual substance with Descartes' idea that extension and thought are separate. In the same way, we will contrast Aristotle's view of the degrees of souls in nature (vegetative, animal and rational) with the theory of the animal-machine in which Descartes posits that only human beings have a soul. For him, a soul is both rational and free in nature, so only humans can be understood as having one. Just as freedom cannot be "cut" into degrees (you are either free, or not free), then in the same way the fact of having a soul or mind cannot be found in degrees: a soul is necessarily a human soul.

Important text: Descartes, *Meditations on First Philosophy*, 2nd Meditation, passage about the piece of wax, AT VIII, p. 29-31.

III. Problematic consequences for the question of individuation

- a. The Ancient and Medieval conception of individuation
- b. Descartes' lack of a principle of individuation in the *Principles of Philosophy*
- c. How mechanism needed to make space for dynamism in the face of the problem of individuation: the cases of Leibniz and Spinoza.

In the last section, we will examine what problematic implications this theory of matter as undifferentiated extension or space had for the question of the individuation of bodies, since in the new Cartesian philosophy, they no longer have any form or entelechy (and for the living world, no "souls" of any kind) to explain that they are what they are. In particular, the cases of Leibniz and Spinoza will be studied (particularly Spinoza) in order to show how they felt constrained to reintroduce a dynamic principle within mechanism: substantial forms for Leibniz ("monads"); the "*conatus*" for Spinoza.

We will first recall the Medieval view inherited from Aristotle about individuation in a being, that is, in a “matter and form” compound.

- The classical Aristotelian and Thomist view is that in a given category of being or essence, it is matter that constitutes the individuation principle. For instance, for any given “cat” sharing the form of “cathood” or felineness with many others, it is its matter that makes it be this cat rather than that one over there.
- The nominalist view, notably expressed by Duns Scot, denies the existence of universal essences or universal forms. Hence, on the contrary, the form is always individual in itself, and hence it is the soul which constitutes the primary principle of individuation.
- In both cases, we can see that both matter and form are needed for a singular being to exist as an individual entity.

Then, we will study several passages from the second part of Descartes’ *Principles of Philosophy* (1644) devoted to what makes a body “one,” and we will discuss the two principles of individuation which he gives: by movement, and by volume or place. We will notably see how they are complementary rather than opposed, and in any case, how unsatisfactory they are for accounting for any real individuality of the bodies in the world. The case is different for human beings, who are true individuals thanks to the fact that they each have a soul that is itself individual. But all the other beings and things in the world, having no “soul” attached to them, vanish in the indifferentiation of the status of being mere “modes” of the extended substance.

Important texts / quotes by Descartes:

“There is no difference between space and corporeal substance” (*Principia* II, 11 – interesting in all its length).

« L’étendue du monde est indéfinie » (*Principia* II, 21).

« La terre et les cieux sont faits d’une même matière » (*Principia* II, 22).

« Il n’y a donc qu’une même matière en tout l’univers, et nous la connaissons par cela seul qu’elle est étendue (...). Car, encore que nous puissions feindre, de la pensée, des divisions en cette matière, néanmoins il est constant que notre pensée n’a pas le pouvoir d’y rien changer, et que toute la diversité des formes qui s’y rencontrent dépend du mouvement local » (*Principia* II, 23).

« Il n’y a rien qui joigne les parties des corps durs, sinon qu’elles sont en repos au regard l’une de l’autre » (*Principia* II, 55).

« Remarquez en passant que je prends ici et que je prendrai toujours ci-après pour une seule partie tout ce qui est joint ensemble et qui n'est point en action pour se séparer » (*Le Monde*, chap. III, in Alquié t. 1, p. 329).

« Par un corps, ou bien par une partie de la matière, j'entends tout ce qui est transporté ensemble, quoiqu'il soit peut-être composé de plusieurs parties qui emploient cependant leur agitation à faire d'autres mouvements » (*Principia* II, 25).

« Car le corps de Jésus-Christ étant mis à la place du pain, et venant d'autre air en la place de celui qui environnait le pain, la superficie, qui est entre cet air et le corps de Jésus-Christ, demeure *eadem numero* qui était auparavant entre d'autre air et le pain, parce qu'elle ne prend pas son identité numérique de l'identité des corps dans lesquels elle existe, mais seulement de l'identité ou ressemblance des dimensions : comme nous pouvons dire que la Loire est la même rivière qui était il y a dix ans, bien que ce ne soit plus la même eau, et que peut-être aussi il n'y ait plus aucune partie de la même terre qui environnait cette eau » (Letter to Mesland from February 9, 1645, AT IV, 164-165, in Alquié, *Œuvres philosophiques* t. III, p. 546).

« L'espace, ou le lieu intérieur, et le corps qui est compris en cet espace, ne sont différents aussi que par notre pensée. Car, en effet, la même étendue en longueur, largeur et profondeur, qui constitue l'espace, constitue le corps; et la différence qui est entre eux ne consiste qu'en ce que nous attribuons au corps une étendue particulière. Que nous concevons changer de place avec lui toutes fois et quantes qu'il est transporté » (*Principia* II, 10).

Finally, we will look at Leibniz's requirement that "substantial forms" be reintroduced in philosophy, precisely as a felt need to account for the difference between bodies, and we will then spend more time on Spinoza' about whom we will see how he tries to reconcile mechanism with a form of internal dynamism (called the "conatus") at play everywhere in nature.

Important passages in Leibniz:

Leibniz, *Discourse on Metaphysics* (1685), sections 10-12.

Leibniz, *Monadology* (1714), sections 8-9 :

Section 8 : "Still Monads must needs have some qualities, otherwise they would not even be existences. And if simple substances did not differ at all in their qualities, there would be no means of perceiving any change in things. Whatever is in a composite can come into it only through its simple elements and the Monads, if they were without qualities, since they do not differ at all in quantity, would be indistinguishable one from another. For instance, if we imagine a plenum or completely filled space, where each part receives only the equivalent of its own previous motion, one state of things would not be distinguishable from another."

Section 9 (so-called “*Principle of the Indiscernables*”): “Each Monad, indeed, must be different from every other. For there are never in nature two beings which are exactly alike, and in which it is not possible to find a difference either internal or based on an intrinsic property.”

Leibniz, Letter from April 30, 1687 to Arnauld: “What is not authentically *one* being is not authentically one *being* either.” (« Ce qui n’est pas véritablement un être n’est pas non plus véritablement un être »).

Important passages concerning Spinoza:

Victor Delbos : « En ramenant la matière à l’étendue mathématique homogène, il [Descartes] semblait bien exclure de la matière tout principe *essentiel* d’individuation; il devait soutenir que la matière, primitivement privée de toute distinction et de toute spécification de parties, reçoit du mouvement seul la diversité des choses qu’elle manifeste; cette diversité est donc modale, non substantielle; la substance étendue, dans son fond, doit être une. Par là Descartes se prêtait aux thèses propres à Spinoza » (*Le spinozisme*, Paris, Vrin, 1983, p. 32-33).

Spinoza, *Ethics* II, Definition after prop. 13:

« When a number of bodies, whether of the same or of different size, are so constrained by other bodies that they lie upon each other, or if they so move, whether with the same degree or different degrees of speed, that they communicate their motions to each other in a certain fixed manner, we shall say that those bodies are united with one another and that they all together compose one body or individual, which is distinguished from the others by this union of bodies (Gebhardt II, 99-100).”

Spinoza, *Ethics* III, Propositions 6 and 7 :

Prop. 6 : “Each thing, as far as it can by its own power, strives to persevere in its being.”

Prop. 7: “The striving (*conatus*) by which each thing strives to persevere in its being is nothing but the actual essence of the thing.”