

Materialism and sense perception
in Thomas Hobbes's natural philosophy
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Thomas Hobbes has been at large considered as one of the fathers of modern materialism. Baron d'Holbach spent some memorable pages on this author of the seventeenth-century British empiricism.

Hobbes embraced a materialistic philosophy, that was considered for a long time a metaphysical system, as a consequence of its mechanical, monistic, and deterministic physicalism.

According to the so-called *vulgata*, Hobbes's materialistic monism represented the typical form of modern mechanism¹. However, differently from Descartes's mechanism, Hobbes's materialism involves some interactions with Renaissance naturalism making his natural philosophy more interesting than a *pure* mechanism.

A first difference with Descartes's metaphysical system focuses on the denial of Descartes's metaphysics of the *subjectum* as *substantia*. Hobbes does not accept Descartes's system, founded on the duality of the substances (*res cogitans/res extensa*), and, consequently, he denied Descartes's conception of the living body as a *separated* mechanism, although connected to the incorporeal substance of the human mind.

As a follower of the monistic view, Hobbes *can* attribute to the 'mechanism' of the human body all psychological qualities that, according to Descartes's dualism, should have to be attributed to the «incorporeal substance». Hobbes's mechanistic account on sense

¹ In the last four decades, an extensive number of Hobbes's scholars denied the former reading, which considered Hobbes as follower of a metaphysical and dogmatic materialism. In 1965, Arrigo Pacchi reminded the reading by Paul Natorp and Ernst Cassirer, and he supposed that Hobbes's materialism had several steps, culminating, in *De Corpore* (1655), with a compromise between realism, phenomenism and hypothetical materialism (*Convenzione e ipotesi nella formazione della filosofia naturale di Thomas Hobbes*, Florence, La Nuova Italia, 1965, pp. 42-215). After 1970s, many researchers dealt with Hobbes's materialism by means of some topics of linguistic conventionalism and scientific constructivism (see A.G. Gargani, *Hobbes e la scienza*, Turin, Einaudi, 1970; M. Bertman, *Hobbes on Language and Reality*, «Revue Internationale de Philosophie», 32, 1978, pp. 536-550; Id., *Body and Cause in Hobbes: Natural and Political*, Wakefield, Longwood Academic, 1991; I. Hacking, *Linguaggio e filosofia*, Milan, Raffaello Cortina, 1994; A. Biletzki, *Talking Wolves: Thomas Hobbes on the Language of Politics and the Politics of Language*, Dordrecht, Kluwer, 1997; D. Sepkovsky, *Nominalism and Constructivism in the Seventeenth-Century Mathematical Philosophy*, «Historia Mathematica», 32, 2005, pp. 33-59). Pacchi's reading was enhanced by the studies of Gianni Paganini (see *infra*) and Agostino Lupoli (*Nei limiti della materia. Hobbes e Boyle: materialismo epistemologico, filosofia corpuscolare e dio corporeo*, Milan, Baldini Castoldi Dalai, 2006). In the present essay, I will agree with Pacchi's aim to identify, in Hobbes's natural philosophy, an internal tension between ontology and arbitrariness, realism and empiricism.

perception, denying Descartes's metaphysics – that sense perception involves a judgment made by the incorporeal human mind –, fits out a materialism more different than Cartesian mechanism of the corporeal substance (*res extensa*).

Let us first deal with the principles of Hobbes's mechanical philosophy contained in the *Philosophia prima* and in the *Physica generalis* of his *Elementa philosophiae sectio I De Corpore* (1655). In this work, Hobbes presented his system of nature; his scientific image of the world. He illustrated his mechanical view in the chap. VII, at the beginning of the *first philosophy*, with the well-known «annihilation experiment», a thought-experiment concerning the annihilation of the world (*ficta universi sublatio*). Hobbes tries to imagine – «if such annihilation of all things (*rerum annihilatio*) be supposed» –, «what would remain for any man (whom only I except from this universal annihilation of things) to consider as the subject of philosophy, or at all to reason upon»².

The lonely survivor of the supposed annihilation of the world is a man dealing with the phantasms of his mind. He has the faculty to re-create his knowledge of the world by means of memory, and sense perception of the external objects: «I say, therefore, there would remain to that man ideas of the world, and of all such bodies as he had, before their annihilation, seen with his eyes, or perceived by any other sense; that is to say, the memory and imagination of magnitudes, motions, sounds, colours, &c. as also of their order and parts. All which things, though they be nothing but ideas and phantasms, happening internally to him that imagineth; yet they will appear as if they were external, and not at all depending upon any power of the mind»³.

This man should be able to reckon his phantasms, by reasoning on their causes. Indeed, Hobbes did not supply a reply to the following question: what remains of this man? A mind, a simple rational being (and however, it could be a mind without brain)? According to Hobbes's materialism, we suppose this man survives both with his body, and what needs to the being of his brain.

So, allow us to consider the psychological process Hobbes accounts in the rational re-creation of the world, by means of the phantasms of sense perception and imagination.

The survivor provides the foundation for a scientific image of the world. He starts with the more abstracted and general concepts, grasped by a reckoning of the «accidents» or the

² T. Hobbes, *Elementorum philosophiae sectio I De Corpore*, Londini, A. Crook, 1655 (hereafter «DCo»), chap. VII, art. 1, p. 56; engl. trans. *Concerning Body* (1656), repr. in *The English Works of Thomas Hobbes of Malmesbury*, ed. by W. Molesworth, 11 vols., London, 1845 (hereafter «EW»), vol. I, p. 91.

³ T. Hobbes, *EW* I, p. 92.

«phantasms» of sense perception⁴.

In this foundational process, the first entry is the concept of the «imaginary space», that is to say, of the (three-dimensional) «place» of a (possible) body⁵. The following concepts are time and motion, number and (continuous) space. In the chap. VIII, Hobbes adds up the notions of «body» and «real space», *i.e.*, the concept of the extended body, joined to the phantasm of the «imaginary space». In other words, the supposed re-creation of the world begins from the queen of the new sciences at Hobbes's times: the mechanical philosophy, whose path was traced, in the early modern age, by the Galilean science of motion.

It is a thought-experiment which anti-Cartesian argument is evident. Hobbes qualified the supposed annihilation of the world as the starting point of his natural philosophy; and, differently from Descartes (who 'misplaced' the existence of the corporeal world, by means of the doubt), with the re-creation of the world, by means of phantasms of the sense perception and imagination, is what clearly showed be not necessary to choice (as *fundamentum inconcussum*) the Cartesian way of the *res cogitans*.

In the making of the scientific knowledge of the world, Hobbes's man turns to the world itself the first act of thinking. In order to find that a world exists *before* its annihilation, it is enough the *memory* or the sense perception that *once* has been a world. By the «annihilation experiment», Hobbes faced Cartesian *cogito*, and that difficulty, learned from the skeptical claim, to distinguish the records of his conscious life from those of his dreams⁶.

After the supposed annihilation of the world, what survives is *not* a subject who knows himself by the certitude of the being of his thoughts. Hobbes's removing of the self-consciousness is not a *lapsus*, nor a scientist *naïveté*. Hobbes will state that the survivor finds himself thanks to the existence of the world (although the latter should be a world that *formerly* has been)⁷.

The annihilation experiment is the starting point of the natural philosophy of *De Corpore*. It presumes the evidence of the world. Despite Descartes' doubt, Hobbes falls to

⁴ T. Hobbes, *DCo*, chap. VI, art. 1, p. 42; *EW I*, p. 66: «The first beginnings, therefore, of knowledge, are the phantasms of sense and imagination; and that there be such phantasms we know well enough by nature; but to know why they be, or from what causes they proceed, is the work of ratiocination; which consists [...] in *composition*, and *division* or *resolution*». See also *DCo*, chap. I, art. 2, p. 12; *EW I*, p. 3.

⁵ T. Hobbes, *DCo*, chap. VII, art. 2, p. 57; *EW I*, p. 93.

⁶ T. Hobbes, *Leviathan* (1651), eds. G.A.J. Rogers and K. Schuhmann, 2 vols, Bristol, Thoemmes Press, 2003, vol. 2, chap. III [§§ 5-7], pp. 13-14. See *Id.*, *Elements of Law Natural and Politic* (1640), in *EW II*, part I, chap. II.

⁷ In the chap. VIII, art. 1 of *DCo*, in order to define the concept of body, Hobbes evoked the words of *subjectum* and *suppositum*, according to the ancient Greek *hypokeimenon*, that is to say, what is «placed in», and «subjected to» (the «imaginary space»), see *EW I*, p. 102.

make plain the *reality* of the external world. The evidence of the external world draws from experience, or from the memory of it.

Before asserting that the knowledge of the world persisted even if the world disappeared, Hobbes tells us that the existence of bodies should be likely even if there was no conscience of them. The annihilation hypothesis shows either the *linguistic* nature of the scientific knowledge, and also the existence of the subject 'world' before, and independently from, a thinking self: «For seeing, that after the destruction of all other things, I suppose man still remaining, and namely that he thinks, imagines, and remembers, there can be nothing for him to think of but what is past; nay, if we do but observe diligently what it is we do when we consider and reason, we shall find, that though all things be still remaining in the world, yet we compute nothing but our own phantasms. For when we calculate the magnitude and motions of heaven or earth, we do not ascend into heaven that we may divide it into parts, or measure the motions thereof, but we do it sitting still in our closets or in the dark. Now things may be considered, that is, be brought into account, either as internal accidents of our mind, in which manner we consider them when the question is about some faculty of the mind; or as species of external things, not as really existing, but appearing only to exist, or to have a being without us. And in this manner we are now to consider them»⁸. Indispensably, the experiment of the *ficta universi sublatio* supposes the existence of a world.

In the foundation of the *first philosophy*, it should seem that Hobbes focuses on the *scientific* evidence of the supposed principles of the external world *more* than the *empirical* evidence of the same. In fact, as we will show, Hobbes *cannot* provide *any* scientific evidence to the knowledge of the world *without* give a response to the ontological status of the empirical knowledge.

The problem of the relationship between these two parts of knowledge is an essential reading key to recognize the function of materialism and empiricism in the shaping of Hobbes's natural philosophy. It moves to explain what Hobbes means as scientific knowledge, and what is the difference between the scientific discourse (the rational, *scientific* image of the world) and the empirical knowledge (the *outward* image of the world).

At the core of Hobbes's epistemology we find the definition of *philosophy*: «Philosophy is such knowledge of effects or appearances, as we acquire (*acquisita cognitio*)

⁸ T. Hobbes, *DCo*, chap. VII, art. 1, p. 56; *EW I*, p. 92. For a thorough examination of the contents of Hobbes's annihilation hypothesis and its implications in the context of the modern philosophy, see G. Paganini, *Hobbes, Gassendi e l'ipotesi annichilitoria*, «Giornale Critico della Filosofia Italiana», 85 (2006) 1, pp. 55-81, and, more recently, A. Milanese, *Principe de la philosophie chez Hobbes. L'expérience de soi et du monde*, Paris, Garnier, 2011.

by true ratiocination from the knowledge we have first of their causes or generation (*effectuum sive phaenomenon ex conceptis eorum causis seu generationibus*): And again, of such causes or generations as may be from knowing first from effects (*ex cognitibus effectibus*)»⁹.

In the chap. VI of *De Corpore*, Hobbes recovers the classification (from Aristotle's *Posterior Analytics*), between the *τοῦ ὅτι* and *τοῦ διότι* knowledge¹⁰: «And this is the science of causes (*scientia causarum*), or, as they call it, of the [*τοῦ*] *διότι*. All other science (*alia cognitio omnis*), which is called the [*τοῦ*] *ὅτι* is either perception by sense (*sensio*), or the imagination, or memory remaining after such perception (*a sensione remanens imaginatio sive memoria*). The first beginnings, therefore, of knowledge, are the phantasms of sense and imagination»¹¹.

According to Hobbes's definition of philosophy, the true form of the scientific knowledge is that pertaining to the *τοῦ διότι* knowledge. The two sides of knowledge, the *τοῦ ὅτι* and *τοῦ διότι*, lie respectively as *sentire* to *scire* (*effectuum per causas cognititas vel causarum per cognitos effectus*)¹².

The twofold definition of science-sensation also entails a duality: the world, the «external body» (the object of sense perception as a fact, *τοῦ ὅτι*), is *not* the same world, the object, or the external body of *τοῦ διότι* knowledge.

The true meaning of Hobbes's materialism lies in the link between these two images of the world; the drama between ontology and science, realism and scientific constructivism is played about the relation between these two forms of knowledge. It is the first task in the setting of Hobbes's natural philosophy.

Hobbes tries to resolve this link at the beginning of chap. VII of *De Corpore*: as we have seen, the first issue Hobbes introduced in the scientific re-creation of the world is an empirical data, grasped from the *τοῦ ὅτι* knowledge: the «phantasm» of the external things, the *spatium imaginarium*. The phantasm of the imaginary space, the evidence of an external

⁹ T. Hobbes, *DCo*, chap. I, art 2, p. 12; *EW I*, p. 3.

¹⁰ Aristotle, *Posterior Analytics*, I 13 78a 21, 78b 32-33. In the writings prior to *De Corpore*, Hobbes's partition is arranged under the form of the «Original knowledge» and the «Derivative knowledge». See A. Pacchi, *Convenzione e ipotesi nella formazione della filosofia naturale di Thomas Hobbes*, cit., pp. 101-142.

¹¹ T. Hobbes, *DCo*, chap. VI, art. 1, p. 42; *EW I*, p. 66.

¹² See T. Hobbes, *DCo*, chap. I, art. 2, p. 3; *EW I*, pp. 65-66: «*Philosophy is the knowledge we acquire, by true ratiocination, of appearances, or apparent effects, from the knowledge we have of some possible production or generation of the same; and of such production, as has been may been or may be, from the knowledge we have of the effects*». Hobbes's science implies two kinds of causal reasoning: they are the two methods of philosophy, *resolutio* and *compositio*: the former is the knowledge *propter quid* (or synthesis), that is the knowledge of the effects from knowledge of their causes (*cognitio ex causis*); the latter is the *quia*, that is the knowledge of the causes from knowledge of their effects (*cognitio ex effectibus*), corresponding to the *resolutio* or analysis. See T. Hobbes, *DCo*, chap. XXV, art. 1, p. 223; *EW I*, p. 388.

world, lies at the foundation of the building of the scientific image of the world.

Thus, in the setting of the *τοῦ διότι* knowledge – the construction of the *first philosophy* –, once the phantasm of the external world is integrated in a logical chain of axioms and definitions, it has to receive a conceptual handling: being formerly the sense perception or the memory of an «*extra stare*», of a world without us, it becomes the *definition* of an external world, the *idea* of a *world* from which all but the *place* of the single objects occupying a place has been removed. In this way, Hobbes may conclude: «I return to my purpose, and define *space* thus: *SPACE is the phantasm of a thing existing without the mind simply*; that is to say, that phantasm, in which we consider no other accident, but only that it appears without us»¹³.

In aim to explain the difference between the sense perception of the external world and the rational ‘shape’ of it in a system of *first philosophy*, it needs to consider the psychological status Hobbes attributed to the *definition* of space.

Hobbes has just defined that «SPACE is the phantasm of a thing existing without the mind simply; that is to say, that phantasm, in which we consider *no other accident*, but only that it appears without us» (emphasis mine). This is to say that the knowledge of the world needs essentially the knowledge of the «accidents» of the perceived things.

Afterwards (echoing Galileo’s physicalism), he explains how those accidents can be classed in two categories:

1) the accidents «which are common to all bodies»; they are the so-called «primary qualities», which «can never perish except the body perish also», that Hobbes identifies with motion, extension, rest, figure, and so on. In the tradition of Aristotelianism, these accidents are classified as *sensibilia* (or *accidentia communia*).

2) the accidents «which are *not* common to all bodies»; they are *not* inherent to the external bodies, and are known as «secondary qualities». In the tradition of Aristotelianism, these accidents are classified as *sensibilia* (or *accidentia propria*):

«And this, also, is explicated by *Aristotle* no otherwise than negatively, namely, *that an accident is in its subject, not as any part thereof, but so as that it may be away, the subject still remaining*; which is right, saving that there are certain accidents which can never perish except the body perish also; for no body can be conceived to be without extension, or without figure. All other accidents, which are not common to all bodies, but peculiar to some only, as

¹³ T. Hobbes, *DCo*, chap. VII, art. 2, p. 57; *EW I*, p. 94. Hobbes took into consideration the natural vagueness of phantasms of sense perception (to give them, by the act of naming, the status of abstracted or common notions); see the chap. I, art. 3, of *DCo* (about the idea of *logica sive computatio*), as well as the syllogistic version of the same experiment, *DCo*, chap. IV, art. 8, p. 31; *EW I*, pp. 49-50.

to be at rest, to be moved, colour, hardness, and the like, do perish continually, and are succeeded by others; yet so, as that the body never perisheth. And as for the opinion that some may have, that all other accidents are not in their bodies in the same manner that extension, motion, rest, or figure, are in the same; for example, that colour, heat odor, virtue, vice, and the like, are *inherent*; I desire they would suspend their judgement for the present, and expect a little, till it be found out by ratiocination, whether these very accidents are not also certain motions either of the mind of the perceiver, or of the bodies themselves which are perceived»¹⁴.

The aim of Hobbes's mechanism was to reduce the *sensibilia propria* to the *sensibilia communia*. Having the status of «accidents of the perceiver», the *sensibilia propria* are corporeal motions that are *inherent* to the cognitive structure of the mind; they are *provoked* by the bodies of the external world, and *perceived* by the organs of sense. I shall come again on the matter. Now, it is important to clarify it as follows: it seems Hobbes did not pay attention to explain if the distinction between primary and secondary qualities had to be considered like a record of *τοῦ ὅτι* knowledge, or an element of *τοῦ διότι* knowledge.

In other words, Hobbes did not *explicitly* explain if the classification between the accidents of the body and those of the perceiver deals with the realm of the «originall» knowledge *or* with the realm of the «derivative» knowledge. However, all seems suggest that the distinction between the *sensibilia propria* and the *sensibilia communia* was a pivot for the new scientific image of the world. In fact, the outward, 'pre-scientific' image of the world (the sense perception of the external world) is a 'factual' knowledge where the accidents of the bodies and the accidents of the perceiver are *not* quite separated. In the first take of the annihilation experiment, they are not included, as common notions (*κοιναί ἔννοιαι*), in the logical structure of definition.

What's more, we think that the first feeling of the consistency, and 'certainty' of an external world – the original trust in a world being without us, which not depends from the pictures of fancy – is grasped from the 'natural' way¹⁵ by which the perceiver formerly fills the objects of the world.

Afterwards, when, in the realm of the *τοῦ διότι* knowledge, the subject will begin to

¹⁴ T. Hobbes, *DCo*, chap. VIII, art. 3, pp. 63-64; *EW I*, pp. 104-105. On the subject, see C. Leijenhorst, *The Mechanisation of Aristotelianism. The Late Aristotelian Setting of Thomas Hobbes' Natural Philosophy*, Leiden, Brill, 2002, pp. 160-163.

¹⁵ What is the «common» accident – the *spatium imaginarium* – before to be categorized in a system of common notions? It seems anything but sense perception of a similitude, a common 'nature' of the external objects that is not perceived independently from the *sensibilia propria*. It is important to say that, in order to obtain the «definition» of the *spatium imaginarium*, Hobbes has previously submitted the external world to a *ficta universi sublatio*.

differentiate and classify, in separated notions, the *sensibilia propria* and the *sensibilia communia*, he will divide them, after Galileo's example, in «accidents of the body» (motion, magnitude, and so on) and «accidents of the perceiver» (sounds, colors, odors, and so on).

Hobbes upholds a constructivist pattern for the scientific knowledge, inspired to the *mos geometricus*; and he will inform us about it in the exordium of the chap. XXV of *De Corpore*. This pattern involves, to prevent to fall in the ancient metaphysical realism – the realism of the substantial forms, of the abstracted essences, of the *species intelligibiles* and *sensibiles* – a sort of 'de-ontologisation' of the world; that is, a categorization, in an axiomatic system, of the sense-data of perception and imagination.

However, the beginning of the *first philosophy* starts from the «originall» knowledge of the sense perception, which carries out the empirical certainty of an external world. The latter pre-exists before the individuals, and, as we said, does not depend from the pictures of fancy.

Science cannot exist if anyone has made experience of a world. Moreover, any science of world can be settled, without an extra-scientific sense perception of the world. The empirical data of Hobbes's *philosophia prima* are the roots of his scientific system, founded on the *mos geometricus*. Just like in Euclid's *Elements*, the first definitions and common notions of Hobbes's science have to be settled without to discuss the empirical sources they are grasped from.

Behind the annihilation hypothesis, Hobbes also tells us that, if someone affirms that a world exists without us, it is not necessary that this world actually be, here and now, in front of us. Here Hobbes plays a decisive move about the function of the scientific image of the world stands facing the outward image of the world.

To better explain this subject, we will suggest a variation of the annihilation experiment. We suppose *per absurdum* that, after the annihilation of the world, *two* men survive, but only *one* of them has made experience of the world. The one without experience *cannot* learn the world by means of the teaching of the other, because he also needs the *contents* of that experience. Without the understanding of the *matter* of that experience, a definition will be a pure linguistic convention, somewhat to assume without to full learn it.

At this point, we can explain *why* Hobbes insists to say that, «though a man were alone in the world, they [*viz.* words] would be useful to him in helping him to remember; but to teach others, (unless there were some others to be taught) of no use at all»¹⁶. To teach, «that

¹⁶ T. Hobbes, *DCo*, chap. II, art. 3, p. 9; *EWI*, p. 15.

is, to demonstrate, supposes two [men] at the least, and syllogistical speak»¹⁷; that is to say, teaching supposes two speakers, which partake a common experience of the world. According to Hobbes's philosophy of mathematics, it should be unlikely a geometry whose axioms were not founded on the evidence (*expositio*) to the sense perception¹⁸. Moreover, in the tradition of Euclidean geometry, definitions and postulates are unverifiable because they are evident, and not *vice versa*.

Therefore, it needs that basis for the scientific discourse consists in sense-data grasped from the outward experience of the world. In this way, science will have an apodictic value, according to the point of view endorsed by the *mos geometricus*.

From these remarks one can focus the complex drama of the unresolved tension between ontology and Hobbes's idea of a science *more geometrico demonstrata*: on the one hand, the cost of a full 'de-ontologisation' of science should be the loss of any self-evidence of the first principles that *not* depends from evidence to sense perception of the objects of the external world; on the other hand, the only way for a science that should not be entirely founded by the 'inward' (rational, linguistic) structures of the human mind is that of an *incompletely* 'de-ontologisation'. The latter presumes in itself the evidence of the world to the sense perception, carrying out all that of 'external', 'empirical', 'extra-scientific', this criterion involves¹⁹. By the way, that tension marks the difference between Hobbes and one of the most important thinkers of the late seventeenth-century Britain, that is John Locke.

Here also joins the *social* meaning of Hobbes's science, bearing out itself on the *universality* of the empirical testimony. At the core of the definitions and axioms of the *philosophia prima*, Hobbes lies a matter of fact grasped from *τοῦ ὄτι* knowledge, attesting the

¹⁷ T. Hobbes, *DCo*, chap. VI, art. 11, p. 49; *EW I*, p. 80.

¹⁸ On the role of evidence in Hobbes's philosophy, see *DCo*, chap. XII, art. 2-3, pp. 88-89; *EW I*, pp. 139-140. See A. Lupoli, *Nei limiti della materia*, cit., pp. 139-165; E. Sergio, *Contro il Leviatano. Hobbes e le controversie scientifiche, 1650-1665*, Soveria Mannelli, Rubbettino, 2001, pp. 125-133.

¹⁹ Behind the reading which made Hobbes as a follower of the scientific constructivism (see above, n. 1), it is useful to suppose that the outward image of the world became an essential part of the scientific image of the world. Once the former has been connected to *τοῦ διότι* knowledge, it will be considered a definition, without any ontological meaning (in fact, in the chap. VIII of *DCo*, the concept of body is included as a *suppositum*, with a procedure quite different from Descartes's metaphysics). This remains an unquestionable status of Hobbes's scholarship. However, we believe that one can accept the idea that Hobbes provided for the constrain of an *incomplete* 'de-ontologisation', dealing with the concept of a materialistic ontology of the *outward* image of the world. As we said before, in Pacchi's work (*Convenzione e ipotesi*, cit., pp. 44 ss.) one stands out that the relationship between science and experience was one of the most complicate issues of Hobbes's natural philosophy. Some years before Pacchi's book, Nicola Abbagnano (who Pacchi himself considered, p. 96, the first to have focused, in Italy, the novelties from Natorp's and Cassirer's readings), denied the label of a dogmatic materialism for Hobbes's philosophy, defining it «un impegno ontologico piuttosto che una dottrina di natura metafisica» (N. Abbagnano, *Storia della filosofia moderna*, Turin, Utet, 1958, vol. II, p. 218). Our focus on Pacchi's worthwhile book (*e.g.*, about the link between «essere» and «pensare»), deserved a wider space than the requested in the present essay. I will turn on the subject in a next contribution.

existence of the external world, that is, the empirical *certainty* of an «*extra stare*» *outside* us; a trust, a feeling, or a common sense which is very different from that of an universal consent about some exclusively ‘internal’ or ‘inward’ principles.

Here it may be useful to focus on some aspects of the abovementioned passages from Hobbes’s first philosophy, by way of the analysis of a well-known author of Hobbes studies, that is Gianni Paganini.

Paganini’s reading is very interesting, for he worked on Hobbes’s *De Corpore* after he dwelled on the outstanding reading provided by Arrigo Pacchi’s book (1962) on Hobbes’s natural philosophy; but also because he made a comparison between the chapters VII and VIII of *De Corpore* and Hobbes’s manuscript *De Motu* or *Anti-White* (c.1643)²⁰. By means of Paganini’s commentary on this subject, I will focus on the relation between science and experience in Hobbes’s first philosophy.

In *De Motu*, Hobbes provides a slightly different version of the annihilation experiment. The main issues of the earlier version are quite similar to those contained in *De corpore*; for example, in the classification between «image» and «object»: the «*spatium apparens*» of the object «*non inhaeret in ipso obiecto, sed est mere imaginarium*»²¹; and, according to the definition of «imaginary space» («*Spatium igitur imaginarium nihil aliud est quam imago, sive phantasma corporis*»)²², Hobbes pointed out how the latter depends «*non ab existentia corporis sed ab existentia in imaginativae facultatis*»²³.

However, as Paganini wrote, «the following step of Hobbes’s reasoning is to reconstruct the ‘real space’, starting from the ‘imaginary space’ to which the world has been reduced, after its supposed annihilation»²⁴. In the rational setting of the «real space», it is required to suppose that «every imagination is caused by the action of a certain agent, which we ‘suppose to exist or to be existed without the mind that imagines’, and since this ‘suppositum’ is usually called ‘*corpus sive materiam*’, [...] bodies will exist even though any imagination should be existed (‘*sequitur extitura esse corpora, etiam si nulla omnino esset imaginatio*’)²⁵.

Now, this reasoning, which Hobbes entered in his first philosophy as a *suppositum*, is grasped, above all, from the sense perception of something outwardly to the mind, what is

²⁰ It is Hobbes’s critique to Thomas White’s *De Mundo dialogi tres* (Parisiis, apud Dyonisium Moreau, 1642), available in the volume *Thomas Hobbes: Critique du De Mundo de Thomas White*, éd. critique d’un texte inédit par J. Jacquot et H.W. Jones, Paris, Vrin, 1973 (hereafter T. Hobbes, AW).

²¹ T. Hobbes, AW, p. 116.

²² *Ivi*, , p. 117.

²³ *Ibid.*

²⁴ G. Paganini, *Hobbes, Gassendi e l’ipotesi annichilitoria*, cit., p. 57.

²⁵ *Ibid.*

supposed by the act of seeing²⁶, *i.e.*, by the «phantasm of the body», that is to say, the «spatium imaginarium». This latter reasoning is announced by Hobbes himself in *De Motu*, as he affirmed that ‘spatium imaginarium’ is ‘the knowledge of the existence of our body’ (‘nostra corporis existentis cognitio’)²⁷. Paganini also pointed out how «the twofold meaning of representations (which are always ‘ideae tantum et phantasmata’), both as internal accidents of the mind, as appearances of things external to us, is recovered by Hobbes in *De Corpore*»²⁸.

Granted, the main difference between *De Motu* and *De Corpore* regards «without any doubt the *theory of body*, which in the later work [*De Corpore*] is replaced by the term ‘real space’²⁹. It is overall in *De Corpore* that one detects the presence of Hobbes’s ‘realism’; even though it deals with a realism shaped by the constructivist approach³⁰.

Let me to say what I feel to *add* to Paganini’s analysis. The constructivist method Hobbes used in the chapter VIII of *De Corpore* (a method setting up the reality of the world as the *prime* subject of his first philosophy, by means of the supposition that every imagination raises up by means of the stimuli of an external agent) will be not achievable, if it was lacking of the *impression* of existence of an external world without us, what is implicitly subjected to the phantasm of body, *i.e.*, the «imaginary space».

As Paganini rightfully pointed out, the definition of *De Corpore* (VIII/1) has «the merit to insist more clearly both *on the outwardly connotation of body* and the suppositional function of the reason in the ‘re-creation’ of the world»³¹. However, the rational re-creation of the world does not be possible without the outward evidence of a world, deriving from the realm of *τοῦ ὄτι* knowledge, to which Hobbes primarily ascribes the «phantasm of the body», that is the *spatium imaginarium*. By means of the same notion, through the constructivist method, Hobbes can affirm (*DCo* VIII/4) that «spatium imaginarium» and «magnitudo» are

²⁶ Hobbes focused on it in the chap. I of his *Leviathan*; see afterwards, n. 41.

²⁷ *Ibid.* See T. Hobbes, *AW*, p. 117.

²⁸ G. Paganini, *Hobbes, Gassendi e l’ipotesi annichilitoria*, cit., p. 58. The quotation refers to the chap. VII, art. 1, of *DCo*.

²⁹ G. Paganini, *Hobbes, Gassendi e l’ipotesi annichilitoria*, cit., p. 60, emphasis mine.

³⁰ To this subject, Paganini writes: «while Hobbes was concerned, in *De Motu*, to focus on the process from the “phantasmata” (survived after annihilation) to the “agent” that caused them, what we “suppose to exist or to be existed outside our mind”, in the later work the “deduction” of body is somewhat different [...]: the “re-creation” or “reposition” of something in the “imaginary space”, after the “supposed annihilation”, sets up a reality that not only coincides with that space, but also has the quality of “subsistens per se” (for he does not depend upon our fancy) and of “existens”, being “extra nos subsistit”; lastly, the body is “Suppositum” and “Subjectum”, for it is literally “subjected to imaginary space”, so that it can be known by reason, not by senses» (*ibid.*). The quotation refers to the chap. VIII, art. 1, of *DCo*.

³¹ G. Paganini, *Hobbes, Gassendi e l’ipotesi annichilitoria*, cit., p. 60, emphasis mine.

as the effect is to the cause³².

Briefly, *spatium imaginarium*, being as an *accidens animi*, hides in itself an ontological meaning, that Hobbes felt to play only after that (*DCo* VIII), he provided, by constructivist method, the definition of body as magnitude (*magnitudo*). This method cannot be the starting point of Hobbes's first philosophy without the empirical evidence of an external world without us.

Hobbes's «ontological claim», formerly suggested by Nicola Abbagnano, made explicit in the chap. VIII of *De Corpore*, had its beginning in the empirical *appearance* of an external world outside us; even though it formally appears, by the act of reasoning, under the definition of «body» as «*Suppositum*» and «*Subjectum*».

Body as *subjectum* is the leading concept of *τοῦ διότι* knowledge. A rational meaning it grants to sense-data of *τοῦ ὅτι* knowledge, for instance, the 'phantasm of body', from which the *subjectum* itself raised.

As we said before, Hobbes's anti-Cartesian perspective involves some consequences dealing with the ontological status of mechanism. It is undeniable how, denying Cartesian dualism, Hobbes's theory draws a deep chasm between two different conceptions of mechanism. In fact, we owe to the effects of a scientist *vulgata*, and of a series of metaphysical biases, the idea that Hobbes's mechanism was no other, or not much, that Cartesian mechanism excepting the *res cogitans*³³.

Once Hobbes followed the (monistic) way opposed to Cartesian dualism, he had no difficulty to place the origin of the basic properties of sensation and cognition in the simplest structures of the organized matter. On this subject, Hobbes provides a philosophical suggestion which allows to place his scientific materialism close to Renaissance pansensism by Bernardino Telesio and Tommaso Campanella. In the chap. XXV of *De Corpore*, after

³² T. Hobbes, *DCo*, chap. VIII, art. 4, p. 64: «*Extensio corporis idem est quod magnitudo ejus sive id quod aliqui vocant spatium reale; magnitudo autem illa non dependet a cogitatione nostra sicut spatium imaginarium. Hoc enim illius effectus est, magnitudo causa; hoc animi, illa corporis extra animum existentis accidens est*»; *EW I*, p. 105: «*the extension of a body, is the same thing with the magnitude of it, or that which some call real space. But this magnitude does not depend upon our cogitation, as imaginary space doth; for this is an effect of our imagination, but magnitude is the cause of it; this is an accident of the mind, that of a body existing out of the mind*». See G. Paganini, *Hobbes, Gassendi e l'ipotesi annichilitoria*, cit., p. 61 n. 20. Paganini remarks is that from *De mundo* to *De Corpore* Hobbes left behind the expression «*spatium reale*», considering it a puzzling name.

³³ For a review on this subject, see F.A. Lange, *Geschichte des Materialismus*, Iserlohn, Baedeker, 1873-1875; and W. Dilthey, *Weltanschauung und Analyse des Menschen Seit Renaissance und Reformation*, in *Gesammelte Schriften*, Bd. II, hrsg. Von G. Misch, Leipzig, Teubner, 1914. In his recent study, A. Lupoli (*Nei limiti della materia*, cit., pp. 529 e 531) drew attention to the fact that before Frithiof Brandt's *Thomas Hobbes's mechanical conception of nature* (Levin & Copenhagen-London, Munksgaard-Hachette, 1927), no one endorsed that Hobbes's mechanism dissolved Cartesian substantialism of *res extensa* in what that Brandt himself defined «[Hobbes's] motionalism» (pp. 112-113, 379).

Hobbes explained in a general way the physiology of sensation, he stated that «I know there have been philosophers, and those learned men, who have maintained that all bodies are endued with sense. Nor do I see how they can be refuted, if the nature of sense be placed in reaction only. And, *though by the reaction of bodies inanimate a phantasm might be made, it would nevertheless cease, as soon as ever the object<s> were removed. For unless those bodies had organs, as living creatures have, fit for the retaining of such motion as is made in them, their sense would be such, as that they should never remember the same.* And therefore this hath nothing to do with that sense which is the subject of my discourse»³⁴.

Hobbes did not prevent to think that inanimate bodies – by means of relationship of mutual influence and reaction, by impact or by contact, or (indirectly) by pressure through the medium – acted a kind – as far as natural – of sense perception. Of course, these bodies will not be able to have a consciousness to perceive (which is nothing but memory), because «[they] had [not] organs, as living creatures have, fit for the retaining of such motion as is made in them [...] as soon as ever the object was removed». However, since all bodies have a reaction to the external stimuli, they will be able to retain, in turn, a hint of the stimuli (*i.e.*, motions) they receive.

Hobbes considered sensation in itself as a process, a local motion including the mutual reaction between bodies, and in the same time as the corporeal *faculty* to have a feeling of sense perception, and a memory of the reaction with other bodies. In order to this, the sentient body needs to have organs of sense, to retain the experience of those motions and bodies, so that it can ‘translate’ them, if necessary, in a consciousness of sense.

Like this, while the simple presence of the corporeal stimuli is inadequate so that between inanimate bodies come up some durable forms of psychological phenomena, given that, when «the object was removed [...], their sense would be such, as that they should never remember the same», Hobbes was as well ready to admit that, after repeated corporeal stimuli, inanimate bodies will be able to acquire some «habits» or (mechanical) ‘behaviors’, to say, some corporeal changes, dealing with the structure or the former shape of the same bodies³⁵.

³⁴ T. Hobbes, *DCo*, chap. XXV, art. 5, p. 226; *EW I*, p. 393, emphasis mine. See B. Telesio, *De rerum natura iuxta propria principia* (1570), ed. by R. Bondi, Florence, La Nuova Italia, 1999, bk. I, chap. 35, pp. 108-109; T. Campanella, *De sensu rerum et magia* (Frankfurt, 1620), bk. I, chap. I. About Telesio’s and Campanella’s influence on Hobbes’s thought, see K. Schuhmann, *Hobbes and Telesio*, «Hobbes Studies», I (1988), pp. 109-133; C. Leijenhorst, *Motion, Monks and Golden Mountains: Campanella and Hobbes on Perception and Cognition*, «Bruniana & Campanelliana», III (1997) 1, pp. 93-121; Id., *The Mechanisation of Aristotelianism*, cit., pp. 68-72, 95-100; E. Sergio, *Campanella e Galileo in un “English Play” del circolo di Newcastle: Wit’s Triumvirate, or the Philosopher*, «Giornale Critico della Filosofia Italiana», 86 (2008) 2, pp. 298-315.

³⁵ Hobbes faced this argument in the chap. XXII of *DCo*, in a section about the elasticity of bodies. By means of

Although Hobbes denied that bodies without organic parts can retain the external stimuli, and be able to have a sense perception (being the memory nothing but «perceive to have perceived»), he supposed that the causes of psychological phenomena are inherent into the deep structures of the body, that is to say, the mechanical principles of sensation are not really separate from sense perception as causal process³⁶.

In this way, the spontaneous generation of the so-called «phantasm of sense» is the terminal point of a process involving the several parts of the organic body and the nature of the perceived objects³⁷.

As we formerly said (note 12), Hobbes defined two philosophical methods: a synthetic method (*compositio*), that attained to the «*knowledge of effects acquired by true ratiocination, from knowledge first had of their causes and generation*» (*cognitio ex causis*), and an analytical method (*resolutio*), that attained to the «*knowledge of such causes or generations as may be, from former knowledge of their effects or appearances*» (*cognitio ex effectis*)³⁸.

In the setting of the *first philosophy*, starting with the basic notions of the *philosophia naturalis* (space, time, motion, body, &c.), Hobbes proceeded according to the synthetic method³⁹. In the *Physica generalis*, starting with (chap. XXV) «Sense and animal motion», Hobbes proceeded according to the analytical method.

Let us now to state this: the sense perception of the external world, that Hobbes formerly placed, at the head of his *first philosophy*, under the notions of «imaginary space»,

some examples (the player of liute; the materials employed in the body of a crossbow), Hobbes explains how both inanimate and animate bodies can have the tendency to acquire different static behaviors, in order to the strength and the duration of the external stimuli. In both cases, it is necessary to know the internal nature of the bodies which change their *habitus* (*DCo*, chap. XXII, art. 20, p. 200). The concept of *habitus* is formerly used in the chaps. XVIII/15 and XIX/7 of *AW*, about the causes of Earth's diurnal motion around its axis, being the latter a reaction to the excessive heat of the Sun. See *AW*, pp. 238 e 246. On the subject, see F. Horstmann, *Ein Baustein zur Kepler-Rezeption: Thomas Hobbes' Physica Coelestis*, «*Studia Leibnitiana*», 30 (1998), 2, pp. 135-160.

³⁶ About this subject, I dissent with the recent study by Sarah Hutton (*In Dialogue with Thomas Hobbes: Margaret Cavendish's Natural Philosophy*, «*Women's Writings*», 4, 1997, pp. 421-432). According to Hutton, the Duchess of Newcastle upheld, differently from Hobbes, a mechanical philosophy influenced by some pansensistic and hylozoistic issues. Hutton seems to accept the traditional picture of Hobbes as a *pure* mechanist, in front of *her* reading of Margaret Cavendish's natural philosophy. The Duchess of Newcastle, however, nourished herself from Hobbes's philosophy.

³⁷ A difference between the «phantasm of sense» and the sensation as a process of instantaneous motions is stated by Hobbes himself in the chap. XXV of *DCo*: «a phantasm is the act of sense, and differs no otherwise from sense than *fieri*, that is, being doing, differs from *factum esse*, that is, being done» (art. 3, p. 225; *EW I*, p. 392).

³⁸ T. Hobbes, *DCo*, chap. XXV, art. 1, pp. 223-224; *EW I*, p. 387.

³⁹ Hobbes provides to confirm it at the beginning of the chap. XXV of *DCo*; after he affirmed that, in the synthetic method, «the truth of the first principles of our ratiocination, namely definitions, is made and constituted by ourselves, whilst we consent and agree about the appellations of things», he pointed out that «this part I have finished in the foregoing chapters» (art. 1, p. 223; *EW I*, p. 388).

«time», «motion», &c., is at the same time the starting point of the causal science of sense and animal motion.

Hobbes provides a twofold concept of sensation: on the one hand, it is the effect or the phenomenon from which we start to know the causes of «sense and animal motion»; on the other hand, it is considered in itself as the *faculty* to feel what *appears* to sense perception; and here it involves to be taught as a whole of corporeal organs and mechanical devices which *make possible* that something «perceive», *i.e.*, that a natural body has the faculty to feel, and something else, consequently, «appears»: «Of all the phenomena or appearances which are near us, the most admirable is apparition itself, τὸ φαίνεσθαι; namely, that some natural bodies have in themselves the patterns almost of all things, and others of none at all. So that if the appearances be the principles by which we know all other things, we must needs acknowledge sense to be the principle by which we know those principles, and that all the knowledge we have is derived from it. And as for the causes of sense, we cannot begin our search of them from any other phenomenon than that of sense itself. But you will say, by what sense shall we take notice of sense? I answer, by sense itself, namely, by the memory which for some time remains in us of things sensible, though they themselves pass away. For he that perceives that he hath perceived, remembers»⁴⁰.

Herewith we find the core of Hobbes's anti-Cartesian view. Hobbes considered the faculty to make appear all the phenomena «which are near us» as the power of «some natural bodies»; and the apparition itself as the «most admirable» of all phenomena. Thus, what sensation be, it is the same that mechanism between some bodies, and others in which «for some time» a sensible «pattern» or «moniment» remains in the organs of sense: «Sense, therefore, in the sentient, can be nothing else but motion in some of the internal parts of the sentient; and the parts so moved are parts of the organs of sense. [...] I have shown besides (in chap. VIII, art. 7) that no motion is generated but by a body contiguous and moved: from whence it is manifest, that the immediate cause of sense or perception consists in this, that the first organ of sense is touched and pressed. For when the uttermost part of the organ is pressed, it no sooner yields, but the part next within it is pressed also; and, in this manner, the pressure or motion is propagated through all the parts of the organ to the innermost. And thus also the pressure of the uttermost parts proceeds from the pressure of some more remote body, and so continually, till we come to that from which, as from its fountain, we derive the phantasm or idea that is made in us by our sense. And this, whatsoever it be, is that we

⁴⁰ T. Hobbes, *DCo*, chap. XXV, art. 1, p. 224; *EWI*, p. 389.

commonly call *the object*. [...] Moreover, I have shown (art. 2, chap. XV) that all resistance is endeavour opposite to another endeavour, that is in the whole organ, by reason of its own internal natural motion, some resistance or reaction against the motion which is propagated from the object to the innermost part of the organ, there is also in the same organ an endeavour opposite to the endeavour which proceeds from the object; so that when that endeavour inwards is the last action in the act of sense, then from the reaction, how little soever the duration of it be, a phantasm or idea hath its being; which, by reason that the endeavour is now outwards, doth always appear as something situate without the organ. So that now I shall give you the whole definition of sense, as it is drawn from the explication of the causes thereof and the order of its generation, thus: SENSE is a phantasm, made by the reaction and endeavour outwards in the organ of sense, caused by an endeavour inwards from the object, remaining for some time more or less»⁴¹.

However, «sense» is a more complex reality than a simple act of seeming. It involves the corporeal being of the human nature as a whole. In the final entries of chapter XXV, Hobbes classed the emotions under the kind of sensations. According to Hobbes, emotions depict the most typical aspect of the human bodies: the vital motions, *i.e.*, the endeavours directed to the conservation of organism, by means of the sense perception of pleasure and pain, and the will of appetite and aversion: «there is another kind of sense, of which I will say something in this place, namely, the sense of pleasure and pain (*sensio voluptatis et doloris*), proceeding not from the reaction of the heart outwards, but from continual action from the outermost part of the organ towards the heart. For the original of life being in the heart, that motion in the sentient, which is propagated to the heart, must necessarily make some alteration or diversion of vital motion, namely, by quickening or slackening, helping or hindering the same. Now when it helpeth, it is pleasure (*voluptas*); and when it hindereth, it

⁴¹ T. Hobbes, *DCo*, chap. XXV, art. 2, pp. 224-225; *EW I*, pp. 389-391. In Hobbes's *Leviathan* (London, A. Crook, 1651), sensation is nothing but a counterpressure (lat. ed. *ἀντιπῆξις*), opposed to the motion impelled by the external body; and, since inward endeavour moves forward outside, it seems something outward of us: «I will consider them [the thoughts of man] first singly, and afterwards in train, or dependence upon one another. Singly, they are every one a *representation* or *appearance*, of some quality, or other accident of a body without us, which is commonly called an *object*. [...] The original of them all, is that which we call sense, for there is no conception is a man's mind, which hath not at first, totally, or by parts, been begotten upon the organs of sense. The rest are derived from that original. [...] The cause of sense, is the external body, or object, which presseth the organ proper to each sense, either immediately, as in the taste and touch; or mediately, as in seeing, hearing, and smelling; which pressure, by the mediation of nerves, and other strings, and membranes of the body, continued inwards to the brain and heart, causeth there a resistance, or counter-pressure, or endeavour of the heart, to deliver itself: which endeavour because *outward*, seemeth to be some matter without. And this *seeming*, or *fancy*, is that which men call *sense*» (part I, chap. I, p. 3). In the chap. XXIX/1 of *DCo*, making a comparison between the act of seeing and the act of hearing, Hobbes classifies the «appearance» or «image» of external things as vision and hearing, distinguishing them only by the nature of *conatus* (in the case of vision, it is a *pressure*; in the case of hearing, it is a *percussion* (*DCo*, p. 279; *EW I*, p. 486).

is pain, trouble, grief, &c. (*dolor, molestia, aegritudo*). And as phantasms seem to be without, by reason of the endeavour outwards, so pleasure and pain, by reason of the endeavour of the organ inwards, seem to be within; namely, there were the first cause of the pleasure or pain is»⁴².

To summarize the topic: in *DCo* Hobbes provided a twofold meaning of *sensus*: on the one hand (1), sensation is a state of mind, concerning a subject faced an object which is exclusively learned by way of the «phantasms» of sense perception and imagination. On the other hand, (2) sensation is an immediate, causal relationship between a sentient and a world of bodies; a connection dealing with the corporeal reality of the human nature as a whole. I respectively call (1) and (2) under the label of *empiricism* (which involves in itself the categories of ‘nominalism’ and ‘constructivism’) and (2) with the label of *externalism* (which involves the categories of ‘realism’ and ‘materialism’). Hobbes’s solution seems to be that of an *externalist empiricism*. I try to explain why the latter expression is not an oxymoron.

As we said above, Hobbes will to include, in his system of first philosophy, the idea of a body as *definition* in a well-founded system of axioms and notions, faced to the empirical evidence of the external world. The reasoned fact is the *mos geometricus*: to say, the aim to found a *first philosophy* and a *natural philosophy* having the same degree of certainty and the epistemological status of a geometrical system, which is composed by definitions, axioms, postulates, theorems and problems⁴³.

That approach didn’t put into an oblivion the true beginning of the first philosophy: the (visual) sense perception of an external world outside the perceiver; straightforwardly, the pure data of sense perception have no interest in the foundation of a science *more geometrico demonstrata*. They are considered *per se* like a *cogitatio sine verbis*, useless in the construction of a science.

As to relationship between the *mos geometricus* and the ontological status of the empirical knowledge, it remains to explain why Hobbes is searching a sort of negotiate between two opposite views – on the one hand, the materialistic realism; on the other hand, the nominalist empiricism.

The true knot of the entire question is represented by the ‘Janus face’ of sense perception knowledge: the empirical evidence or testimony of a corporeal reality outside us, confirmed by the fact that, some of the *sensibilia communia* are the accidents of the bodies of

⁴² T. Hobbes, *DCo*, chap. XXV, art. 12, pp. 233-234; *EW I*, p. 406. As regards the idea of *appetitus* as *aditio, volitio, deliberatio*, see *DCo*, art. 12-13, pp. 234-236; *EW I*, pp. 406-410.

⁴³ See A. Pacchi, *Convenzione e ipotesi*, cit., pp. 199-207.

the external world; and, at the same time, the experience (in other terms, the belief) that, from the external world, we know anything but the phantasms, the images produced by the perceiver, together with the *names* which men gives to those phantasms and images⁴⁴.

The two aspects of sensation clarifies the twofold requirement of Hobbes's philosophy: the need to overtake, on the one side (*a*), the metaphysical realism of the scholastic tradition – of the abstracted essences, the substantial forms, *species intentionales* and *sensibiles* –, and, on the other (*b*), the skeptical approach of Descartes's metaphysics, which gained the knowledge of the *cogito* starting from a previous undervaluing of sensations.

As regards metaphysical realism, Hobbes does not accept the idea of a natural philosophy that is granted by an overestimated trust in the power of *intellectus*: reasoning is a synonym of calculus (*logica sive computatio*), but its roots are the *monumenta sensibilia*, that is sense perceptions⁴⁵. In his philosophical system, grounded on the *mos geometricus*, Hobbes never forget the aim of his first philosophy and his philosophy of mathematics: the true science of the system, the geometry, is provided by a *mechanical* foundation, starting from the first definitions of Euclid's *Elements*. In this way, we understand Hobbes's purpose (in *DCo* VIII/12) to introduce the definition of the geometrical point by the description of the real, empirical experience of the (moving) bodies in the world: «though there be no body which has not some magnitude, yet if, when any body in moved, the magnitude of it be not at all considered, the way it makes is called a *line*, or one single dimension; and the space, through which it passeth, is called *length*; and the body itself, a *point*; in which sense the earth is called a *point*, and the way of its yearly revolution, the *ecliptic line*»⁴⁶. That is the most evident proof of the 'externalist' claim of Hobbes's mechanical empiricism.

The idea of a first philosophy arranged as a system of geometrical axioms did not remove the empirical data from which from that system has been settled. The *mos geometricus*, well-done expressed by the pre-Vichian idea of the *verum-factum*⁴⁷, should seem have no necessity to remind, step by step, the *empirical, materialistic* roots of a system

⁴⁴ On this subject, Cees Leijenhorst has written: «Hobbes' *first philosophy* distinguishes between *ens* (body) and *phantasma* (idea). *Phantasmata* can be considered from a phenomenalist and a realist perspective. According to the phenomenalist perspective, *phantasmata* are representations of external reality. They are not real beings themselves, but only apparent beings. In the realist perspective, *phantasmata* are simply local motion in our bodies, mechanically provoked by external bodies. Despite Hobbes' own claims, the realist perspective dominates *philosophia prima*. Hobbes holds that our *phantasmata* causally depend on external bodies, which act on us by means of local motion» (*The Mechanisation of Aristotelianism*, cit., p. 221). See *ibid.*, pp. 156-157.

⁴⁵ T. Hobbes, *DCo* I/2-3, II/1-2, IV/8. On the issue, see my *Verità matematiche e forme della natura da Galileo a Newton*, Rome, Aracne, 2006, pp. 242-247.

⁴⁶ T. Hobbes, *DCo*, chap. VIII, art. 12, p. 68; *EW* I, p. 111. See *DCo*, chap. VI, art. 6, p. 44; *EW* I, pp. 70-71; *DCo*, chap. XV, art. 2, p. 122; *EW* I, p. 206.

⁴⁷ T. Hobbes, *Six Lessons to the Professors of Mathematicks* (1656), in *EW* VII, pp. 183-185; *Id.*, *De Homine* (1658), chap. X, art. 5, in *OL* II, pp. 144-145.

of definitions, axioms and demonstrations; and yet, Hobbes will give to his readers many occasions to find the limited, incomplete wholeness of his constructivist/nominalistic approach to the first principles of science: in the definition of logic as calculus (*DCo* I/3); in the «generative» definition of mathematical entities and figures (*DCo* VIII/12, I/5, VI/13); in the emphasis of the relationship between imagination and reasoning about common notions (*DCo* II/9), and in the concept of imagination as «decaying sense» (*Elements* I, III/1); in the definition of *conatus* (*DCo* XV/2); and, finally, in the «generative» definitions of the causes of a geometrical construction (*DCo* XX/6).

