MECHANICISM AS SCIENCE AND IDEOLOGY: HOBBES'S EPISTEMOLOGICAL REVOLUTION IN CIVIL SCIENCE

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by

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I declare that the work presented in this thesis is my own, except where due and accurate acknowledgement of another source has been made.

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To Susanna

Abstract

In the seventeenth century a new science of motion emerged that later developed into what we call today classical mechanics. The epistemology of early modern mechanics was split between technical experimentation and mathematical formalisation. 'Mechanicism', Cartesianism *in primis*, was a philosophical project to both preserve the theoretical and technical efficacy of this science and integrate it into a new world picture. In this historical context mechanical philosophy therefore played a double role. On the one hand it was part of a revolutionary event opening new frontiers for materialist thought. On the other hand, as a world picture, it originated a new ideological framework for metaphysical dualism. This thesis uses this historical and philosophical background to radically reconsider the political theory of Thomas Hobbes.

During the 1640s Hobbes's *scientia civilis* progressively incorporated the dualistic epistemology of Descartes's mechanicism into materialist philosophy by privileging one of the two structural features of modern science: the tendency towards 'deduction' rather than experimentation. This philosophical gesture, simultaneously epistemological and ideological, had considerable political consequences. For this reason Hobbes's political theory will be read as an ideological response to the non-geometrical and non-mechanical functioning of 'matter', including 'human matter', evidenced by the threatening experimental practices carried on during the first half of the seventeenth century in both the Galilean science of nature and the English Civil War.

My wider hypothesis is that this profoundly *idealistic* agenda still informs our understanding of nature and of the body politic. It reduces the open method of science to the outdated metaphysical picture of it provided by Descartes, and suffocates politics itself by neutralising the emergence of political conflict and experimentation, labelling them as not only inessential but also dangerous to the body politic. On the contrary, philosophical materialism invites us to understand the self-organising tendency of matter as an undeniable risk implicit in the functioning of all systems, the social system included.

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List of Abbreviations

References to Galileo, Descartes and Hobbes's works follow this list of abbreviations (details are provided in the Bibliography). For Hobbes's works, when possible, citations to the *Opera Latina* (OL) or *English Works* (EW) follow. Translations can slightly diverge from the English versions I refer to, according to my interpretation and on my responsibility. The original quotation is provided in note.

Galileo

[GG]	*Le Opere di Galileo Galilei* (20 vols.)

Descartes

[AT]	*Œuvres de Descartes* (3 vols.)

Hobbes

[Beh]	*Behemoth*
[Corr]	*Correspondence of Thomas Hobbes*
[DC]	*De cive*
[DeCo]	*De corpore*
[DH]	*De homine*
[DM]	*Critique du* De Mundo *de Thomas White*
[DP]	*Decameron Physiologicum*
[EL]	*The Elements of Law Natural and Politic*
[EO]	*A Minute Or First Draught of the Optiques*
[EW]	*English Works of Thomas Hobbes* (11 vols.)
[HS]	*Three Discourses*
[Lev]	*Leviathan*
[Lev Lat]	*Leviathan* (Latin version)
[LN]	*On Liberty and Necessity*
[LO]	*Latin Optical MS*
[OL]	*Opera Latina of Thomas Hobbes* (5 vols.)
[PrG]	*The Answer to D'Avenant's Preface Before Gondibert*
[SL]	*Six Lessons to the Savillian Professors of the Mathematics*
[SP]	*Seven Philosophical Problems*
[TO]	*Tractatus Opticus*

Introduction

> I can imagine no cause, but a reasonlesse imitation of costume; of a foolish custome; by which a man enabled to speake wisely from the principles of nature, and his own meditation, loves rather to be thought to speak by inspiration, like a Bag-pipe.
>
> Thomas Hobbes

In the seventeenth century a new science of motion emerged that later developed into what we call today classical mechanics. The epistemology of early-modern mechanics was split between technical experimentation and mathematical formalisation. 'Mechanicism', Cartesianism *in primis*, was a philosophical project to both preserve the theoretical and technical efficacy of this science and integrate it into a new world picture.[1] In this historical context mechanical philosophy therefore played a double role. On the one hand it was part of a revolutionary event opening new frontiers for materialist thought. On the other hand, as a world picture, it originated a new ideological framework for metaphysical dualism. This thesis uses this historical and philosophical background to radically reconsider the political theory of Thomas Hobbes.

During the 1640s Hobbes's *scientia civilis* progressively incorporated the dualistic epistemology of Descartes's mechanicism into materialist philosophy by privileging one of the two structural features of modern science: the tendency towards 'deduction' rather than experimentation. This philosophical gesture, simultaneously epistemological and ideological, had considerable political consequences. For this reason Hobbes's political theory will be read as an ideological response to the non-geometrical and non-mechanical functioning of 'matter', including 'human matter', evidenced by the threatening experimental practices carried on during the first half of the seventeenth century in both the Galilean science of nature and the English Civil War.

[1] I am assuming a conceptual distinction marked by the expressions 'mechanics', 'mechanicism', 'mechanistic ideology', and 'mechanical philosophy'. 'Mechanics' refers here to the new science of motion that later became Newton's classical mechanics (differentiated from both ancient mechanics and modern quantum mechanics). 'Mechanicism' and 'philosophical mechanicism' refer to philosophies that, starting from the seventeenth century, intended to be systematically grounded on mechanics conceived as an 'interdisciplinary' field of research, and to explain all phenomena in terms of cause-effect relations (labelling a systems of thought as 'mechanicism' helps distancing it from the common meaning of the term 'mechanism', Dijksterhuis 1961: 3, footnote). The phrase 'mechanistic ideology' pinpoints the ideological nature of such theories and the related world picture, in particular as far as they entail a deterministic ontology. Finally, by 'mechanical philosophy' I name more generally a mechanical conception of reality that can be traced back to ancient Greece. 'Mechanical philosophy' includes mechanicism but does not necessarily coincide with it, and therefore, depending on the context, the phrase 'early-modern mechanical philosophy' may relate to the birthplace of mechanics, mechanicism, and the mechanistic world picture.

My argument is developed through three chapters. In Chapter One I briefly sketch the early debate concerning the epistemological status of mathematics and the ontological status of matter in motion, in order to understand what was at stake in the philosophical questioning of the *subject* and the *object* of the new Galilean science, as it resulted in Descartes's metaphysical synthesis. My purpose is to analyse the effects of the philosophical debate around mechanics and its ontology of matter in Hobbes's political theory, where political power and science became closely connected for both epistemological and political reasons.

Chapter Two is devoted to a close analysis of the development of Hobbes's epistemology of civil science during the 1640s, and shows its ideological convergence with Descartes's mechanicism. The peculiar positioning of *De cive* at the crossing of two 'lines' of research – epistemological and political – allows us to 'calculate' the impact of Hobbes's systematic project on the development of his civil science. My aim is to show that an epistemological shift occurred in *De cive* which transformed Hobbes's political theory from an *ontology* of the body politic based on the mechanics of light to an *epistemology* of the laws of nature conceived as the principles of right reason. The analysis of this transition particularly focuses on two connected issues: the concepts of 'law(s) of nature' and 'right reason', evidencing the discontinuity in the use of these concepts between *The Elements of Law* and *De cive*. Hence I shall enquire into Hobbes's progressive consolidation of determinism during the 1640s, when he made of it an ontological postulate endowed with an epistemological function (the guarantee of the neutrality and objectivity of science) that would found the actual power of reason once it was implemented with civil power.

As explained in Chapter Three, Hobbes's ideological interest during the 1640s in the questions that the epistemological shift of *De cive* had left wide open was a response to an epistemological *and* political exigency of foundation. The main instrument of such an operation was the redefinition and disciplinary organisation of human natural motion, which allowed for a reformulation of the ancient Platonic project according to the new geometrical science of motion. As a result, civil science had to provide civil power with its own material means of existence, requiring it to be supplemented by cultural technologies, such as rhetoric, religion, and history. As a matter of fact, Hobbes's political-pedagogical project eventually became perfectly consistent with the dualistic world view on which Descartes had founded the new mechanical science of nature, and materialism could thus be reduced to the political agenda of mechanicism. This agenda entailed the convergence of sovereignty, science, and technocracy in a theory that would plan an artificial body politic as the only possible solution to the political problem posed by human nature.

My wider hypothesis is that this profoundly *idealistic* agenda still informs our understanding of nature and of the body politic. This agenda is epistemologically wrong, as far as it reduces the open method of science to the outdated metaphysical picture of it provided by Descartes, but is also politically bad, in so far as it suffocates politics itself by neutralising the emergence of political conflict and experimentation, labelling them as not only inessential but also dangerous to the body politic. On the contrary, philosophical materialism invites us to understand the self-organising tendency of matter as an undeniable risk implicit in the functioning of all systems, the social system included. But the early-modern agenda cannot be abandoned without the elaboration of a new epistemological agenda that takes into account the development of the twentieth century's natural sciences. As I will explain in the conclusion, it is my conviction that this very framework allows for both the demystification of the early-modern conception of the deterministic machine and a new materialistic understanding of the relations between science and political power.

In this Introduction, I will discuss the scholarship on Hobbes's philosophical system and in particular on the problematic relation between his natural philosophy and political theory. The gaps, oscillations and problems emerging from the analysis of Hobbes's system will not be dismissed as the mark of its inconsistency; rather, they will introduce a more accurate study of the internal tensions that inhabited the actual *development* of his philosophy. Hence I will pinpoint some key contributions to a theory of the development of Hobbes's research in the field of political philosophy that will be challenged in Chapter Two, through the analysis of the link between the epistemological exigencies of Hobbes's materialistic mechanicism and its implicit ideological concerns. Subsequently, I will take into consideration different interpretations of Hobbes's enterprise that either implicitly or explicitly endorse a position on the relation between science and ideology today. Some examples of what I call 'epistemological' interpretations in intellectual history, sociological constructivism, and Marxism will allow me to question the opposition between science and ideology in early-modern mechanicism and to define the 'mixed' approach I have adopted in my current analysis of the epistemological and political agenda of early-modern mechanical philosophy.

The place of scientia civilis *in Hobbes's system of sciences*

Hobbes's political philosophy was meant by its author to be a *scientific* and *systematic* foundation of a new political science on the ground of a geometrical theory of motion. More generally, the problem of providing a common foundation for his system of sciences was a key issue in the whole of his oeuvre, at least from the 1640s onward, when he

explicitly planned, developed and eventually accomplished an ambitious project inspired by Euclide's *Elements*, which he eventually entitled *Elementa philosophiae*:

> I go from the varying motions to the dissimilar shapes of various things, and the deceptions of matter; the inner motions of men, the heart's hiding-places; and finally to the goods of authority and justice. I immerse myself in these studies. For the Body, Man, the Citizen, contain every kind of philosophising. On these three things I decide to compose three books and each day collect my material. (OL I, XC)[2]

Nevertheless, the consistency, or even the existence of a 'Hobbesian system' has been a major subject of debate among scholars. Particularly important for my purpose is the debate about the relationship between Hobbes's research in the fields of natural and political philosophy.

The scholarly debate on Hobbes's system of sciences

The whole story starts from Hobbes's rediscovery by Tönnies (1889). Before Tönnies, only Croom Robertson (1886) had recognized Hobbes's debts towards Galileo and Descartes, while the traditional view still persisted of Hobbes as a 'minor philosopher of the English empiricist school' (Bobbio 1989: 201), close to Bacon and manifestly opposed to mathematical rationalism. But at the beginning of the century a strongly 'polarized' scholarly debate raged about the unity of Hobbes's system and the reconstruction of its sources, organised around the historico-philosophical categories of Empiricism and Rationalism. The article of Frischeisen-Koehler (1902) was an attempt to point out Hobbes's value as a political thinker, at the price of endorsing a complete devaluation of Hobbes's natural philosophy. On the other hand, the theory of a 'rationalist influence' was drawn on by Brandt (1928), who (precisely against Frischeisen-Koehler) tried to show how Hobbes built his natural philosophy on the basis of an 'emulative' conflict with Descartes. Unfortunately, in his analysis Brandt did not consider Hobbes's political writings, and in the end it was Frischeisen-Koehler who traced the main stream of scholarship on Hobbes's political philosophy.

As a matter of fact – as the interest in Hobbes's political theory grew up connected with the events occurring between the two world wars – any attempt to provide a systematic

[2] 'Motibus a variis feror ad rerum variorum dissimiles species, materiaeque dolos; motusque internos hominum, cordisque latebras: denique ad imperii iustitiaque bona. Hic ego me mersi studiis. Nam philosophandi Corpus, Homo, Civis continent omne genus. Tres super his rebus statuo conscribere libros' (*Thomae Hobbes malmesburiensis vita carmine expressa*). In 1641 the first draft of *De cive* circulated in Paris, *De corpore* was published in 1655, and *De homine* in 1658. Only in 1668 the three complete sections appeared in their proper logical order (*De corpore*, *De homine* and *De cive*) under the common title *Elementa philosophiae*, within a collection of Hobbes's Latin works which also included *Leviathan*, edited by the Dutch publisher Blaeu (Martinich 1999: 173, 324-25).

interpretation of Hobbes's philosophy was blocked by Leo Strauss (1936).[3] Still referring to Frischeisen-Koehler, he established the centrality of Hobbes's *political* philosophy and the marginality of his *natural* philosophy which, according to him, had been little more than an obstacle to his political theory and was to be considered of no interest at all. In short, twentieth-century scholarship on Hobbes's political philosophy was born out of a basic undervaluation of the 'continental' debts in Hobbes's natural philosophy, in order to treat his political philosophy as a separate field of research, the integration of which into a system was never successful. In this sense the article of Taylor (1938) can be considered the prototype of all the approaches neatly dividing Hobbes's natural science from civil science, particularly focusing on problems concerning the relationship between politics and religion, human and divine law in Hobbes's works, and claiming the non-existence – or, at least, the radical inconsistency – of a Hobbesian 'system' of sciences.[4]

In his *Introduction to Leviathan*, Oakeshott (1946) was perhaps the first who ventured to claim that Hobbes's was a coherent 'system', although what he actually referred to was a sort of systematic critical function carried on by his philosophy *despite* its materialistic assumptions: in Hobbes, 'civil philosophy belongs to a philosophical system, not because it is materialistic but because it is philosophical' (Oakeshott 1946: 16). But during the 1960s a couple of books appeared in which Watkins (1965) and Goldsmith (1966) tried to demonstrate the relation between Hobbes's political philosophy and his system of sciences, without ignoring the complexity of his epistemology and particularly highlighting his debts towards Galileo and Descartes.[5] Along the same line of thought, Spragens (1973) pointed out Hobbes's attempt to provide, against Aristotle but within the 'tacit framework of the Aristotelian paradigm which persists in Hobbes's ideas' (Spragens 1973: 47), an alternative system based on the concept of motion, the result of which is a conception of political life as a part of nature and the subsequent correlation of natural and political sciences.[6] At the same time Pacchi (1965) revived the interest in Hobbes's

[3] A remarkable exception was Schmitt 1938 who, on the contrary, based his theological-political interpretation of *Leviathan* on Hobbes's mechanicism. Another attempt for a systematic approach, yet from a completely different political point of view, was Vialatoux 1935. I will rapidly go through these crucial references – Schmitt in particular – in Chapter 2.4.

[4] For a wide discussion of the 'Taylor thesis', see Brown 1965, Chapters 2-3, where also Taylor's article is reprinted.

[5] In particular, Goldsmith considers how Hobbes's system, being strongly dependent on Galileo's conception of science, inherits the same fundamental limitations: 'Hobbes's political science, however, exhibits the weakness of Galilean science in an especially noticeable way. This weakness is the absence of criteria for falsifying the theory by an empirical test. The theory is allowed to explain phenomena, but it is not permitted to be tested by them' (Goldsmith 1966: 242). However, both accounts on Hobbes's system are quite 'static', particularly Watkins's, which wrongly assumes that 'when Hobbes […] wrote the *Tract* he was already a full-fledged physical determinist' (Watkins 1965: 19) and subsequently maintains that 'his early philosophizing split over into his political theorizing' (Watkins 1965: 14).

[6] Spragens assumes Leo Strauss was right in observing that a deductive relationship between natural and political philosophy 'is simply a logical impossibility', nevertheless he claims that 'human mind works in many ways other than deduction'. Spragens's hypothesis is *not* of a 'deductive derivation' of political philosophy

natural philosophy, renewing an interpretative line which had remained suspended since Cassirer (1907) had claimed that Hobbes's 'hypothetical materialism' served as a logical postulate for the unity of a scientific method based on an 'epistemological phenomenalism'.[7]

More recently, the contested but prized book of Shapin and Shaffer (1985) on Hobbes's quarrel with Boyle had the undisputable merit of raising some interest in the relation between Hobbes's philosophy of science and the experimental method supported by the Royal Society, thus providing new interest in what Sorell has named 'the old question called "Hobbes's system"' (Sorell 1996: 45). Sorell himself (1988a) took part into the dispute with an article where he contrasted what he called the 'standard interpretation' (the 'systemic' one), trying to show the relative autonomy of *De cive* within the *Elementa* project. Conceding that the 'standard interpretation' could perhaps be reasonable if referred to *Leviathan*, Sorell claimed that it did not fit at all to *De cive*'s structure, which clearly shows its inconsistency with the basic assumptions of Hobbes's mechanical philosophy. From his analysis Sorell concluded that the method of natural sciences differs from the method of civil philosophy not only as far as *De cive* is concerned, but also in *Leviathan*, where the first and second parts are actually autonomous (Sorell 1988a: 70).

Despite criticizing some of Sorell's arguments, Malcolm (1990) endorsed his 'split' thesis, claiming that during the development of Hobbes's system his epistemological writings had become 'more and more misleading as guides to his actual practice' of civil science (Malcolm 1990: 155). In a more recent article Sorell (1996), slightly attenuating his view without substantially changing it, goes back to the 'traditional' relationship between the theses of the Baconian influence and of the autonomy of civil philosophy, and concludes that

> Hobbes is closer to Bacon than to Descartes […] but the task he undertook was not quite the Baconian one of making a massive report on the progress of learning up to his own day: it was the different one of reducing the mass of existing science to its

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from natural philosophy, but rather of a 'considerable interaction', the results of which is the final content of Hobbes's political doctrine (Spragens 1973: 36-37).

[7] According to Pacchi (1971), before Cassirer, within the Neokantian school of Marburg, Natorp 1882 had already noted Hobbes's 'phenomenalism'. Cassirer claims that 'from the first beginning of his philosophy it was [Hobbes's (and Grotius's)] great ambition to create a theory of the body politic equal to the Galilean theory of physical bodies – equal in clarity, in scientific method, and in certainty'. Hobbes's aim would be to find a 'mathematics of politic' grounded on the assumption that 'man's social life is not a mere mass of incoherent and haphazard facts' (Cassirer 1946: 165). Laird minimizes Bacon's influence and rather underlines Descartes's (Laird 1934: 45). Although claiming Hobbes was a 'rationalistic materialist' (Laird 1934: 86) (or even a 'naïve rationalist', Laird 1934: 123), he believes his 'phenomenalism' was not 'directly contradictory to his materialism. He held that the material motion called thought took its place among other material motions. I do not say he succeeded, but I suggest that it was not unreasonable for him to try' (Laird 1934: 124).

> elements and presenting them so that they could be taken in by others. (Sorell 1996: 60)

If no other systematic reading of Hobbes's system would be possible out of thinking it as functional to Bacon's project of a science open to collective research, we should conclude with Sorell that the 'internal tensions' in Hobbes's account of sciences are due to a radical contradiction between Hobbes's mechanical materialism and his empiricist epistemology. In fact a project of re-founding science on the first elements of knowledge would rather *connect* Hobbes to the 'intellectual context' nourished by Bacon.[8] In what follows I will rather endorse the hypothesis that the fundamental unity of Hobbes's epistemological *project* and its materialistic *premises* also concerns his political theory. In my view, as his epistemology evolved, it entered in contradiction not with the 'materialistic' characterization of his mechanical ontology, but with the 'deterministic' characterisation of it, which he matured during the 1640s, alongside physical and theological reflexions, as an *ideological* exigency. Therefore, I will try to follow the problematic development of Hobbes's materialistic epistemology along his three political treatises without falling into the trap of taking for granted a priori the unity of an alleged complete 'system', and yet will read his epistemology of civil science in the light of the postulate that all the names, principles and definitions it relays on, should be caused, and therefore explained, by anything 'but' the local motion of matter.

Development of scientia civilis

Scholars who tried to explain the development of Hobbes's civil philosophy within the boundaries of his political thought, often interpreted Hobbes's different epistemological claims in the three political treatises as 'inconsistencies' rather than as different methodological perspectives. And when such differences are considered 'inconsistencies', the standard view usually prescribes a progressive development for Hobbes's civil philosophy, culminating in the masterpiece of *Leviathan*. Such a tendency is well characterized by the book of McNeilly (1968), which ascribes the methodological differences in *The Elements of Law*, *De cive*, *Leviathan* and *De corpore* to a fundamental inconsistency in the development of Hobbes's views on the foundations of political theory (McNeilly 1968: 4). McNeilly's grand narrative, in which both *The Elements of Law* and *De cive* are considered preliminary steps, results in the assumption that only an adequate a*natomy of Leviathan* can allow us to piece together a coherent picture of an Hobbesian methodology. McNeilly's merit of having noticed a development in Hobbes's political

[8] In this direction Milanese draws on the Baconian heritage evidenced by the epistemological centrality assumed in *De corpore* by the concept of fancy (Milanese 2011: 24-25). In my analysis such an 'epistemological' stance should be considered rather the result (possibly a 'return' to Bacon) of Hobbes's epistemological development than an unvarying methodological assumption of his research.

thought is therefore attenuated by the univocal interpretation of its inconsistencies from the point of view of the work which he considers Hobbes's final *summa*. McNeilly in fact establishes *Leviathan* as a kind of 'basic' logic (the foundation of political theory on the knowledge of human nature) that works as a criterion for dividing what is 'pre-Leviathan or Leviathan' in Hobbes's production.[9]

Indeed, as Brandt had earlier demonstrated in his key study on Hobbes's natural philosophy, Hobbesian epistemology had always been in progress rather than fully accomplished, and the completion of the *Elementa Philosophiae* with *De homine* was not to be considered the final fulfilment of a deductive system starting from the principles of motion, but rather its definitive sinking (see also Pacchi 1965: 217). I am assuming here that it is possible to adopt a similar perspective on Hobbes's civil philosophy, considering *Leviathan* a phase (and not necessarily the most scientifically consistent) of Hobbes's philosophico-political development, rather than its 'natural' achievement. Although not challenging the undisputed primacy of *Leviathan* in Hobbes's political production, this at least allows us to question the differences between it and the preceding political works.

This is what a few scholars already tried to do, usually focusing on particular aspects of Hobbes's doctrine. Hood (1967), for instance, points to the change in Hobbes's definition of liberty from *De cive* to *Leviathan*, while Schumann (2004a), despite maintaining that *Leviathan* was mainly the rewriting of *De cive*, notes the important exception represented by the centrality assumed by the concept of *persona* in Chapter XVI.[10] More general stances are assumed by other scholars who argue for a major development in Hobbes's political thought. Zagorin (2009), for instance, claims that the more Hobbes's thought advanced, the nearer politics came to geometry: it progressively abandoned its relation to mechanics and physics and became closer and closer to the – abstract – perfection of geometry, eventually allowing its deduction from the principles of moral philosophy.[11] Quite differently, Johnston (1986) explains that Hobbes, who aimed with his civil science to give a rational political stability alternative to theology and metaphysics, sought in *Leviathan* to implement this aim with rhetoric, a thesis which Skinner (1996) later revived and extended. For Johnston *Leviathan* was the turning point in Hobbes's political

[9] This is what McNeilly does, for instance, in finding a passage in *De cive*'s *preface* which would exemplify the threshold between a conception of the state of nature based on the consideration of human motives, to the more 'formalised version' of it provided in *Leviathan* (McNeilly 1968: 167). On the process of formalisation of civil science carried on by Hobbes in *Leviathan*, and the ideology of neutralisation it entails, see below, in particular Chapters 2.5 and 3.2.

[10] Both issues were later widely developed by Skinner 2008 (on liberty) and 2007, 2002 chap. 6 (on *persona*). These important themes will be discussed in Chapter 2.4.

[11] See also Zagorin 1993: 'If we are to posit one supreme motive or aim that drove Hobbes from the beginning of his career as a philosopher, it is this: that philosophy should be a science, a deductive enquiry which is akin to geometry in its rigorous definitions and proofs, which is centred on body and the knowledge of causes and effects as its fundamental subject, and which should not offer results contrary to experience' (Zagorin 1993: 517-18).

production: not only a work of science, but also of rhetoric. But the change was, according to him, dramatic and systemic: due to the growing awareness that reason cannot assert itself, rhetoric came in Hobbes's picture with the purpose of supporting the rational understanding of his argument, thus making of *Leviathan* itself 'a political act' (Johnston 1986: 91).[12]

Only few scholars claim today that there was no substantial change in Hobbes's civil philosophy. For instance Nauta (2002) focuses on the themes of religion and the church-state relationship during the 1640s and concludes that there is no discontinuity in it. Tuck also considers Hobbes's religious thought, and although he theorises no evident development in Hobbes's political theory, he considers *Leviathan* a kind of utopian 'turn' of the arguments displayed in *The Elements of Law* and *De cive*. If the former treatises allowed for a quite partial role played by 'ritually ordained *ecclesiastics*' (DC XVII.28, OL II, 413)[13] in providing the sovereign with a correct interpretation of the Scriptures, *Leviathan* 'compromised the unity of his theory in this one respect, for he allowed (albeit in a kind of advisory position) a crucial role to the Church in the formation of public doctrine' (Tuck 1989: 85). The reason for Hobbes's prudent opening to the Anglican Church was, according to Tuck, both political and philosophical:

> The reason for the shift probably lay partly in Hobbes's enthusiasm for the anti-Presbyterian struggle, in which he saw Independency as having the best chance of winning; but another part of the reason lay, I think, in Hobbes's increasing awareness of the real implications of his general philosophical position. (Tuck 1989: 86)[14]

Today, the traditional interpretation which conceived Hobbes's political theory as a smooth path oriented towards the accomplishment of *Leviathan* can no longer be sustained, *pace* those scholars who contend that in Hobbes's political treatises there was no relevant change but rather a progressive clarification of ideas.[15] And nevertheless, although noting the many differences characterising Hobbes's political treatises, many 'philosophical' interpretations (not only in the analytic tradition), still oppose this 'historical' kind of explanation and prefer to focus with accuracy on the contradictions and 'errors' sparse in

[12] This purpose would explain the very structure of *Leviathan*, divided into two halves corresponding to the two different aims: parts three and four would 'shape the thoughts and opinions' of the reader in order to make the scientific demonstration displayed in parts one and two 'persuasive and compelling' (Johnston 1986: 129 ff.). On my interpretation of the purposes of Hobbes's civil science, see Chapter 3.1.

[13] 'Per *ecclesiasticos* rite ordinatos'.

[14] The mark of this shift would be the unanimous reaction against Hobbes's possible atheism after the publication of *Leviathan* compared to the fact that 'there was little hostility […] towards either the *Elements of Law* and *De cive*' (Tuck 1989: 86).

[15] Many of these are listed in Skinner 2008: XIV-XV, notes 23, 24, 25, 27.

Hobbes's texts, in order to reconstruct a supposedly original philosophical design as not 'perverted' by rationally inconsistent issues.[16]

Hoekstra (2004) sketches a clear and useful 'archetypical' opposition between the two main streams of interpretation of Hobbes's changes in political theory, the Philosophers' and the Historians': while the latter provides a political explanation of these changes in terms of political agenda, the former basically charges Hobbes with theoretical inconsistency. Against the former, I shall hold that Hobbes's philosophy is not the building of a system according to a model of rationality, it is rather part of the process of construction of the rationality of modern science itself, and therefore its inconsistencies are often to be intended as oscillations, alternative paths whose interrogation can be the source of fundamental questions that still inhabit our mechanical world picture, and silently drive our way of questioning these texts. In contrast with the latter, we can certainly assume Hobbes's political agenda was of central importance in changing his conception of the relationship between science and rhetoric, but I claim that we must not overlook either the sound and consistent epistemological arguments Hobbes derived from continuous work on *De corpore* during the 1640s in Paris or the ideological conclusions he drew from it. In short, while 'philosophical' interpretations consider as ideology whatever hinders a supposed clear rational understanding, most 'historical' interpretations reduce the problem of the influence of ideology on Hobbes's civil science to his personal fears and interests.

What all these contrasting positions share is that they all revolve around Hobbes's *political* agenda as the supposed effective or non effective cause of 'Hobbes's changing conception of civil science', and around *Leviathan* as the centre of this shift. On the contrary, my research is meant to add to the different accounts of the development in Hobbes's civil science by highlighting the impact of the *epistemological* agenda of mechanicism on Hobbes's epistemology of civil science, and hence to grasp the *ideological* agenda inscribed in mechanical philosophy itself, concerned as it was with providing secure and definitive boundaries to the domain of reason both over the natural and human sciences. This will consequently shift the centre of the analysis onto *De cive*, which represents the true epistemological turn in Hobbes's research. Hence it will be possible to provide a consistent account of the ideological effect of Hobbes's changing epistemological approach to the very contents, structure and function of his political theory.

[16] On McNeilly's 'logic' of *Leviathan* see above, note 9. See also Gauthier 1969, who considers systematically Hobbes's moral and political theory, but separately from his theory of natural science, and 'extracting' Hobbes's method mainly from *Leviathan*.

It is in this sense that a 'political' interpretation, explicitly centred on questioning the very relation between science and ideology, still proves to be an alternative approach to the study of Hobbes's philosophical research. In this direction, although he does not conclude for any significant change in Hobbes's political theory, I will adopt a methodological suggestion from Macpherson (1962). Macpherson assumes that, despite the compelling exigencies of his political agenda, Hobbes actually 'intended to be consistent', and therefore the inconsistences in the theoretical structure of his political thought cannot be explained in terms of opportunism and must rather be explained at another level, of which 'the theorist could have been unconscious'. At this level, postulating consistency turns out to be a quite useful theoretical tool: 'The hypothesis that a thinker was consistent within the limits of his vision is useful less as a way of resolving inconsistencies than as a pointer to the direction and limits of his vision, which may then be established by other evidence' (Macpherson 1962: 7-8). In Macpherson's account this deeper level of consistency is clearly ideological: he concludes that Hobbes unconsciously projected his conception of the early market society on his model of man in the state of nature. His argument in a way repeats presented that of Rousseau in an early draft of a chapter of *The Social Contract* that was later discarded:

> The error made by Hobbes, therefore, is not so much his assertion of a state of war between independent men in society, but his supposition that this state is natural to the species, and to have made it the cause of the vices by which it was produced. (Rousseau 1762: 175)[17]

Although I can accept neither Macpherson's 'static' treatment of Hobbes's political thought nor his understanding of the state of nature, I shall hold to his methodological rejection of the easy claim of inconsistency. This will allow me to ground my interpretation on Hobbes's epistemological *development*, thus demonstrating that the 'inconsistencies' cannot be correctly circumscribed through any 'static' account of Hobbes's system. By abandoning a sterile charge of inconsistency, my intention is in fact to follow a *philosophical-political* path, and to explain Hobbes's shift in both epistemological and ideological terms, considering all *historical* explanations on the basis of a 'political agenda' the very background of a *philosophical* explanation, and not the explanation itself.

All these issues will be eventually brought to a head in Chapter Three, where the relationship between the mechanical science and the mechanistic ideology will be discussed through the achievements of the analysis of the epistemological *and* ideological development of Hobbes's civil science. For this purpose in Chapter Two I shall particularly

[17] I shall go back to Macpherson's book in discussing more in general the relation between mechanistic science and ideology in Chapter 3.4.

focus on the period preceding the writing of *Leviathan*. In fact, scholars uniformly agree that during the 1640s Hobbes kept collecting materials, writing and reflecting on his natural philosophy, mainly in antagonism with Descartes. What they seldom do, is to look for the effects of this continued activity on the development of his political thought.[18] On the contrary, my research is precisely focused on the epistemological stance Hobbes adopted in his political treatises, a stance that profoundly changed between *The Elements of Law*, *De cive* and *Leviathan*. A historical-philosophical approach will then provide all the means for understanding Hobbes's political philosophy within the context of its elaboration and to understand how his epistemological views influenced his political theory without mistakenly considering the latter as if it were elaborated in a kind of abstract and pure 'world of ideas'.

In the conclusions to his *Reason and Rhetoric in the Philosophy of Hobbes* (1996), trying to answer the question 'Why did Hobbes change his mind?', Skinner attributes some importance to both the different influences Hobbes underwent during the 1640s in Paris and the peculiar audience of his English *Leviathan* in 1651 (Skinner 1996: 427). But what he eventually claims is that Hobbes's philosophical 'turn' – although not completely unrelated to epistemological stances – derived from his political agenda:

> If we focus on Hobbes's account in *Leviathan* of the concept of civil science itself, what we find is not a new version of his earlier theory but a new and contrasting theory, evidently motivated by a desire to reappropriate much of what he had earlier cast aside. *The Elements* and *De cive* had been based on the conviction that civil science must transcend and repudiate the purely persuasive techniques associated with the art of rhetoric and the 'adornment' of truth. By contrast, *Leviathan* reverts to the humanist assumption that, if the truths of reason are to be widely believed, the methods of science will need to be supplemented and empowered by the moving force of eloquence. (Skinner 2002: 80)[19]

In my view Hobbes's 'change of mind' was not regressive: his conclusions in *Leviathan* were not only that reason and rhetoric must constitute an 'alliance' in order to produce the utmost pedagogico-political effects, as in the humanist tradition embodied by Cicero, to which Skinner refers when he says that Hobbes was 'returning in *Leviathan* to the humanist roots from which he had cut himself off in *The Elements* and *De cive*' (Skinner 2002: 83-85; see also 1996: 437).[20] In *Leviathan* Hobbes was also still trying to provide an

[18] On how 'Hobbes's political ideas have, in turn, influenced his natural philosophy' see instead Finns 2006. Polin 1953 even maintains that Hobbes's natural philosophy is built in order to *justify* his political philosophy.
[19] 'To Hobbes, in short, the English revolution appears as a victory for the irrational but overwhelming power of neo-classical and antinomian rhetoric over the small power of science and rationality' (Skinner 1996: 435).
[20] Viano detects a continuity between the (anti-Aristotelian) critique of rhetoric developed by Hobbes in his *Thucydides* in the name of history, and the theory of mathematical knowledge of the emotional basis of human

epistemological solution to the ancient question of Plato's *Republic* concerning the relationship between government and philosophy in the light of the new epistemological stance he had assumed in *De cive*. No reference to any Platonic world of ideas, or to any Cartesian innate knowledge was possible within his radical materialism.[21] If reason was ultimately based on the collective human power of instituting, diffusing and conserving 'names' through education and discipline, then only power could provide the ultimate *foundation* of scientific truth against the groundless use of rhetoric. Therefore, even though in *Leviathan* reason *remained* the only and unique criterion for distinguishing the genuine use of the art of rhetoric (Skinner 2002: 78-79), it could be effective (and capable of using rhetoric 'for the good') only under the condition of a sovereign power. From this perspective Hobbes's epistemology is to be considered political in its essence, as far as necessarily concerned with its own – material – conditions of possibility.

In this sense I shall endorse Skinner's assumption that 'Hobbes's claim to originality lies to a greater degree at the epistemological level' (Skinner 2002: 307),[22] along with Zarka's suggestion that in Hobbes's speculative structure, 'it is at the political level that one has to look for an answer to the problem posed at the metaphysical level by the separation of discourse and being' (Zarka 1999: 25). Zarka refers to a 'metaphysical decision' through which Hobbes would separate the levels of truth (logic) and of matter (ontology). This 'metaphysics of separation' would provide, according to him, the horizon of both Hobbes's political science and of his conception of politics. The absence of a 'natural' ontological and/or axiological order would entail the exigency of its political foundation, and it is therefore at the political level that, in Hobbes's philosophy, an answer to the metaphysical problem of separation should be searched for. In short, politics would found what cannot be metaphysically founded (Zarka 1999: 24-25). Zarka's view has the indisputable merit of focusing on the link between Hobbes's (ideological) metaphysics and his political philosophy. A certain 'preponderance' of political science on the other sciences (Zarka 1999: 175) would find its apex in the 'new theory of authorization' displayed in *Leviathan*

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nature he presents in *The Elements of Law* (Viano 1962: 360-61). Yet, according to him, the demystification of human rationality achieved by *The Elements of Law* eventually destroys the very foundations of the Baconian rationalist and anti-rhetorical project still endorsed by Hobbes at the time, thus compelling his science to recur to technics of 'disciplination of imagination' ultimately committed to state power (Viano 1962: 381-83, 391-92). Unfortunately, and precisely because he limits his analysis to *The Elements of Law*, Viano cannot grasp that rhetoric, on the contrary, will be taken by Hobbes as one of the major technics through which the state can implement the power of reason: 'At the time, human existence appeared to him [Hobbes] as basically made of a texture of emotions on which it is possible to act only technically, and not rhetorically' (Viano 1962: 392). On the pedagogical project entailed by Hobbes's mechanical philosophy and the conception of the state as an automatic and allegedly 'neutral' machine devoted to the maximisation of security, see below, Chapters 3.3, 3.4 and Conclusion.

[21] On Hobbes's explicit reference to Plato, see below, Chapter 3.1.

[22] More precisely, according to Skinner, 'It was in his attempt to deduce his political system from an account of human nature, and in his emancipation from the confines of the providentialist vocabulary, that Hobbes made his most original contributions to the political theory of his age' (Skinner 2002: 307).

(Zarka 1999: 325), the fictive procedure that, instituting the state, would open the peculiar epistemological space of modern politics:

> Hobbes exits the alternative between realism [Machiavelli] and utopia [Plato, More, Bacon]. Posing univocally the problem of foundation, he tears politics apart both of nature and of history, without leaving it deprived of its own place, but rather shifting it. (Zarka 1999: 244)

It is necessary to stress that in this sense Hobbes never provided a definitive solution, and the underlying tension of the relation between science and political power was never cancelled in his political theory, not even in *Leviathan*. The tie between the artificial world of politics and the natural world of matter was neither cut by Hobbes, nor solved by his political science, and his treatment of human nature never ceased to carry the stigma of that tension. In my interpretation, Hobbes's metaphysical 'question' was in fact generated within the epistemological openness of the new mechanical science itself, while his metaphysical 'decision' was the ideological outcome of a long and dramatic confrontation between the emerging epistemological and political exigencies and Hobbes's materialistic postulate. From a materialistic perspective this tension could not be solved within the boundaries of early-modern mechanicism, irremediably marked as it was by the Cartesian cogito. Hence the foundational aim of Hobbes's materialistic civil science should be analysed not only in the light of the political agenda dictated by the English civil war, but also, at the same time, of the epistemological agenda dictated by Descartes's metaphysical dualism to the new mechanical philosophy.[23]

An epistemological-political work in progress

In order to make my point about the 'old question' of Hobbes's system, I am going to focus on the way the clash with Descartes's metaphysics influenced his philosophical development. Hence it will be necessary to abandon any understanding of Hobbes's system as the result of a successful research, the apex of which would be the completion of the 'trilogy' of the *Elementa Philosophiae*. If, on the contrary, one considers the whole of Hobbes's oeuvre, his repeated claims that politics had to become a science such as 'geometrical' sciences were becoming, can be regarded as a propitiatory ritual rather than

[23] Following Zarka's interpretation, Marion draws from Hobbes's *Objections* in order to show that his materialistic 'decision' relied on the hypostatisation of the provisional epistemological decision sketched in Descartes's *Regulae* concerning the existence of 'simple material natures' (Marion 2005: 69-72). On this basis the author questions the lack of epistemological foundation in Hobbes's peculiar 'phenomenology' of the body (Marion 2005: 75-77). This lack is precisely what, according to my interpretation, invested Hobbes's political theory of an epistemological purpose. I assume that the transcendental 'irreducible privilege of *cogitatio*' to which Marion refers is only relative to the peculiar kind of reductionist materialism typical of a deterministic ontology: one of Hobbes's (unaware) merits has been to make explicit the metaphysical dualism entailed by this kind of alleged materialism (see below, in particular Chapter 3.3 and Conclusion).

as an actual achievement. Yet, from now on, I will read the above mentioned 'inconsistencies' as oscillations proper to a radically materialistic philosophical research.

It is indubitable that Hobbes's natural and civil philosophy are both concerned with bodies as the only possible object *and* subject of knowledge. And therefore, despite all its apparent theoretical inconsistencies, Hobbes's 'system' leaves no chance of claiming any 'ontological difference' between man and nature, reality and thought, animal and machine. His whole work testifies no substantial concession to Descartes's metaphysical dualism. Hobbes had to challenge the problems raised by physical and mathematical research without resorting to Descartes's dualistic epistemology. As a result, his epistemology was a strange and often contradictory mix of Baconian empiricism and Galilean geometrical realism which, clashing with Descartes's philosophy, gained a twofold nature. On the one hand it assumed an ontological realism based on the fundamental postulate of body as 'matter in motion', on the other hand an epistemological approach based on sense as the one and unique source for human knowledge. Keeping the two together was not only the main problem of Hobbes's 'critical materialism' as Pacchi (1965) called it, or the mark of his 'obsession with providing a unified theory of science', as Malcolm (1990) claimed: it was also a crucial issue in his tormented elaboration of the epistemology of civil science.

The different interpretations of Hobbes's civil science open new possibilities of studying it as a work in progress. Such an aim can also be pursued by highlighting the internal theoretical interferences between epistemology and politics which of course do not exclude – though can be *conceptually analysed* independently of – the influence of Hobbes's political agenda, and hence possibly transferred to a materialistic analysis of the ideological heritage of the relationship between the epistemology of modern science and political theory that I shall suggest in my conclusions. In this sense in my research I have considered equally insufficient an approach that would derive Hobbes's political theory straight from his physics and an approach that completely overlooks the systematic connection between the development of Hobbes's physics of motion and his political theory. Indeed, all attempts to connect the concepts of Hobbes's political theory to the concepts of mechanicism pose the same important question, one which revives 'the old question called "Hobbes's system"' and sheds more and more light on the relationship between Hobbes's philosophical development and the ideology of mechanicism. In this sense a simple identification of the laws of (human) nature with the natural laws (of motion) – often assumed by those scholars who unproblematically attribute the *Short Tract* to Hobbes – is nonsense, because determinism was not openly adopted by Hobbes before the 1640s. This was, rather, a 'collateral effect' of Hobbes's epistemological revolution in civil science which first appeared in the new methodological approach he

elaborated in *De cive*. As I will explain in Chapter 2, by establishing both the perfection and the impotence of right reason the new epistemological perspective assumed in *De cive* marked an epistemological gap in civil science that Hobbes progressively filled during the 1640s with a new, and even more radical, ontological determinism than the one he seemed to implicitly adopt in *The Elements of Law*.

It is in this sense that I will assume that the shift from ontology to epistemology Hobbes enacted in *De cive* affected the whole *Elementa Philosophiae* project. I shall demonstrate that Hobbes's quarrels about light and metaphysics with Descartes, along with his polemics with White and Bramhall, influenced the development of his epistemology of civil science, and finally made of natural science itself a *political* issue. My hypothesis is that, despite his fidelity to materialism, Hobbes could not see that the faith in ontological determinism was an idealistic one, driven – also in the theory of knowledge – by the aim of preservation of individual and 'collective' motion, that is life, at all costs. That is why the materialistic epistemology of Hobbes's *Elementa* project, in which the principles of the natural sciences were supposed to provide the final foundation for civil science, raised a set of philosophical tensions which entailed the intertwining of civil science and political power. As a matter of fact, at the beginning of the 1650s *Leviathan* had already made it clear that only civil science could provide the 'power' to found the whole philosophical system, but such power was not the power of science itself.

Methodology

To accomplish my research I shall therefore sketch an epistemological and ideological analysis of mechanical philosophy, both as a theoretical and a historical event. This enquiry will be guided by a few underlying philosophical questions: Does the supposed neutrality of 'facts' mean something which is only related to their ontological status or does it have a relevant ideological function? What is 'ideological' then? Anything but facts? Did the world picture provided by mechanicism fit the purpose of providing a neutral science of nature, of human nature and of the body politic? In short, was modern science the discovery of a method for truth, or should we rather consider it an ideological expression of the desires and hopes of some individuals, of the spirit of an epoch, or of a class? These questions will push my research out of the boundaries of Hobbes's philosophy to a wider interrogation of the political agenda of mechanicism. For this purpose I will draw on three different interpretations concerning the role played by ideology in early-modern mechanicism, based on quite different approaches: constructivist epistemology, based on sociology of science; what I shall call 'historical epistemology', based on intellectual history; and Marxism, based on historical materialism. Each of these approaches entails a theory of the emergence of modern science and of its political stakes on the one hand,

and a theory of truth on the other. Yet in order to keep my research focused on the case-studies I have chosen, the following analysis is only based on scholarship that directly refers to Hobbes and Descartes, and hence more or less explicitly deals with a general theory of modern science.

Constructivist epistemology

In their exemplary attempt to directly challenge the political implications of Hobbes's epistemological project, Shapin and Schaffer (1985) assume a quite original point of view. As Lupoli (1976) had already done, they take the *Dialogus physicus de natura aeris* as an example of how much Hobbes's project openly contrasted the purely experimental approach Robert Boyle and other scientists were carrying on in a research group that later resulted in the foundation of the Royal Society in 1660.[24] But they address the same problem from the perspective of a sociology of science focused on the connections between science and politics:

> We argue that the problem of generating and protecting knowledge is a problem in politics, and, conversely, that the problem of political order always involves solutions to the problem of knowledge. (Shapin and Schaffer 1985: 21)

According to the two scholars, Hobbes and Boyle pursued the same aim of constructing and granting a new order, challenging in fact a unique twofold problem concerning both social peace and the foundation of mechanical science. But their projects took divergent paths. On the one hand Boyle intended to define the boundaries of natural philosophy in relation to the 'contentious' field of civil philosophy. On the other hand, Hobbes aimed at grounding civil philosophy itself on the same geometry on which he was grounding natural philosophy. The epistemological value of geometry on the one hand and of experiment on the other was therefore the central issue. For Hobbes geometry could be the solid base of any scientific knowledge and science could be extended to all the domains of being, because the whole of being was matter in motion. For Boyle only empirical evidence of 'matter of facts' could appropriately ground scientific knowledge *of nature* without mixing it with non-scientific (and dangerous) speculations on metaphysics *and* politics.

In order to develop their argument, Shapin and Schaffer borrow from Wittgenstein the concept of 'form of life' and focus on the different conceptions of experiment characterising the two forms of life represented by Hobbes and Boyle. In short, Boyle's 'language game' consisted in constructing a new, completely 'neutral' and non-theoretical science empirically based on 'matter of facts': a conventional 'pattern of activities' which included collective participation in experiments and discursive practices was aimed at

[24] Lupoli had already dedicated a brief essay to the *The Dialogue* (Lupoli 1976), which Shapin and Schaffer actually quote, although they received it after completing their manuscript (Shapin and Schaffer 1985: 10, n.17).

establishing the distinction between causal explanation and factual evidence in order to 'justify' the convention itself. According to Boyle this codification of 'experimental life' would led to the formation of a safe 'intellectual *space*' where the community of scientists could contribute to a development of science and technology, thus being useful for society without undermining the public authority which materially sustained it. This approach inaugurated the legitimation of the existence of a class of scientists-technicians who were not concerned with politics, but only with establishing a truth independent from any political power, precisely because dependent on truths deposited by God in nature itself, and therefore accessible through observation and experimentation (Shapin and Schaffer 1985: 298).

This program was harshly contrasted by Hobbes, who considered it neither possible nor effective (Shapin and Schaffer 1985: 80-81), or rather either impossible and dangerous. According to him, Boyle's projected community was another kind of heretic group, not so different from those congregations of enthusiasts that in his view usually menaced public order. Experimentalists were in fact a new kind of clergy that built its own truth and falsehood (Shapin and Schaffer 1985: 310), thus possibly helping churchmen with weapons which could eventually be used (once again) against the recently restored monarchy. In fact, the lack of foundation for experiments would make scientific knowledge independent of civil power and – what was more dangerous to Hobbes – the production of consent would be committed to the free exercise of rhetoric by specialised groups. On the contrary, it was urgent that science be provided with a well-founded systematic unity in order to prevent it from fomenting dissent: only geometry – and the force civil philosophy derived from it – could grant a true assent-producing efficacy.[25]

Hence the political reasons for Hobbes's refusal of Boyle's experimental 'form of life' are clear and sound. But what 'form of life' was his own? The authors provide three possible explanations of Hobbes's stance: a couple of personal reasons (to defend the theoretical scheme which sustained his supposed primacy as a natural philosopher; to pursue his personal aim to secure order[26]) and a generic 'historico-sociological' one: 'the heightened sensibility to the practical problem of dissension that was displayed by all English intellectuals during the making of the Restoration settlement' (Shapin and Schaffer 1985: 81). In this sense the Hobbes-Boyle quarrel would be a struggle for finding out the more

[25] Yet as far as Hobbes's political agenda is concerned, Shapin and Shaffer did not analyse the way Hobbes thought *developed*, shifting from an epistemological solution to the problem of (deterministic) order to a purely ontological one methodologically unsustainable but politically necessary, namely ideological (see below, Chapter 2).

[26] While the first hypothesis appears to generally correspond to Hobbes's views on human nature, the second could also find adequate biographical support in Hobbes's own reference to his mother's fear at the moment he was prematurely born in April 1588 while voices were spreading concerning the coming of the *Armada Invencible*: 'And at that point my mother was filled with such fear that she bore twins, me and together with me fear' (*Vitae Hobbianae*; OL I, XXII).

effective (scientific) method for the production of certainty in order to establish public belief. As I have explained, Hobbes's political pedagogy was precisely aimed at producing public opinion as a secure foundation of social stability. And Shapin and Shaffer conclude that, quite similarly, the 'experimentalist clergy' aimed at instituting rational belief through 'the production of matters of fact within the community of reliable believers' (Shapin and Schaffer 1985: 317).

But when in Chapter VII they explicitly enquire about the different interests pertaining to the different 'forms of life', Shapin and Schaffer show the sense in which Boyle's project was spiritualist, because the experimental form of life confined spirits in their own realm, thus implicitly *confirming* their existence. In effect, referring to 'matters of facts' marked the limits of experimental knowledge and implicitly pushed the knowledge of 'extended spirits' out of the boundaries of science. In this sense experimentalist spiritualism was against both sectarian enthusiasts who saw spirits everywhere and materialist atheists who denied their existence (Shapin and Schaffer 1985: 298). Now, this was evidently a claim that Hobbes's materialism could not accept either as true or as safe. On the contrary, this collectively built experimental knowledge was precisely what was to be challenged by a philosophical reflection on science, whether or not we call it metaphysics. These premises rather helped push his intransigent materialism further – up to the explicit negation of any possible existence for spirits, phantasms etc. In this sense materialism was both an epistemological and a political weapon. For Hobbes witches and ghosts were to be a 'real' problem in the eyes of legal and civil powers as long as a 'double sight' still infected civil life. The phantasms of imagination and the practices associated with them – the results of bodily motions in the brain and in the organ of sight – were to be prosecuted, but only geometrical materialism could be a definitive solution to a problem his dualist antagonists could not defeat:

> This 'seeing double' could be remedied by collapsing the hierarchical division between matter and spirit; and the triumph of the civil sovereign could be assured by collapsing that hierarchy in favour of matter. (Shapin and Schaffer 1985: 98)

Shapin and Schaffer's constructivist approach is grounded on the assumption that scientific truth was the result of intellectual and political practices that ultimately define the form of life characterising Western modernity. From this perspective political modernity and modern science are inscribed in the same *political* field, because they represent the process of emergence of the same form of life – namely 'European' modernity – eventually institutionalised in the modern state, as explicitly theorised by Latour (1993).[27]

[27] This usage of Wittgensten's concept of 'form of life' is made explicit by Latour's rely on Shapin and Shaffer's book in order to criticise the ideological status of modern science as such.

Intellectual historians, in particular when the history of epistemology is concerned, adopt a completely different approach, whose presuppositions are probably less evident, but not at all a-political.

Intellectual history

Partially relying on Shapin and Shaffer's work, Malcolm paints his picture of the 'ideological' struggle between Hobbes and the Royal Society with the much more soft pastel colours of intellectual history. In his convincing picture the attack on Hobbes's mechanistic atheism was part of the defensive ideological strategy carried on by the Royal Society through to the rhetorical pattern of a *via media* between scepticism and (Hobbesian) dogmatism, which would allow for the mechanistic views of its members a safe research ground, independent from any risky metaphysical commitment (Malcolm 2002: 330-34). According to Malcolm this argumentative pattern was inspired by Latitudinarian theology, a sort of deism *ante-litteram*, the main argument of which was 'turned to the defence of the new science', or at least of its public 'image'. In the end, it was precisely the profound similarity between the mechanical assumptions of Hobbes and the Royal Society that made of Hobbes the designed polemic target of this ideological operation of differentiation (Malcolm 2002: 332, 334). This explanation of the whole sequence of events in the apparently neutral terms of intellectual influence cannot avoid revealing in the end its presupposed framework: a non professed theory of human nature. Although admitting the 'misleading' character of 'unifying explanations', Malcolm concludes with a quick reference to what appears to be taken as a trans-historical category defining human nature, in order to give 'one possible reason for doing science in this period': 'curiosity' (Malcolm 2002: 335). Of course, curiosity cannot explain any political conflict unless it is conceived as profoundly connected to individual interest and to a conception of politics as ultimately based on individual interests and their composition.

The problem is that intellectual history is usually grounded on the implicit belief that individuals are the ultimate source of philosophical thought. And, correspondingly, a rather 'spontaneous' psychology becomes the ultimate tool for explaining the philosopher's 'ideology', namely her or his perseverance in trying to maintain theses that do not comply with what was accepted as a matter of fact in his epoch. Indeed, the psychology usually adopted is a quite Hobbesian one that points to the *individual* striving for power. On this implicit ground, those who are dealing with intellectual history display a common need to distance themselves from – when not explicitly criticising – Shapin and Shaffer's approach, concerned as it is with a *collective* construction of truth.

By shifting the focus of his analysis onto Hobbes's polemics against Wallis on the topic of the squaring of the circle, Jesseph (1999) makes the criticism against social

constructivism even more explicit. This approach – he states – after Shapin and Schaffer 'has become quite commonplace in Hobbes scholarship' (Jesseph 1999: 343). Trying to explain why Hobbes was so *resolutely* wrong in defending his geometry, Jesseph rejects any reference to collective 'forms of life', and claims that Hobbes's stubborn insistence depended on an epistemological issue: the 'empirical' conception of geometry and the fundamental status assigned to geometry *within* Hobbes's system of sciences. Jesseph concludes that, since geometry was considered by Hobbes the methodological basis of *any* possible scientific knowledge, this failure would cast doubt on the whole system, and in particular on the very 'science of the commonwealth (itself an 'artificial body' constructed by human agreement)' (Jesseph 1999: 341-42). Rather than providing a radical alternative to Shapin and Shaffer's approach, Jesseph appears to expand it by adding an epistemological argument ('mathematical factors') to their 'seriously wrong' interpretation of the controversy 'as driven *purely* by social factors' (Jesseph 1999: 343, italics added). But when he comes to the question of where this necessity of a grounded and unassailable system comes from, he is at a dead end. It is clear that such a question relies on biography, psychology, sociology, politics and other things, but without one field of the analysis excluding the other; in short, it requires a *philosophical* enquiry. However, among so many possible interpretive tools, when he grounds the explanation of Hobbes's unreasonable insistence, Jesseph eventually seems to choose Hobbes's own 'competitive' psychology:[28]

> Convinced that he had delivered principles that could make short work of any mathematical problem, blinded by his passionate desire to defeat Wallis and reap his share of mathematical glory, and ultimately embedded by his failures, Hobbes himself betrayed his want of right reason by his claim to it. (Jesseph 1999: 356)

A similar presupposition can be detected in Lupoli's study of the metaphysical presupposition of Hobbes's physics of motion. Lupoli displays a detailed analysis of the inconsistencies implied by Hobbes's epistemological intersection between physics and theology under the conceptual umbrella of the 'material god'.[29] Although he claims that, for Hobbes, abandoning this 'intersection' 'would be disadvantageous both at the ideological and at the philosophical level' (Lupoli 2006: 571), he only dedicates three pages of his

[28] Emblematically pictured by Hobbes's metaphor of the race between individuals in EL IX.21 and Lev XV; EW 3, 122.

[29] Lupoli seems to adopt the same model used by Garber in reading Descartes's metaphysical 'choice' as the ground of his deductive physics. Garber grounds his explanation on the assumption that experiments are 'theory-neutral means of choosing between independently constructed theories' (Garber 2001: 110, n. 26). Hence, according to him, Descartes's refusal of self-evidence to 'a-theoretical facts' was essentially non scientific, because in his deductive project, on the contrary, 'experiment plays a carefully regimented role' (Garber 2001: 109-110; see also Garber 1992a 307-308). Unfortunately, although he pictures 'the context of the larger intellectual trends', Garber's ultimate explanation refers to 'Descartes as a living, breathing human being, who learns (and forgets) things, whose views develop and change over time, even if he himself is not always aware of that dimension of his thought' (Garber 2001: 3-4).

book to *explaining* the reasons for Hobbes's stubborn insistence on this theologically dangerous and epistemologically inconsistent topic. In fact, the whole book rather points at the epistemological level, explaining how, by expelling the inconsistences of his physics into the realm of theology, Hobbes ultimately aimed at preserving the internal coherence of the former. The 'ideological' level of explanation, instead, is rapidly liquidated in a single paragraph, where 'ideology' simply refers to Hobbes's necessity of providing a justification of the compatibility of his philosophy with the bible and avoiding the charge of atheism. Again, a 'historical epistemological' approach tends to conceive ideological explanations in terms of personal interests, deviations from the consistent thinking required by rational thought, which would determine the undeserved intromission of individual passions in the path of rational scientific research. In a word, a 'historical epistemological' explanation tends to conceive truth as the (historically situated) scientific knowledge of matters of fact, and ideology as a deviation from it, without questioning the material basis of either science or ideology, and in fact implicitly assuming the individual mind, or brain or soul – in a word, reason – as their ultimate source.

In general, most *historical* approaches share the apparently genuine purpose of explaining the philosopher's individual 'agenda' on the background of the unquestioned assumption of the interference between scientific truths concerning 'matters of fact' and individual 'intentions'. Yet if it is definitely a crucial task of the history of philosophy to read texts with the purpose of understanding 'what their authors were doing in writing them', it is also the basic task of philosophy to question the concept of authorship itself. And for this *philosophical* task 'getting inside the heads of long-dead thinkers' (Skinner 2004: X) may not be the best strategy, unless we assume that *inside* the head is where thought takes place. From this point of view, I pointed out that constructivist approaches have the indisputable merit of questioning the individualistic premises of a historical approach by analysing the social processes underlying the invention of truth at a wider, collective order of magnitude, that they characterise as 'form of life'. That human body (and especially the brain) is a privileged place for philosophical thought to take place is a basic assumption of Marxist philosophers too, yet what Marxism, along with evolutionism, has made quite clear is that although brain is a main biological condition for thought, its source is society.

In this sense *The Leviathan and the Air Pump* is to be taken as a necessary complement to this intellectual history, because it carries the merit of questioning the often unstated presupposition that science is the knowledge of matters of fact, by thematising the relationship between science and ideology rather than their sharp opposition, and considering this relationship a collective rather than an individual outcome. Yet this sociological approach, if pushed at its limits, might look like a degeneration of the Marxist

approach, entailing the presupposition of a meta-language concerning the ultimately apolitical struggle between different 'forms of life' instead of the dialectic of class struggles. In this sense, the undisputable merit of what I have called 'historical epistemological' approach is to have recalled, against 'constructivist' approaches, the impossible reduction of the epistemological struggles concerning 'matters of fact' to a supposed sociologically 'concrete' last instance, whether it be the Wittgensteinian 'form of life' or the Marxist 'class'. But the quite individualistic psychology usually adopted by this approach does not go farther than the sociology of knowledge in making of some alleged invariant characteristics of the individual psyche a kind of entirely determinant 'basis'. This individual is much more abstract than the concepts of 'form of life' or 'class'.

In fact, the problem is still alive, and requires further interpretations of the historical (socio-political) forces traversing what in *The Holy Family* Marx and Engels once defined as Hobbes's 'one-sided' 'Baconian' materialism (MEW 2: 136). But for this purpose it is of the utmost importance to move the horizon of this research *out of* Hobbes's own 'supposed' mind, by transforming the question itself. It is worth openly declare that the problem Hobbes was facing, differently raised by the former analyses, ultimately concerned the historical status of rationality and the 'resistance' of natural motion to the social and scientific construction of mechanicism as truth, also in civil science. This enquiry necessarily entails a more profound attempt to question mechanicism as both an epistemological *and* a political attempt to cope with the overturning of the natural and (therefore) human universe operated by the scientific revolution.

Marxism and science

Marxist accounts of the historical emergence of mechanicism provide, of course, a wide range of interpretations, which are nevertheless based on some shared assumptions. Firstly, they refuse any Enlightened or Positivistic linear account of Renaissance and early-modernity as the first steps of a progressive liberation of man from his theological chains through modern science – because they refuse the assumption that liberation is an automatic effect of scientific and technological progress. Secondly, following Marx's narration of the development of capitalism from the 'subjective organization' in manufacture to the 'objective organization' in great industry (see in particular Capital I, XII-XII; or XIV-XV in the English edition) they understand the emergence and consolidation of the mechanistic world picture as an ideological issue related to class struggle. In this view, the principles on which early-modern scientific knowledge was based – laws of nature, efficient causality, mathematical regularity – can be considered as neither ontological features of Nature nor epistemological invariants of human knowledge, mind or any transcendental subject. Mechanical science was not only a revolutionary achievement of

man freed from theological binds: the *Wissenschaftliche Denkweise* (scientific way of thinking) was also the philosophical and ideological expression of the bourgeoisie. Therefore scientific method, objectivity of facts and the mechanistic world picture, need to be explained through a socio-historical analysis of the relations of production in which the emerging class, bourgeoisie, in its attempt to challenge the Medieval world picture, elaborated its own.

This approach gained particular importance after the mechanistic picture of Nature had crashed under the developments in physics at the beginning of the 20th century. Discoveries such as the theory of relativity and quantum physics troubled the undisputed faith in the mechanistic account of 'reality' as the objective and definitive one, both in the epistemological sense – whether transcendental (e.g. in Neokantism) or conventionalist (e.g. in Empiriocriticism) – and in the ontological sense. Mechanicism was in different ways studied as the superstructural effect of infrastructural variations at the socio-economical level, and modern science turned to be (in a way as much as both metaphysics and ontology) strictly linked to – and even dependent on, or in some extreme cases *reduced* to – the ideological effects of the capitalistic mode of production. Not only did these great historical narrations try to resist any ingenuous Positivistic faith into 'pure facts', they also questioned the progressive account of sciences (and civilisation) which is usually given particular evidence by considering the development of technology. Nevertheless they often incurred the opposite mistake of overlooking that technics provides human beings with direct relation to a reality that precedes any effort of symbolisation and crucially shapes *scientific* symbolisation. Human techniques (and thus science itself) face matter, the specific 'resistance' of which to human efforts of transformation and symbolisation, if not properly a-temporal, develops at an order of magnitude which is incommensurable to human species' social and even biological developmental speed, and notably to any political project. For this reason, as I will explain in Chapter 3.4, the status of technics has always been a problematic issue for historical materialism where, usually concealed by an almost exclusive concern for labour, it was rarely challenged in itself.[30]

In this sense the 'spontaneous philosophy' of scientism[31] that often underpins intellectual history represents a serious critical challenge for both a constructivist approach to the sciences of nature which would consider them a merely 'cultural' phenomenon and for any Marxist attempt to explain the superstructural emergence of mechanicism (and even of

[30] For a critique of Marx's failed differentiation of technics and labour, see Simondon 2012, in particular part II. On the way in which, consequently, Marxism failed to clearly locate natural science, as far as it *also* depends on technics, either in the ideological superstructure or in the social base, see below, Chapter 3.4.
[31] With this expression I am deliberately referring to Althusser 1967.

modern science and technology) exclusively in terms of class composition. In fact, the faith in a-theoretical facts compels to ask an epistemological question about what is 'real' and actually *resists* any reduction to historical and sociological coordinates, and brings to question mechanicism at a double level: as a world picture emerging from a historically determinate society *and* as the result of a long term development linked to the technical relationship of the human species with its natural milieu. Thus my research has inherited from Marxism and constructivism the exigency of considering science – both on its theoretical and experimental sides – as the result of historical collective processes of invention, but it has also gained from what I have named the 'historical epistemology' of sciences the exigency of taking the existence of 'a-theoretical facts' seriously. I have therefore tried to maintain these approaches together: firstly, considering rational theoretical choices – modern science included – as themselves historical and political products, and not neutral elaborations of some immaterial and ahistorical 'reason'; and secondly, assigning to modern science a specific relation to reality because its efforts of symbolisation are, at least in part, bound to the actual resistance of matter experienced by technics. Adopting these complementary perspectives, the present thesis offers a study of the nature and emergence of mechanicism as science and ideology.

Chapter 1

Galileo, Descartes, and Hobbes's Political Epistemology

Newton's treatise on the *Philosophiae naturalis principia mathematica* [*Mathematical Principles of Natural Philosophy*] (1687) begins with the definition of the terms of his discourse. They are 'mathematical' quantities: first matter, motion, forces, and then – in the *Scholium* – time, space, place, and again motion; immediately thereafter the laws of motion follow as 'axioms'. Newton conjointly provides the elements for mathematical description and the principles for physical explanation of the motion of matter. It is evident that in the third book, which he entitled *De mundi systemate* [Of the System of the World], natural philosophy seemed to have finally achieved the *mathematisation* and *mechanisation* of nature, presented in an orderly and 'popular method, that it might be read by many' (Newton 1687: 401).[1] The purpose of a complete mathematical description of the fundamental laws governing the physical universe was Newton's legacy for the following centuries, a dream that lasted as long as classical mechanics. Yet the possibility of such a synthesis had not always been taken for granted during the elaboration of mechanical philosophy. In fact, the convergence of mathematical description and mechanical explanation was achieved neither by a common progression towards a clear goal nor by any *coup de théâtre*: it was the outcome of a slow and variegated process through which the two fields of research eventually converged in what we call today 'classical physics'. Furthermore, early-modern mechanics was not, as we clearly know today, the final achievement of physics, neither on the side of mathematical formalisation nor of the explanation of its object, matter in motion.

At the time of the scientific revolution a long-lasting world picture was to be challenged, which originated with the Greeks and had been adapted during the centuries first to the Muslim and then to the Christian religious exigencies, and was based mainly on Aristotle's qualitative physics, where mathematics did not play a crucial structuring role. The method of the new science, which would soon thereafter be called mechanics, was mathematical modelling plus experimentation, and its object was nature conceived as matter made of measurable quantities and motion depending on exclusively efficient causes. If seen through the lens of the history of science, the two sides of the 'scientific method' are little more than names that keep together quite different sets of practices, theoretical modelling and technical experimentation, that preceded and followed the Newtonian synthesis. This

[1] 'Methodo populari, ut a pluribus legeretur'.

twofold nature, that Newton's provisional synthesis makes so clear to appear paradigmatic, can be traced back to a double chain of research practices mixing scientific and ideological issues,[2] along whose development metaphysics played a crucial role. Philosophical systems accompanied scientific research by both influencing and displaying its results, providing its framework and justification or criticising its implications, notably theological, ethical, and political: in general, we can assume that philosophical thought has always mediated the outcomes of scientific research with the different exigencies and resistances of culture, where by mediation we do not necessarily mean conciliation. During the seventeenth century philosophical thought tried to enhance, analyse, explain, and frame this method, and at the same time to discuss, circumscribe, and finally provide a systematic foundation for it. From this perspective, Newton's mechanical universe – like any other philosophical world view – was at the same time a techno-scientific and an ideological outcome.

The huge epistemological and ontological debate on mechanicism is part of what we call today the scientific revolution,[3] which during the seventeenth century expanded into the fields of metaphysics, theology, ethics, and politics, and contributed to completely changing the European world view of a human-centred cosmos. I aim to show that this debate had ideological consequences that cannot be measured within the boundaries of scientific research. Mathematisation and mechanical explanation were not only the pillars of a new method of knowledge and of an action on the environment so powerful that it would completely change the 'natural' history of our planet and of its inhabitants, humans included; they were also the theoretical counterpart of an emerging new mode of production (capitalism) and of an emerging new form of political organisation (the state). But the effects of the scientific revolution on the collective imaginary was as powerful as the undeniable technological progress it offered. And yet, while science and technology have moved quite far from their original early-modern conceptual and material frameworks, on the contrary the philosophical changes entailed by the scientific revolution still frame our epistemological, ontological, moral, and political discussions. In fact, along with the very method of science, what was elaborated in seventeenth century mechanicism was an ideological equipment that lasted much longer than the scientific image of the world with which it was associated at the moment of its emergence.[4]

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[2] I am deliberately leaving aside whether this twofold nature is rooted in the peculiar sociological structure of Western civilisation. According to Zilsel the difference in the social origins of the two components of Galileo's method is evident in the way in his *Discourses* Galileo 'gives the mathematical deductions in Latin and discusses the experiments in Italian' (Zilsel 1942a: 943). This topic will be debated in Chapter 3.4.

[3] For general studies of the scientific revolution through mechanicism, see the classics by Dijksterhuis 1961, Westfall 1978.

[4] I will develop this argument in my Conclusion.

In this chapter I shall briefly sketch the early debate concerning the epistemological status of mathematics and the ontological status of matter in motion – the cores of the method and the object of the new Galilean science – in order to understand what was at stake in the philosophical questioning of the *subject* and the *object* of such a science, as it resulted in Descartes's metaphysical synthesis. My purpose is to analyse the ideological effects of this debate out of the field of natural philosophy, and in particular to enquire into the ideological implications of this process of 'mechanisation of the world picture' in Hobbes's political theory.

1.1 On Mathematical Certainty and the Relativity of Motion

The *Quaestio de certitudine mathematicarum*

During the second half of the 16th century a huge debate took place concerning the ancient problem of the knowledge and nature of mathematical objects, and the quite new problem of their relation to the method and object of mechanical philosophy. Arguing against Platonic mathematical realism (which attributed to mathematical *objects* the highest ontological existence, as separated 'ideas') the Aristotelian tradition had traditionally attributed to mathematical sciences a floating epistemological status, according to the intermediate ontological status Aristotle had attributed to its objects in *Metaphysics* XIII:

> Geometry will not be about perceptible objects just because its objects happen to be perceptible, because it does not study them *as* perceptible; the mathematical sciences will not for that reason be sciences of perceptible objects, nor will they be about other things separate from the perceptible ones. (Aristotle, *Metaphysica* XIII.3, 1078a 2-5)

In fact mathematics was considered by Aristotle a quite useful tool for physics, which he at times adopted when dealing with optics, harmonics, and astronomy – domains in which mathematics functions as a 'composite science'.[5] But he considered it unfit to provide a dynamic explanation of *all* the causes of natural change, local motion included. Because true scientific explanation depended on the knowledge of causes, the explanation of natural change was something that only what he called 'physics' could actually offer. In the Aristotelian tradition informing Averroes any 'absolute demonstration' (as the ones provided in geometry) was considered quite problematic in natural philosophy because of the hidden causes which might differentiate knowledge 'for us' from knowledge 'for

[5] Composite sciences were optics, harmonics, and astronomy, concerned with 'mathematical lines not qua mathematical, but qua physical' (Aristotle, *Physics*, II.2, 194a 8-12). 'Composite science' was first named 'mixed mathematics' by Bacon (Brown 1991).

nature', while it was generally held that in pure mathematics the two visions would coincide (Jardine 1998: 693). In short, the price paid by mathematics for being considered such a perfect science was that of being methodologically dependent on Aristotle's logic on the one hand, and to be precluded from providing perfect knowledge of physical nature *in itself* on the other.

In the 16th century a *Quaestio de certitudine mathematicarum* arose within the Aristotelian framework, that openly posed the problem of the actual scientific value of mathematics. The *Questio* soon came to directly question the status of mathematics as a science of causes and to indirectly question the nature of its objects: numbers, figures, relations. The scholarship sees in Piccolomini's *Commentarium de certitude mathematicarum* (1547) the key text to accessing the origin of the whole *Quaestio*.[6] Piccolomini contrasted the shared view inherited from Averroes, according to which the inductive knowledge of effects and the deductive knowledge of causation were both present in mathematical 'potissima demonstratio'. In short, Piccolomini maintained that no 'potissima demonstratio', as required by Aristotelian logic (that is in *Posterior Analytics*), was possible in mathematics (that is in Euclidian geometry), because the latter could not access the physical cause-effect relations.[7] Mathematical demonstration was perfectly certain, and in effect the very model of abstract perfect clarity, and yet all knowledge of physical causes remained open and undetermined. Mathematics could not provide an adequate and univocal account of natural causes; it just provided different demonstrations for the same effect, and not its actual explanation.

The ultimate reason for the limits of mathematics was the fact that it depended on human imagination rather than on any physical or metaphysical forms of causation. The irregular motion of the imperfect and decaying matter constituting the sublunary world was apparently the farthest from the abstract perfection of mathematics and made the latter appear a quite beautiful masterpiece of human imagination with no use at all in the knowledge of physical causes.[8] From this perspective, what made of the *Questio* a crucial turning-point is that it helped detach the two fields of research: a mathematics of relations could be developed independently from any concern for actual physical causes, as a pure science of quantity which, on the long term, would become the 'materia communis' of the different fields of natural philosophy. Along this path Renaissance Platonism progressively

[6] Mancosu 1992 and 1996, Jardine 1998, Sergio 2006.

[7] Aristotle attributed to mathematical demonstrations the first degree of certainty, but no relevance for natural science: 'Mathematical accuracy is not to be demanded in everything, but only in things which do not contain matter. Hence its method is not that of natural science; because presumably all nature is concerned with matter' (*Metaphysics* II.3, 995a 14-18).

[8] In fact, the epistemological problem exploded when mathematics was to be extended and applied to the whole of the universe, of its physical motion and of its causes, not only to the regular and eternal (or believed so) motion of the skies.

gained its place in the history of science.[9] But in the meantime, Aristotelianism kept dominating the scene of natural philosophy for a quite long time. A strong continuity with Aristotelianism was maintained by the epistemologies of Bacon and Harvey, where the role of mathematics as a technical tool was perhaps not underestimated, but any form of centrality was certainly denied to it. On the contrary, the Aristotelian primacy of physics soon became strongly problematic in Galileo's research, and it was definitely abandoned by Descartes's epistemology (Jardine 1998: 710), where the apparently insurmountable gap between mathematical knowledge and the natural world investigated by natural philosophy became an explicitly metaphysical problem.

Galileo

According to a standard interpretation in the history of science, after Francis Bacon's 'sterile attempt' at the origins of early-modern mechanics there was Galileo's return to Plato's mathematics and Archimedes's statics.[10] Galileo's primary goal in renewing ancient statics was to abandon the qualitative approach typical of Aristotelian dynamics.[11] For this aim, a science was necessary to study bodily motion without explaining the *causes* of motions, which – in the Aristotelian framework – would mean to provide *qualitative* explanations. The solution was a 'purely kinetic' account of motion which did not refer to any causal explanation, but was perfectly suitable for mathematical formalisation. Galileo limited himself to a plain description of quantitative *relations* in mathematical terms, thus becoming the initiator (although not at all the accomplisher) of a new, entirely quantitative account of nature which would later find its mature formulation in Newton's dynamics. Thus, although in his research Galileo was not concerned with grounding a 'true science' of natural causes, he paved the way for an integrally mechanical approach to the study of nature: the very existence of his mathematical science of local motion can be said in this sense to have posed a problem at the same time ontological and epistemological, which could not be solved without further philosophical effort.

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[9] In fact Platonism and Pythagoreanism continued to develop throughout the Middle Ages, Humanism, and the Renaissance, partially crossing and merging with Aristotelianism and Averroism. In any case, seventeenth century mechanical philosophers used 'Aristotelianism' as a label for the 'old fashioned' philosophy taught in the universities that they were challenging.

[10] Particularly crude if not dismissive towards Bacon were Koyré 1935-39, Lenoble 1943 and Dijksterhuis 1961. I am far from endorsing such a monolithic and outdated stance, although for my purposes I will particularly focus on Hobbes's continental debts. On Bacon's matter theory, see Gaukroger 2001: 166 ff. No matter how pre-modern it is to be considered, the independency of Bacon's matter theory from mechanics is in fact a quite complex subject that indirectly questions the reductionist tendency of early-modern mechanics.

[11] For Koyré 1935-39 Galileo's mechanism was not even merely Archimedean but also still partially compatible with Aristotle. And this is what, according to Garber, made it acceptable to Mersenne (Garber 2004: 157). More recently, Machamer underlines the crucial role played by Archimedean statics in giving rise to 'to the mathematical and experimental structure of the mechanical world picture (though not to all aspects of its widespread power of intelligibility)' (Machamer 1998b: 57-58). Without a doubt, though, when the mathematisation or, better, geometrisation of reality had to abandon the Aristotelian framework, it proceeded through mechanical models.

In effect, two crucial aspects of the same problem emerge from Galileo's scientific research – one strictly ontological, the other epistemological – that can be easily related to the twofold nature of the scientific method. The two aspects concern respectively the object and the subject of the new science. Galileo's overall project was to read the 'book of nature' written in 'mathematical language' (GG VI, 232).[12] The image of the book of nature was not Galileo's invention, of course, and it was rather a quite common *topos* of Humanistic polemics against Scholasticism through the reference to Plato's *Timaeus*. It is possible to grasp the exact meaning of Galileo's version of the metaphor by crossing this passage with another of his most famous sentences, included in the *Dialogue Concerning the Two Chief World Systems* (1632), where he clearly establishes the absolute and universal 'intensive' value of geometrical knowledge as paradigmatic for the new science:

> Understanding can be taken in two modes, *intensive* or *extensive*. Extensively, that is, with regard to the multitude of intelligibles, which are infinite, the human understanding is as nothing […]. But taking man's understanding intensively, in so far as this term denotes understanding some proposition perfectly, I say that the human intellect does understand some of them perfectly, and thus in these it has as much absolute certainty as Nature itself has. Of such are the mathematical sciences alone; that is, geometry and arithmetic, in which the Divine intellect indeed knows infinitely more propositions, since it knows all. But with regard to those few which the human intellect does understand, I believe that its knowledge equals the Divine in objective certainty, for here it succeeds in understanding necessity, beyond which there can be no greater sureness. (GG VII, 128-129)[13]

In short, Galileo claimed that mathematical language was the code for the understanding of nature precisely because nature itself was created geometrical by God, and the equal certainty characterising the humans' and the creator's knowledge granted that nature was, at least in principle, perfectly transparent to those who mastered the new geometrical science. But the project thus displayed remained in Galileo's works scarcely more than a metaphor: although it was a kind of postulate, or at least the horizon of Galileo's research, it was not at all its achievement. For many reasons Galileo's texts lack any metaphysical

[12] 'Philosophy is written in that great book which ever lies before our eyes, that is the universe; but it cannot be understood unless one first learns to understand the language and grasp the symbols in which it is written. It is written in mathematical language, and the symbols are triangles, circles and other geometrical figures, without whose help it is impossible to comprehend a single word of it, and one wanders in vain through a dark labyrinth' (Galileo, *Il Saggiatore* 1623).

[13] 'L'intendere si può pigliare in due modi, cioè *intensive* o vero *extensive*: […] *extensive*, cioè quanto alla moltitudine degli intelligibili, che sono infiniti, l'intender umano è come nullo […] ma pigliando l'intendere *intensive*, in quanto cotal termine importa intensivamente, cioè perfettamente, alcuna proposizione, dico che l'intelletto umano ne intende alcune così perfettamente, e ne ha così assoluta certezza, quanto se n'abbia l'istessa natura; e tali sono le scienze matematiche pure, cioè la geometria e l'aritmetica, delle quali l'intelletto divino ne sa bene infinite proposizioni di più, perchè le sa tutte, ma di quelle poche intese dall'intelletto umano credo che la cognizione agguagli la divina nella certezza obiettiva, poichè arriva a comprenderne la necessità, sopra la quale non par che possa esser sicurezza maggiore'.

systematisation of the actual achievements of his mechanics, and yet his research was the starting point for seventeenth-century mechanical philosophy: the systematic analysis of the metaphysical, epistemological, ontological, and, as I will try to demonstrate, political implications of the new world picture. In fact, Galileo's distinction between mathematical certainty and physical explanation never led to a philosophical solution to the problem posed by the *Quaestio*.[14] Thus, precisely because he did not provide a philosophical synthesis of the duality inscribed in the very method of science itself, Galileo had to challenge here and there the two horns of the problem under a concealed form. He had to cope with both the actual resistance of matter to geometrical account, and the theoretical relativity of any measurement of motion. In short, as I am going to explain, he faced a twofold problem concerning the object and the subject of the science he was inventing.

On the one hand, in Galileo's method the role of experimentation was quite marginal, or at least strictly purposed to the control of hypotheses rather than to observation,[15] and the role of matter was in a way that of an obstacle, which marked the boundaries of scientific knowledge, and implicitly represented an actual risk for its certainty. According to Galileo the very nature of matter in motion resisted measurement, and therefore it was not easily reducible to geometrical account, that is to science. In the *Dialogue* Galileo openly opposed Simplicio's Aristotelian-fashioned claim that a sphere does not touch a surface just in one point (GG VII, 229-30).[16] But in his *Postille di Galileo Galilei al libro intitolato Esercitazioni filosofiche d'Antonio Rocco filosofo peripatetico*, also recalling the Aristotelian 'sphaera aenea non tangit planum in puncto', Galileo made of the paradoxical tension between mathematics and mechanical practice (and, therefore, experimental evidence) an explicitly aporetical issue: 'Claiming that the continuous is made of ever divisible parts, and claiming that the continuous is made of indivisibles, is the same thing' (GG VII, 745). And in fact, as far as the material sphere is concerned,

> Mr Rocco should be aware that Mathematicians, when they want to build a sphere, do not resort to the indivisibles, but they rather go to the wood turner [*torniajo*], if they want it made of wood, to the smelter, if they want it made of metal. (GG VII, 749)

[14] Sergio 2006: 61, n. 18, expanding Jardine 1991.

[15] According to Dijksterhuis it was just functional to the verification of hypotheses, or even superfluous if the theory could be assumed as sufficiently persuasive (Dijksterhuis 1961: 333-359). Although less categorically, scholars generally agree on the dominance of 'theoretical' experimentation in Galileo's work.

[16] Simplicio states: 'These mathematical subtleties are true in the abstract, but they do not comply […] as one comes to matter, things go the other way round' (GG VII, 229). Galileo-Salviati's 'poor discussion' of the argument might display the very 'split' between mechanics as a mixed science and mathematics: 'to cover up the gap between his physical causal discourse and his mathematical analysis, Galileo attempted to deny any boundary between mathematics and physics in the *Dialogue* and to erase the traditional discourse on mathematical entities' (Feldhay 1998: 127-128, 132-33).

As a matter of fact, the very object of the new science, matter in motion, represented a problem that could hardly be solved within the boundaries of mechanical knowledge. And in effect, since his earlier speculation, Galileo had lamented that mathematical 'reality' had to cope with a reluctant, contingent matter which constantly menaced the – *intensive* divine – status of geometrical science. In a letter of 1602 he had posed the problem, as usual, in a quite 'practical' way, as a problem of measurement:

> As far as matter is concerned, its contingency affects the abstract propositions of the geometer; and being these [propositions] so distorted that no perfect science is thus possible, therefore the mathematician is relieved from considering them. (GG X, 100)[17]

On the other hand, a further complication emerged from the astronomical discoveries of Copernicus concerning the point of view of the subject of the new science. After Copernicus' discovery, the starting point of Galileo's new physics of motion was necessarily that the earth was *moving*, and yet from this (quite unstable) ground some universal rules for the measurement of motion had to be settled, and an answer provided to the question: How can one measure motion while moving? Hence a new conception – scientifically grounded – of the relativity of motion was growing, which would soon deprive the universe of a definitive reference frame.

From a mathematical point of view the problem of the measurement of motion can be solved through a quite simple transformation (now called the 'Galilean transformation', even though it was not even Galileo's invention).[18] From a physical point of view, when no absolute reference frame can be taken to be at rest or in motion, the measurement of motion is always relative to the established reference frame, which can be indifferently supposed to be at rest or in uniform motion. Galileo makes an example of a group of friends carrying on different experiments on a moving ship, and observing that their measurements do not diverge from the ones they used to make on land. In short, a reference system in uniformly accelerated motion perfectly corresponds to a still system for perception as well as for objective measurement. As a result, the relativity of all measurements of motion to the respective reference frames can be mathematically calculated, assuming a consistent picture of the universe as an ontologically unitary

[17] 'Quando cominciamo a concernere la materia, per la sua contingenza si cominciano ad alterare le proposizioni in astratto dal geometra considerate; delle quali così perturbate siccome non si può assegnare certa scienza, così dalla loro speculazione è assoluto il matematico' (Galileo Galilei, *Lettera a Guidobaldo Del Monte*, Padua 29 November 1602).

[18] The scientific concept of 'Galilean relativity' does not match Galileo's conception of the relativity of motion, which cannot be considered a 'principle' of his physics, in fact still earth-centred and linked to a quasi-Aristotelian conception of free-fall and the 'nature' of heavy bodies (Chalmers 1993: 200-1). Today, 'Galilean relativity', or 'invariance', also named 'Newtonian relativity', refers to a three-dimensional 'Cartesian' coordinate system (not Descartes's invention either) which allows the calculation of speed in relation to the chosen reference frame.

system. And nevertheless, the *mathematical* simplicity of this solution, if we consider the *physical* implications, appears to completely invalidate the former Aristotelian framework.

Aristotle's system had for centuries won a battle against the relativism of atomists, thanks to a plainly physical argument, by anchoring space coordinates to an absolute point of view and cancelling chance from motion:

> Such directions (up, down, right, left, etc.) do not exist only relative to us; for to us a thing is not always the same in direction but changes according as we change our position […] By nature, on the other hand, each of these is distinct and exists apart from the others; for the up-direction is not any chance direction, but where fire or a light object travels, and likewise the down-direction is not any chance direction but where heavy or earthy bodies are carried, as if these directions differed not only in position but also in power. (Aristotle, *Physics* IV.1, 208b 14-16, 18-22)

On the contrary, Galileo's mathematical account of the relativity of local motion required neither any physical centre of the universe nor any ontological distinction between quiet and motion. From this perspective the diffusion of Galileo's discoveries concerning motion was a really devastating event for the Aristotelian-Christian world picture, because it cancelled the possibility of conceiving motion as 'naturally' relative not only to the centre of the earth but to any possible centre of the universe at all. In this sense it is clear that Galileo's concept of inertial motion, although still quite qualitative,[19] de facto reintroduced relativity in the Aristotelian-Christian world in a way much more dangerous than the (more or less explicit) adoption of Copernicanism in the *Dialogue*, which made him run the actual risk of being sent to the stake. In fact the attack on the Ptolemaic-Aristotelian earth-centred worldview does not appear to have been the most challenging novelty carried on by the new astronomy. The Copernican revolution, in itself, did not revive the spectre of relativity that had been exorcised for centuries by Christian philosophy: it certainly deprived humans of their narcissistic primacy in the centre of the universe (on earth), but it still allowed the sun-god to be another sufficiently glorious centre. More seriously, it was the new Galilean concept of the relativity of motion that ruined the keystone of the entire monument represented by the Aristotelian physics of motion, where an absolute high and low existed along with the natural tendency of the four elements to spontaneously reach their natural places.

As a matter of fact, Galileo's purely *mathematical* description of the relativity of local motion completely invalidated Aristotelian physics without providing any alternative

[19] In fact Galileo's mechanics was not fully inertial. Such notions as 'impressed force', 'intrinsic motions', and notably 'impetus' still inhabited his texts and his world view. The unaccountability of gravitation, in particular, did not allow him to provide the causes of inertial motion. And yet it was Galileo who first connected systematically all the issues concerning motion in a kinetic picture that was incompatible with Aristotle's (Hooper 1998: 157 ff.).

physical explanation of motion. In this sense Galileo's mechanics was a threshold that, once crossed, cancelled the ancient universal order without being capable of producing a new one, and, furthermore, it called into question the very idea of a universal order, a cosmos, with all its theological and political counterparts. More threatening than ever, the spectre of relativity was therefore reappearing with new physical evidence through Galileo's mathematical evocation. This process was about to bring to a new picture of the universe as lacking *any* centre at all (a quite dangerous picture indeed – as Bruno had personally experienced just a few years before), while on the other hand, by contrast, the revolutionary ideas of Galileo – as the term 'revolution' implies – elicited in many of his admirers the exigency of a return to some new metaphysical foundation.

Mathematics, mechanics, and mechanicism

The main points of Galileo's mechanics were the pervasive uniformity of local motion and the objectivity of primary qualities: both issues provided the undisputed basis for early-modern mechanical philosophy. The first one (the local motion of matter as the postulate of any possible explanation of natural phenomena) was completed by the second one (the foundation of qualities on purely quantitative differences). And from this distinction the typically modern version of the sceptical problem of the relationship between epistemology (the theory of knowledge and of science) and ontology (the theory of being) derived its framework. In effect this approach posed the problem of a structural gap between subjective representation and objective reality, which drove scientific discourse towards the quest for a metaphysical solution. In the previous pages, a separate consideration of mathematical formalisation and physical explanation allowed for the *mise en scène* of 'the conflict between the demands of mathematical mechanics and mechanical philosophy' (Westfall 1971: 47). It is now time to understand how a new mechanical philosophy progressively grew up during the seventeenth century from a concern limited to natural philosophy to the elaboration of complete systems of sciences. This was achieved through a process of convergence of the epistemological and ontological demands of the new physics into metaphysical systems to which the label of 'mechanicism' can be applied.[20]

The lack of adequate physical explanation of *the causes* of motion, along with the attested resistance of matter to geometrical formalisation, constituted a complex set of problems that required a new philosophical conception of the subject, method, and object of science which, in effect, paved the way for a completely new world picture. In short, to be seriously taken as a metaphysically grounded world picture, Galileo's physics of 'local motion'

[20] By 'mechanicism' I mean the mechanical philosophy that, during the seventeenth century, assumed the task of discussing, developing and finally founding, the theoretical achievements of the new mechanical physics (see above, Introduction, note 1).

required a more subtle philosophy. Hence it was for seventeenth-century mechanical philosophers the source of two different but connected aims, which today we might distinguish as respectively philosophical and scientific: 1) to provide an *epistemological* and *ontological* (and actually *metaphysical*) foundation of a neutral point of view on the causes of motion; 2) to provide a complete *mathematical* account of the deterministic invariance of the cause-effect relations determining the motion of matter. As I am going to explain, mechanicism progressively emerged as the attempt to provide the ultimate synthesis of all these issues by superposition of the universal power of mathematical science over the mechanical characterisation of matter in motion.

For many reasons Galileo did not intend to offer such a philosophical claim. No attempt to destroy the Aristotelian-Christian world picture was accomplished nor even explicitly carried on by him, – he always worked as a 'pure' mathematician. But as soon as the new science of matter in motion became a shared 'reference frame' in Europe, all the problems it comprised were received by those who intended to build a philosophical system out of Galileo's mechanics, and in particular – what I am particularly concerned with – by those who gravitated around the man who was the true epicentre of the spreading of Galileo's ideas in Europe, the Minim friar Marin Mersenne.[21]

Mersenne

After an initial wavering over the innovative aspects of Galileo's work, Galileo's account of free-fall became the most important source of inspiration for Mersenne's work at the middle of the 1630s, and strongly influenced his understanding of mechanics as a theory of motion.[22] But Mersenne probably took Galileo as a 'mixed mathematician' rather than a natural philosopher, and this allowed him to accept mechanics as a development 'internal' to Aristotelian science (Malet and Cozzoli 2010). At the same time, Mersenne's 'mitigated' scepticism allowed him to leave untouched the hidden contradiction between a harmony of appearances and the actual order of the real cosmos, of which mathematical harmony could only be considered a reflection. Mathematical demonstrations were for Mersenne certain, causal, and scientific, but they did not concern physics (Dear 1988: 72). Thus, as a 'mathematician' and not a 'physicist' himself, Mersenne can be said to have been working for the reinforcement of Aristotelianism, but in fact injecting into the Parisian intellectual milieu the mathematical germs of mechanicism.[23] In this sense he is certainly a

[21] Mersenne's crucial role in making of mechanics a not-only-Italian affair during the 1630s is certainly beyond doubt (see for instance Roux 2004: 36). A still valid pioneering study of Mersenne's merits was Lenoble 1943.
[22] According to Palmerino, the problems related to Galileo's theory of acceleration through infinite degrees of speed eventually increased Mersenne's scepticism towards mechanistic models (Palmerino 1999: 324-28).
[23] 'Mersenne's mechanism, his world machine, was not set forth as the true picture of the real world […] but as a hypothesis for organizing and utilizing our knowledge' (Popkin 1960: 142). On the way in which seventeenth-century 'mixed mathematics' contributed to exiting the Aristotelian framework and establishing ontological determinism, see Daston 1992: 30-38.

noteworthy 'case study' for the transition from the Aristotelian to the mechanical world picture (Garber 2004), and his case also demonstrates that the separation of the fields of mathematics and physics was a key epistemological tool for this turn. Once the germ of mathematics was injected into the ancient world picture, the latter could not survive: at the logical level because of the rational force of mathematics; at the ideological level because of the powerful efficacy displayed by the mathematically built machines.

Perhaps Mersenne could hardly see the 'incompatibility' between the new mechanical view of nature and the Aristotelian cosmos. And in fact, there was no way to assume Galileo's Archimedean new science of motion without abandoning the Aristotelian framework: this is a radical consequence that only those concerned with the enterprise of building a philosophical system could assume. Thus it was Descartes, Gassendi, and Hobbes who drew from Galileo's research its philosophical, epistemological, and political consequences.[24] On the basis of Galileo's science of local motion, Descartes, Gassendi, and Hobbes aimed at building complete philosophical systems. And elaborating the epistemological and metaphysical foundations for the new physics, they also transposed in their philosophies the problems they inherited from Galileo's *methodology*.

Descartes and mechanics

In *Le mecaniche* Galileo was quite dismissive towards the dreams of the 'poorly talented engineers' (GG II, 158).[25] Indeed, for him 'mechanical philosophy' in the strict sense was impossible, because the adjective 'mechanical' denoted the qualitative world of the Aristotelian four elements rather than the actual quantitative world made of shapes, numbers, and motions (Gabbey 2004: 15). Quite consistently, the twofold nature of the new hypothetical-experimental method was in fact strongly bent towards geometrical formalisation by the traditional attitude of ancient science, deeply rooted in a strong prevalence of the theoretical moment over the practical one. This was quite evident in the opposition between 'geometrical' and 'mechanical' knowledge, and the devaluation of the latter as far as it depended on empirical experience. This classical heritage Leonardo had already tried to contrast:

> They call mechanical the knowledge which is born from experience, and scientific the one which is born and ends in mind, and semi-mechanical the one which is born form science and ends being operated by hand. But I hold to be vain and full of errors all those sciences which are not born from experience, the mother of

[24] 'In this sense one can say that a truly new philosophy begins not with Mersenne, but with Descartes and others in his generation, such as Hobbes and Gassendi, who attempted philosophical systems. Mersenne, like Galileo, I think (and this is somewhat controversial) is doing something somewhat different' (Garber 2004: 157).
[25] 'Poco intendenti ingegneri'.

> certainty, and which do not end in a well-known experience (Leonardo *Treatise on Painting*, 19r).[26]

It was precisely under the premise of a re-evaluation of experience as 'the mother of certainty' that Leonardo could conclude for a strong connection between mechanical praxis and mathematical achievements: 'Mechanics is the Paradise of mathematical sciences, because here we come to the fruit of mathematics' (Leonardo *The Notebooks*, 1155).[27]

Although Descartes apparently welcomed this kind of conceptual innovation, he partially maintained Aristotle's terminological distinction between mathematics and mechanics, and the related theoretical approach. An emblematic example of the resulting ambivalence can be found in the *Discourse on the Method* (1637), his first published work, which contained an introduction to his method (commonly named *Discourse on the Method*) and three scientific essays he had previously written, concerning *Dioptrics*, *Meteorology,* and *Geometry*.[28] In *Geometry* Descartes expressed open disagreement with the current, depreciative use of the term 'mechanical', but nevertheless he accepted and used it to sketch a distinction between 'mechanical' (= rough) and 'geometrical' (= exact) knowledge (AT VI, 411-412). Furthermore, within the very realm of geometry Descartes distinguished pure 'geometrical' from 'mechanical' curves ('the spiral, the quadratric and similar ones'), the construction of which was to be operated through non a priori calculable relations (AT VI, 389-390).[29] In the *Discourse* itself he conserved this ambiguity: he first despised a merely 'mechanical' use of mathematics (AT VI, 7), while in what followed he supported 'the strength of mathematical demonstrations' with a direct reference to the mechanical necessity of blood circulation and clock functioning (AT VI, 50). This problematic connection between mathematics and mechanics was not at all clarified by his sharp remark: 'the rules of mechanics […] are the same as the rules of nature' (AT VI, 54).[30]

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[26] 'Dicono quella cognitione essere meccanicha la quale è partorita dall'esperientia, e quella essere scientifica che nasce et finisce nella mente, e quella essere semimeccanicha che nasce dalla scientia et finisce nell'operatione manuale ma a me pare che quelle scientie sieno vane et piene d'errori le quali non sonno nate dall'esperientia, madre d'ogni certezza et che non terminano in nota esperientia'. Leonardo is following a quite common issue in the treatises on painting: 'The social antithesis of mechanical and liberal arts, of hands and tongue, influenced all intellectual and professional activity in the Renaissance […]. This fact appears rather distinctly in the writings of contemporary artists who over and over again discussed the question as to whether painting and sculpture belong with liberal or mechanical arts. In these discussions the painters usually stressed their relations to learning (painting needs perspective and geometry) in order to gain social esteem' (Zilsel 1942a: 940). On the innovative interpretation of the relation between art and science contained in Leonardo's theory of painting, see Luporini 1953: 148-54.

[27] 'La meccanica è il paradiso delle scienze matematiche, poiché con quella si viene al frutto matematico'.

[28] The full title was *Discours de la méthode pour bien conduire la raison et chercher la vérité dans les sciences. Plus la dioptrique, les météores et la géométrie, qui sont des essais de cette méthode* [*Discourse on the Method of rightly conducting one's reason and seeking the truth in the sciences, and in addition the Optics, the Meteorology and the Geometry, which are essays in this Method*].

[29] On Descartes's exclusion of the 'mechanical curves' from the realm of geometry, see Mancosu 1996: 72 ff. and Jesseph 2004: 204.

[30] 'Les règles de la Mécaniques […] sont les mêmes que celles de la nature'.

Was Descartes identifying mechanics and physics (and thereby machines and nature), by differentiating the (rough) functioning of both from the pure exactness of geometry, or did he use the word 'mechanics' in a way (mechanical = natural = exact) which evidently differed from the way he had used the adjective 'mechanical' in *Geometry*, that is *before* eventually writing the introductory *Discourse* to the three essays in 1637?

Since his early work with Beeckman, Descartes practiced 'mixed mathematics' – also named 'mathematico-physics' in the early seventeenth century – with no evident ontological purpose. It was only after the long elaboration, in the *Regulae ad directionem ingenii* [*Rules for the Direction of the Mind*] (1619-29), of his project for a universal knowledge based on intuitive evidence that Descartes transformed the previous approach into a double-sided purpose that drove his effort during the following decade: to provide a unified theory of the objects of physics and mathematics, and to provide their metaphysical foundation in divine legislation (Roux 2004: 29-31). This is the period in which Descartes conceived and wrote also *Le monde ou traité de la lumière* [*The World or Treatise on Light*] and *L'homme* [*Treatise on Man*] – two works he avoided publishing to avoid running the risk of inquisition more than for reasons to do with the provisional nature of his work. There he already set the complete framework and planned the future path of his research.[31] Koyré suggests that in his *Cogitationes privatae* [*Private Thoughts*] (1619) the young mathematician Descartes was still working on the concept of movement, wavering between a physical and a purely mathematical conception of space,[32] and his hesitations disappeared only when the two coincided in *Principia Philosophiae* [*Principles of Philosophy*] (1644).[33] What seems quite clear is that, although at the beginning of the 1630s the identification of physics and mechanics was yet to come, Descartes had already set the agenda of making natural philosophy as certain as geometry, and in this agenda mechanics had a crucial role to play.

The structural ambiguity of Descartes's mechanistic project was emphatically displayed by his reply to the criticism of Fromondus, who had noticed a 'rude' Epicurean blend in his physics (AT I, 402-3).[34] It is quite problematical to establish what Descartes precisely meant by using the expression 'mechanica philosophia mea' ('my mechanical philosophy')

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[31] They eventually informed two more systematic works he published during the 1640s: *Principia Philosophiae* (1644) and *Les Passions de l'âme* (1649), respectively.

[32] 'Motion is a paradoxical entity: it is a state of the moving body which nevertheless passes from a moving body to another; it represents change and, at the same time, remains identical to itself. It appears to Descartes as a hybrid entity, and he deliberately as instinctively substitutes for this notion the more concrete, clear, and more easily *imaginable* notion of motive force on the one hand, and of trajectory on the other' (Koyré 1935-39: 119, italics added; cf. also Koyré 1962).

[33] In fact Descartes never completed his program, often contenting himself with analogical mechanical explanations. In this sense, as Koyré notes, the process of mathematisation of physics reached a standstill in *Principia Philosophiae* (Koyré 1935-39: 128).

[34] 'Non raro in physicam Epicuri nesciens, credo, recidit, rudem at pinguisusculam, nec satis elimatam, ut plerique credunt, ad limae extactae veritatis' (Letter of *Fromondus to Plempius*, 13 September 1637).

in two letters dated 3 October 1637 (Descartes AT I, 420-21, AT I, 430). Gabbey (2004) and Roux (2004) strongly disagree about that. Both recognise that geometry and physics together constitute for Descartes the science of a nature which is, at least theoretically, entirely reducible to geometry, but they disagree about the epistemological role Descartes attributed to mechanics. Despite his admiration for mechanics, as for medicine and all the useful techniques, according to Gabbey Descartes scarcely attributed to it any theoretical value: in fact he used the expression 'mechanica philosophia mea' with a hint of 'ironic self-deprecation' (Gabbey 2004: 20). Roux, instead, thinks that the letter marks the turning point after which for Descartes the adjective 'mechanical' eventually equalled 'geometrical'. In this sense Roux concludes that with the expression 'mechanica philosophia mea' Descartes was in fact announcing his new natural philosophy (Roux 2004: 32-35).

As Roux notes in passing, 'some weaker senses of "mechanical" would [later] emerge' in Descartes's agenda (Roux 2004: 35). Perhaps Descartes's oscillations about the epistemological significance of the term 'mechanics' are not entirely translatable in the terms of a 'progression' of his thought along the lines of a project of mathematisation of nature. They rather seem to derive from a deeper ambiguity which can be detected in the whole of his production, and – as I will try to demonstrate in this thesis – to the theoretical structure of deterministic mechanicism itself. However, one can appreciate Descartes's constant oscillation between two different conceptual operations: 1) theorising all cause-effect relations in the nature-machine as functioning in an entirely deterministic way according to few simple laws of motion; 2) building a method – analytical geometry – which would allow us to fully deduce from the first principles (and thus to describe mathematically) all kinds of possible motions.[35] The first was the ontological assumption of nature as a deterministic system of cause-effect relations, the second was the epistemological assumption of a deductive method. While the first hypothesis was patently in contrast with his theory of rational will conceived as the incidence of the *res cogitans* on the *res extensa*, the second, on the contrary, was *grounded* on that same distinction, because the universal knowledge of the laws of motion could be thus subtracted to motion itself. The inner tension deriving form this structural contradiction crosses the whole of Descartes's production.

In his earlier work, Descartes's mechanistic conception of nature was already established, but a plain identification of natural motion with the rules of geometry was still problematic.

[35] Of course, the method in itself would not allow an *actual* complete deduction of the complex phenomena of local motion one can observe through experiments from the first principles of geometry, but it would allow postulating, in principle, the complete subsumption of all the causal series one can actually observe in nature under the general laws of motion.

Natural science was the exact description, thanks to geometry, of a nature-machine the ontological status of which was still considered problematical in light of the ideal (and divine) perfection of geometry. The result was the well known 'fable' of *Le monde*:

> But, even if all that our senses have ever experienced in the true World seemed manifestly contrary to what is contained in these two Rules, the reasoning that has taught them to me seems so strong that I cannot help believing myself obliged to suppose them in the new World I am describing to you. For what more firm and solid foundation could one find for establishing a truth, even if one wished to choose it at will, than the very firmness and immutability which is in God? (AT XI, 43. Cf. also 63, 80, 82-83, 98)[36]

When Descartes opposed the world deriving from the appearances of senses to the one which reason theoretically builds on the basis of God's immutability he was not childishly defending himself from the charge of atheism with a 'theological' trick. Rather, he was also grounding his metaphysical solution of the problem posed by Galileo on a dualist epistemology, which would later result in a dualistic metaphysics.

In fact, Descartes's solution was much more complicated than it might appear from this brief account, because it followed many years of work on optics, geometry, and various kinds of physical and physiological phenomena, not to mention all the ruminating around the legitimation of this work through what is better known today as Descartes's philosophy (namely the *Discourse* and the *Meditations*).[37] However, the structure of Descartes's solution to the problem posed by Galileo was quite simple. He grounded the science of matter in motion on metaphysical dualism: on the one hand the *res extensa*, that is *moving* bodies with measurable primary qualities; on the other hand the *res cogitans*, that is eternal *non-moving* ideas matching the primary qualities of bodies, and directly accessible by reason. The second founded the knowledge of the first. In this sense Descartes's metaphysical dualism cannot be conceived as a simple theological *escamotage*; it was rather part of a project of progressive clarification of the central notions of mechanics. In fact, not only it was 'theologically correct', it also allowed for a redefinition of the epistemological status of the subject of science on the one hand, and of

[36] 'Mais encore que tout ce que nos sens ont jamais expérimenté dans le vrai Monde, semblât manifestement être contraire à ce qui est contenu dans ces deux Règles, la raison qui me les a enseignées me semble si forte, que je ne lasserais pas de croire être obligé de les supposer dans le nouveau que je vous décris. Car quel fondement plus ferme et plus solide pourrait-on trouver pour établir une vérité, encore qu'on le voulût choisir à souhait, que de prendre la fermeté même et l'immutabilité qui est en Dieu ?' (Descartes, *The World or Treatise on Light*, Chapter VII, *On the Laws of Nature of this New World*).

[37] This was only a small part of Descartes's 'philosophy' if we give the term the comprehensive meaning it had at the time. In fact, most of what he conceived as his truly philosophical enterprise, his natural philosophy, might now simply appear to be some odd old science, while his reflection concerning the grounds of it is often considered the apex of his philosophy. This is probably an *ideological* effect he highly contributed to generating: through the metaphysical separation of the domains of human thought and matter, or liberty and necessity.

the concepts of matter and motion, on the other. The subject of science was reduced to a purely neutralised gaze, the object of science to a purely passive body.

The neutral subject of science, the passive object of science, and the divine laws of motion

Garber's ground-breaking studies on Descartes attribute a central function to metaphysics as a foundational framework for his physics: according to Garber, in Descartes's systematic attempt of providing an alternative to scholastic philosophy only the reference to immaterial causes could adequately replace the abandoned Aristotelian 'substantial forms' with an equally efficient explanatory framework for bodily motion.[38] Following Descartes's claim that the 'six *Meditations* contain all the foundations of my physics' (AT III, 298), Garber concludes that 'the Cartesian doctrine of the distinction between mind and body is intended not only to clarify the notion of mind, but also that of the body' (Garber 1992b: 302). Thus, in a larger sense, Descartes's metaphysical dualism had an epistemological purpose, and the argument of the existence of an external world would serve not only to deflect charges of scepticism, but also to – epistemologically – 'replace the sensual world of colours, tastes and sounds with the spare geometrical world of Cartesian physics' (Garber 1992b: 294-95). Thanks to this metaphysical assumption, on the one hand bodies had only properties related to the *res extensa* and, on the other hand, all the primary qualities matched eternal ideas fully accessible within the *res cogitans*.[39]

From this perspective one can consider the above mentioned oscillations in Descartes's statements concerning 'mechanics' as evidence of a structural problem in his philosophy, which derives from the difficulty of managing one of the main philosophical problems of modernity, the anti-Aristotelian breakthrough in the relation between epistemology and ontology. Descartes's problem can be summed up in a quite simple question: How can we have a science based on fixed and eternal truths if all in nature is matter in motion? The same problem recurs – although with different relative weights – from *Le monde* (where a physics of light still links physics and the theory of knowledge) to the *Principia* (where it is instead metaphysics that provides the framework of both the theory of knowledge and physics). Descartes's final solution was metaphysical: eternal truths (of geometry) are neither matter nor motion, they are not natural but divine, they are *res cogitans*, and therefore subtracted from any possible motion (exception made for God's inscrutable will, of course). This solution was both epistemological and metaphysical: it consisted in

[38] See also Garber 1992b: 321-322, where he eventually concludes that in Descartes's system the true *causes* of motion can only be God and the created substances (finite minds) but *not* bodies that bear no 'active force'.

[39] In this sense *la fable* concerning *Le monde* could be read as the response to an epistemological exigency to prevent a premature identification of the scientific model with physical reality.

geometrically building an external point of view on moving matter and making of it the unique, absolute, and disincarnated subject of modern science.

For this metaphysical choice there was, however, an epistemological price to pay: the gap between the Cartesian *dynamics* and *statics* widened, leading to the separation of the basic magnitudes governed by the (mechanical) *laws* of motion – extension and motion, or size and speed – and those depending on the (geometrical) *principles* of statics – heaviness and displacement.[40] As a result, Descartes had to cope with a double abstraction: the laws of motion were valid only in the void (where there is no heaviness), while heaviness only concerned force, that is statics and purely geometrical demonstration: 'the idea of extending statics to the analysis of motion', so fruitful for Galileo, 'was not considered by Descartes' (Roux 2004: 65).[41] This epistemological split not only was coupled with a new metaphysics, but also had a considerable impact on the ontology of matter in motion:

> The change-over from a developmental to a static conception of matter was as profound as the change from a geocentric to a heliocentric astronomy, and its effects were as far-reaching. Moreover, it was a step that could never have been justified by appeal to logical principles and experimental evidence alone. (Toulmin 1965: 166)

In fact, because Galileo's inertial framework had introduced a fundamental indistinction between rest and motion, the path towards Newton's identification of the 'Innate Force of Matter' with the essentially passive nature of matter was opened. The *vis inertiae* was eventually reduced by Newton to a 'force of inactivity' characterising a matter whose main feature was in fact the 'inactivity of the Mass' (Newton 1687: 2-3).[42] Drawing on Beckham's 'principle of perseverance', Descartes played an important role along this process of reduction of matter to extension, the passive support of the Galilean conception of the relativity of motion. Along this path Descartes worked at reducing matter to a unique, liquid-like, and passive body, independent of motion and presenting no trace of physical void. Thus he eventually separated motion from bodily extension, and considered motion 'a mode of the matter which is moved', different from the general and

[40] According to Koyré Descartes excluded speed from his system because it was scarcely suitable for mathematical intelligibility and geometrical representation (Roux 2004: 58).

[41] Why? Roux's final explanation binds Descartes to 'a more general feature of French mechanics': 'French mechanicians […,] these new Archimedeans [Fermat included…,] were indeed good mathematicians, but they did not consider mathematics as a method for understanding physical things. Mathematical constructions were only abstractions for them, with which it was fun to play, but which were not to be confused with what really happened in nature. Moreover, with the exception of Mersenne, they were not interested in the ways in which motion intervened in natural processes. At best, motion was for them a way of generating curves' (Roux 2004: 66).

[42] See Hooper 1998: 170-71.

perpetual 'cause' of their existence which was situated out of matter and motion, in God's immaterial eternity, in which human reason was allowed to participate (AT VIII, 61-62).[43]

In effect, according to Descartes every single part of the universe participates in many different sequences of motion, and the total amount of motion remains unvaried. Motion is transmitted from a body to another through reciprocal transference. Thus one part of matter can be said to be in motion only when its motion differs from another motion, that is local motion does not consist in a 'change of place' (absolute motion) but in 'separation' (relative motion). In this sense Descartes defines rest as unity, but motion as 'detachment' between the object and the system of reference for measurement. The whole operation apparently entails the arbitrary assumption of one point of view to determine what is reciprocally moving or at rest. In fact, because motion was a basic explanatory notion in Descartes's physics, it had to obey laws which had to be invariant, thus overcoming the lack of 'foundation' in the researches of Galileo, who, 'not considering the first causes of nature, has only sought to the reasons of some particular effects, and thus he has built without foundation' (AT II, 380).[44] Hence the 'absolute' conception of the relation between motion and rest, conceived as a geometrical 'change of place' that Descartes implicitly assumed even though he kept defining motion as 'relative separation' (Garber 1992b: 310).[45] But this absolute measurement of motion was possible only by referring to an external point of view, and this possibility was granted by the existence of an immaterial and therefore non-moving substance, the *res cogitans*.

In conclusion, it was only after Descartes had eventually identified matter with 'extension', that is the metaphysical *object* of mechanics, that he was allowed to commit motion, completely purified from matter, to god's ruling power and the gaze of *res cogitans*, that is to the metaphysical *subject* of mechanics. In effect, it was far before his *Discourse* – when he was still working on *Le monde* – that Descartes had explicitly identified God's 'mathematical truths' and the *laws of nature*:

> In my treatise on physics I shall not avoid discussing a number of metaphysical topics, and especially the following: the mathematical truths which you call eternal have been laid down by God and depend on him entirely no less than the rest of his creatures […]. Please do not hesitate to assert and proclaim everywhere that it is

[43] 'Motus nihil aliud sit in materia mota quam eius modus'.

[44] 'Sans avoir considéré les premières causes de la nature, il a seulement cherché les raisons de quelques effets particuliers, et ainsi [qu']il a bâti sans fondement' (Descartes, *Letter to Mersenne* 11 October 1638). And again: 'Everything he says about the speeds of bodies descending in the void, etc., is built without foundation [*est bâti sans fondement*]' (AT II, 385).

[45] Descartes eventually claimed that each body has only one motion proper to it and wanted to 'eliminate the arbitrariness in the distinction between rest and motion' (Garber 1992b: 307).

> God who has laid down these laws [mathematical truths] in nature just as a King lays down laws in his Kingdom. (AT I, 145)[46]

In fact, this was not Descartes's invention. In *The Advancement of Learning* (1605) Francis Bacon, to whom Hobbes was for a long time the secretary, referring to James I, wrote:

> Kings ruled by their laws as God did by the laws of nature, and ought as rarely to put in use their supreme prerogative as God doth his power of working miracles. (Bacon 1605: I, 175)[47]

This passage makes it quite clear that the origin of the concept of 'laws of nature' was rather theological-juridical than physical, as most scholars agree.[48] Referring to the divine 'laws of nature' and endorsing the disembodied look of a God-like reason, Descartes was able to explain the motion of matter independently of any moving and relative point of view. In his philosophical system the perfect correspondence between the principles of geometry and the laws of nature could be clearly and distinctly assumed by the intuitive faculty of a self-transparent subject of science, and the mechanical motion of matter (once the latter was reduced to body *as* extension) was perfectly ready for a complete account made through the formalised language of geometry.[49] The paradigmatic (and historical) importance of Cartesianism makes possible a shortcut: it was through Descartes's metaphysical foundation that Galilean mechanics was systematically integrated into the new world picture.[50]

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[46] 'Mais je ne lasserai pas de toucher en ma Physique plusieurs questions métaphysiques, et particulièrement celle-ci : que les vérités mathématiques, lesquelles vous nommez éternelles, ont été établies de Dieux et en dépendent entièrement, aussi que tout le reste des créatures […] Ne craignez point, je vous prie, d'assurer et de publier partout, que c'est Dieu qui a établi ces lois en la nature, ainsi qu'un Roi établit des lois en son Royaume' (Descartes, *Letter to Mersenne* 15 April 1630).

[47] This passage is also quoted by Milton, who adds that 'by the beginning of the seventeenth century the idea of nature being governed by laws had become widely acceptable' (Milton 1998: 684).

[48] See the pioneering works of Kelsen 1941 and Zilsel 1942b. As Roux admits, 'the term "law" had been used in science without direct reference to a God legislator also before the seventeenth century, and nevertheless it was only this reference that allowed for a wider generalisation' (Roux 2001: 569). According to Oakley a 'theologically driven shift' occurred in the fourteenth and fifteenth centuries - through the legal metaphor – from the natural laws of (human) nature to the laws of (physical) nature arbitrarily instituted by God, later popularised by Boyle and the Royal Society from the 1660s onward, which later become a cliché (Oakley 2005: 60-61). The most wide-ranging collection of essays on the subject is probably Daston and Stolleis 2008. On the remarkable *absence* of this expression in Hobbes's natural philosophy, see below, Chapter 2.2.

[49] So in the *Principia Philosophiae* mathematical measurement could be assumed to – at least in principle – explain the whole set of the arbitrarily complex cause-effect relations of any physical phenomenon on the ground of a geometrical method based on the laws of nature and, accordingly, to empirical data.

[50] 'La grande Mécanique n'étant autre chose que l'ordre que Dieu a imprimé sur la face de son ouvrage, que nous appelons communément la Nature' (*Letter to Villebressieu*, Summer 1631). In fact, this oft-quoted passage is not Descartes's: it is part of Baillet's comment to an incomplete text (AT I, 213-14). One could say, however, that it corresponds closely to Descartes's spirit if not to the letter.

1.2 For a Materialistic Science of Matter in Motion: Hobbes after Descartes

Like all the philosophers connected to Mersenne, Hobbes was deeply involved in contributing to the foundation of the new mechanical philosophy. But from the beginning he wanted mechanical philosophy to 'unlock the secrets of matter and motion' without referring to any transcendental principle, and radically opposed Descartes's dualism. It is interesting to note that Hobbes's account of the journey in Europe on which he accompanied the young Sir Cavendish in his *grand tour* (1634), starts precisely with the 'Galilean' metaphor of the book:

> But we did not spend all this time with books, unless you could say the world was like a book. Many cities of Italy we saw, many French cities; we saw the sweet recesses of Savoy. But I, I forever pondered the Nature of things, as I travelled by ship, or by coach, or on horseback. And in the whole world only one thing seemed to me true, even though it's falsified in many ways: an only truth, but one that's the basis of those things that we falsely say are 'something': such fleeting things as sleep has, or as by glass I am able to multiply at will: phantasms, offspring of our brain, nothing more; in their inner parts is nothing but motion. So that whoever wishes to learn Physics should first learn well what a power motion has. I therefore unlock the secrets of matter and of motion, and thus cheat my free time all through Italy. I write nothing, I make no polemics; a mistress who taught me was always with me. We leave Italy and come again to the high walls and magnificent roofs of Paris. Here I know Mersenne, and to him communicate what I had worked out about the motion of things. He approves and much commends; from that time I too was numbered among the philosophers. (OL I, LXXXIX, vv. 105-130)[51]

In Paris Hobbes also met Gassendi. Gassendi was part of Mersenne's circle from the 1630s and his importance in the development of mechanicism, adding to it some Epicurean features, in particular atomism, cannot be overlooked. Mersenne succeeded in building a productive relationship between Hobbes and Gassendi, after having failed to do the same for Hobbes and Descartes. If we hold with Sorbière's account, Hobbes's *De*

[51] 'Nec tamen hoc tempus libris consumpsimus omne, Ni mundum libri dixeris esse loco. Italiae multas, Gallorum et vidimus urbes ; Secessus dulces vidimus Allobrogum. Ast ego perpetuo naturam cogito rerum, Seu rate, seu curru, sive ferebar equo. Et mihi visa quidem est toto res unica mundo Vera, licet multis falsificata modis: Unica vera quidem, sed quae sit basis earum Rerum, quas falso dicimus esse aliquid; Qualia somnus habet fugitiva, et qualia vitris Arbitrio possum multiplicare meo; Phantasiae, nostri soboles cerebri, nihil extra; Partibus internis nil nisi motus inest. Hinc est quod, physicam quisquis vult discere, motus Quid possit, debet perdidicisse prius. Ergo materiae motusque arcana recludo ; Sic tempus vacuum fallo per Italiam. Scribo nihil, facio adversaria nulla, magistra Quae docuit, praesens nam mihi semper erat. Linquimus Italiam, rursusque redimus ad alta Moenia Lutetiae tectaque magnifica. Hic ego Mersennum novi, communico et illi De rerum motu quae meditatus eram. Is probat, et multis commendat; tempore ab illo Inter philosophos et numerabar ego' (*Thomae Hobbes malmesburiensis vita carmine expressa*, 1673).

corpore was received by a dying Gassendi with a kiss (Corr II, 836). This can be symbolically taken as the apex of a friendship that lasted from Hobbes's Parisian years, when the two shared their common adoption of Galileo's conception of inertial motion as the keystone of natural philosophy and as a paradigm to expand to other fields of philosophy.[52] Gassendi's mechanicism was a natural *philosophy* and not a mathematical science, as for him the certainty and evidence of mathematics was in no way related to the genuine causes of things (Mancosu 1996: 13; 23-24).[53] In this sense his philosophy was not at all in the mainstream of the scientific revolution, because it maintained the separation of mathematical speculation and the physical explanation of motion. And although it presented a possible mechanical alternative to Cartesianism, Gassendi's philosophy did not directly challenge the metaphysical assumptions of Descartes. Furthermore, his sceptical stance allowed him to avoid endorsing a clearly anti-metaphysical attitude, and to instead adopt a 'theologically correct' Epicureanism which even admitted the immateriality of the soul (Lolordo 2006: 227 ff.).[54] In contrast, the clash with Descartes's metaphysics was crucial to Hobbes's research. The encounter posed to Hobbes's philosophy an epistemological problem concerning the stability of science: a problem that, from a radically materialistic perspective, could not be solved by referring to the transcendence of reason.

When, at the moment of fleeing to France (November 1640), Hobbes joined the scientific community of the mechanical philosophers in Paris, he decided to do it through an incredibly harsh debate with Descartes, on two fronts: the science of optics and metaphysics. The first took place mainly in a letter exchange with Descartes through the mediation of Mersenne; the second, again thanks to Mersenne, who asked Hobbes to provide his comments on Descartes's *Meditations*, which were later published as part of an appendix to the text made of five sets of *Objections* followed by the author's responses. The two debates were strictly connected. At the time Hobbes was still trying to found his theory of knowledge on the Galilean principle of local motion, and he conceived epistemology as part of a physics of motion. In effect, once it was assumed that all human motion was a result of the original impact of external bodies on the senses and the further propagation of motion within the body, then it was plain that the principles of local motion had to explain any kind of motion and therefore also the internal motions of the brain which we call knowledge. The geometrical-mechanical ontology of light was in this sense

[52] Gassendi's *Epistulae de motu* strongly influenced Hobbes's *De Motu* (Leijenhorst 2004).
[53] Highlighting that Gassendi understood Galileo's theory of motion as a physical one, Palmerino considerably attenuates Koyré's dismissive devaluation of Gassendi's mathematical talent as the cause of his failure to connect Galileo's law of free fall to a physical explanation (Palmerino 2004: 164).
[54] 'While Hobbes used inertial motion to substantiate the scientific validity of his social theories, Gassendi used it as one of the means to restore Christian orthodoxy to his materialistic natural philosophy' (Sarasohn 1985: 364-65).

taken by Hobbes as paradigmatic: it seemed to be the model for the epistemology of any kind of knowledge, science included, assuming that only sense could be corrected by sense.[55] For this reason a physics of light conceived in terms of local motion entailed a whole epistemology, which was supposed to ground even the peculiar kind of motion we call science. In this sense, one can maintain that Hobbes was trying to 'deduce' an entire epistemology from the laws of optics.

This could not be without consequences for Hobbes's attitude towards Descartes's dualistic metaphysics, precisely because of the completely different conception of rationality it allowed, on the one hand, and the opposed conception of matter, motion (and light) it entailed, on the other. The contrast between the two philosophers on the subject, the object and the method of science could not be more radical, although, as I will try to explain in Chapter 2, Hobbes's epistemology eventually followed an ideological path.

A clash between theories of light: a (meta)physical quarrel

Hobbes's interest in Descartes's optics dates back to his earlier reading of *La dioptrique* (1637).[56] The two began their quarrel, however, in November 1640, when Hobbes sent to Mersenne a fifty-six-page manuscript criticising Descartes's *Discourse* and particularly the *Dioptrics* (Martinich 1999: 163). Their epistolary exchange via Mersenne lasted a few months at the beginning of 1641, when Hobbes was already in Paris, writing the third *Objections* to Descartes's *Meditations* (Schuhmann 1998: 67),[57] and probably *De cive*.[58] If one considers Hobbes's concern with optics when he was not yet known as a political philosopher and his natural philosophy was not complete, 'Hobbes's philosophy gives the impression of having been developed as the next move in a game where Descartes was the previous player' (Tuck 1988: 28). In effect, although the philosophical system Descartes eventually presented in his *Principia Philosophiae* was centred on metaphysics, quite differently, at the beginning, Descartes's research was still focused on the problems of light and perception. Around 1629-33, between the *Regulae* and *Le monde*, Descartes was still trying to attribute to the physics of light the central role of linking the ontological and the epistemological fields by explaining knowledge as dependent on sensible experience, and therefore functioning according to the mechanism of propagation of light he was studying in his *Dioptrique* (about 1630-35). On the contrary, as previously explained, at the accomplishment of his research Descartes turned to a metaphysical

[55] 'The great deception of sense […] also is by sense to be corrected' (EL II.10).
[56] The reading of Descartes possibly inspired Hobbes's dealing with optics when he had not yet left England (see Digby's letter of 1637, in Corr I, 52). On Hobbes's attacks to Descartes in his optical treatises, see below.
[57] Letters 29-34, 36 of Jan-Apr 1641, in Corr I, 54-120. Hobbes's objections were published in August of the same year.
[58] Although in the Molesworth edition of Hobbes's complete works (OL) the *Epistola dedicatoria* is dated 1 November 1646 (DC *Ep*; OL II, 140), the original manuscript copy dedicated to William Cavendish is dated 1 November 1641 (Schuhmann 1998: 73).

solution, and this is why in the *Principia Philosophiae* light completely 'lacks its central organizing role' (Garber 1992b: 292). It is from this perspective that the optical quarrel between Hobbes and Descartes displays epistemological implications which are worth discussing in detail.

Frithiof Brandt – the first to tackle in depth the Hobbes-Descartes debate as a key issue in *Thomas Hobbes' Mechanical Conception of Nature* (1928) – saw evidence of a strong change from the still partially Aristotelian *Short Tract* (1630-31) to what Hobbes wrote *after* reading Descartes's *Dioptrics*. Almost one century after Brandt, scholars have no definitive solution to the problem of the attribution of the *Short Tract*. Although we have eventually learned from Malcolm (2002) that the manuscript was written by Robert Payne, a close friend of Hobbes's, it is not clear who actually conceived it, and the discussion is also open as to whether it is to be considered 'Hobbesian' or not (Malcolm 2002: 80-145).[59] This scholarly debate on the attribution of the *Short Tract* indirectly crosses the relationship between Hobbes and Descartes with the crucial question on the general characterisation of Hobbes's research as mainly ontological or epistemological. Tuck denies the attribution of the *Short Tract* to Hobbes in order to maintain the emergence of his *epistemological* project from its confrontation with Descartes's struggle against scepticism, namely around the problematic relationship between what is '*really* in the external world' and what is perceived, which constituted the 'crucial issue in the new philosophy' (Tuck 1988: 17-18). On the other hand, arguing against Tuck, Zagorin inclines towards the hypothesis that the *Short Tract* was in fact a Hobbesian work, in order to point out that Hobbes's *ontological* project – already shaped in 1636, before his disputes with Descartes on optics – was strictly ontological and independent from Descartes's profoundly epistemological concern against scepticism (Zagorin 1993: 214-15).[60] I shall not try here to solve the '*Short Tract* attribution' problem, not only because it goes beyond my philological expertise, but also because it is not important to my explanation of Hobbes's philosophical development.

Thus I will follow Zagorin's suggestion to leave aside the *Short Tract*, and focus on the theoretical problem implicitly posed through this philological dispute, which I resume as follows: in the light of his philosophical relationship with Descartes, was Hobbes's philosophy a mechanical ontology or an epistemology of mechanicism? My answer will take this apparent alternative as a marker of a development in Hobbes's philosophy in

[59] Malcolm's hypothesis is that the *Short Tract* was almost certainly written but probably not conceived by Robert Payne. A quite authoritative voice for the party of attribution to Hobbes is Schuhmann 2004b.

[60] According to Zagorin, Hobbes's project was, consistently from the outset, to produce a deductive science akin to geometry, with definitions and proofs, centred on body and the knowledge of causes and effects, which should not offer results contrary to experience (Zagorin 1993: 517-18). In fact, I assume Hobbes *intended* to be consistent with these major assumptions, but had to – as much consistently – change the shape of his project after encountering Descartes's.

which the clash with Descartes's philosophy played a crucial role. I will assume that, when Hobbes fled to Paris at the beginning of the 1640s, the problem of light *as motion* was still a key issue in his mechanistic conception of nature and the strategic core of his mechanical theory of knowledge. The field of *optics* implicitly presented problems the solution to which would supposedly allow Hobbes to swallow the epistemological problem into the ontological one, by entirely explaining knowledge – and science itself – in terms of local motion. Therefore I strongly disagree with Zagorin's hypothesis that Hobbes's philosophy was basically independent of the Mersenne circle's anti-sceptical struggle and not even dependent on Descartes's influence (Zagorin 1993: 514),[61] and endorse the hypothesis that Hobbes's early philosophical work 'was developed very largely in response to the issues raised by Descartes in 1637, and that Hobbes's criticisms of Descartes in 1640-41 were fundamental to his own philosophy' (Tuck 1988: 16). This response was not a change in the basic assumption of materialism and of the universality of motion, but it explains how – at the moment when Descartes's physics was already metaphysically founded – Hobbes's attempt to 'transform the categories of traditional metaphysics into categories of physics' (Zarka 1996: 73) was soon transformed into a harsh metaphysical and epistemological struggle against Descartes's dualism. Hobbes's main concern became the creation of a system of sciences through which he was determined to banish all references to immaterial causes, that is to the non-scientific 'offspring of our brain'. And the original battlefield for this epistemological war was optics.

The letters and optical treatises: a clash between theories of matter (passive/active)

Hobbes wrote three optical treatises in a quite short time span in comparison to the considerable length of his life. The first two, in Latin, were probably conceived between the end of the 1630s and the beginning of the 1640s. The *Latin Optical MS* contains explicit polemic references to Descartes's optical theories.[62] The *Tractatus opticus* has a clear geometrical structure and contains no direct references to Descartes, possibly because of Mersenne's 'censorship'.[63] A third treatise in English, *A Minute or First*

[61] Zagorin intends to demonstrate Hobbes's indifference to the sceptical position about sense, taking on Popkin 1982 and Sorell 1988b (Zagorin 1993: 508, 512-15). Zagorin claims that around 1636 (letter 19, in Corr I, 33-36) Hobbes already had established the principles of his metaphysics, that is 'body as the sole reality, the motion of bodies as the universal cause of change, and the subjectivity of sensible qualities'. Such a 'combination' of empiricism and logical rigor in geometrical deduction would be the 'supreme motive' driving Hobbes philosophical research from the beginning (Zagorin 1993: 515-18). What really matters to Zagorin is to point out that Hobbes's project was ontological and metaphysical, but not at all epistemological, because not concerned with scepticism about sensible knowledge (and Descartes's influence) (Zagorin 1993: 517).

[62] The manuscript *MS Harley 6796*, (fos. 193-266) of the British Library, was published by Alessio 1963. The problem of dating the *Latin Optical MS* is very complicated indeed. Some scholars suppose that it was written in the period 1637-40 (or even earlier, e.g. Tuck 1988: 37). Malcolm initially hypothesised that the manuscript was transcribed by Sir Charles Cavendish at the end of 1640 (Malcolm 1994: LIV), but he later concluded that Hobbes 'completed' it during the 'early years of his Parisian stay', that is around 1641-42 (Malcolm 2012: 3).

[63] When Mersenne published the *Tractatus Opticus* as a part of his *Universae Geometriae Synopsis* (1644), he probably suppressed Hobbes's remarks against Descartes to avoid further quarrelling between them (Brandt 1928: 390). The *Tractatus Opticus* was eventually included in Hobbes's OL V.

Draught on the Optics, accomplished between 1645 and 1646,[64] later became part of *De homine* (1658), namely chapters II-IX, but only after being translated into Latin and depurated of all direct polemic references to Descartes (Alessio 1962: 401 ff.). In the original English version the very 'foundations' of Descartes's theory as it was displayed in the *Discourse*, still appeared to Hobbes a main object of controversy, if not of counter-metaphorical scorn:

> To conclude, I shall doe like those that build a new house where an old one stood before, that is to say, carry away the rubbish. (EO; EW VII, 469)[65]

Following this harsh premise, Hobbes concluded his treatise accurately enumerating nine 'rubbish' theories on optics, three of which can be easily ascribed to Descartes. While the first (the sixth in Hobbes's list) refers to a quite technical matter,[66] the second (the seventh) dismisses 'the opinion that light is a bodie, or any other such thing than such light as wee have in dreams', and introduces, last but not the least, the conclusive materialistic attack to the supposed concurrence of the soul to the explanation of vision, which Hobbes had already criticised in the *Latin Optical MS* (LO IV.14, 207-208):

> Lastly, is to be cast away the conceipt of millions of strings in ye optique nerve, by which the object playes upon the braine, and makes ye soule listen unto it, and other innumerable such trash. (EO; EW VII, 469)

Although it is impossible to suppose that Hobbes contributed towards Descartes 'leaving' light and 'keeping' *res cogitans* (that is clarifying his absolute refusal of the hypothesis of any 'materialistic' foundation of knowledge in vision), it seems quite evident that the epistolary debate on optics was a key moment for Hobbes to rethink his physics of knowledge in terms of an epistemology of the 'principles' of knowledge. In this sense it is still possible to follow Brandt when he assumes that, thanks to the theory of light as an 'ideal-case' of rebound movement, Hobbes was trying to reduce psychology and epistemology to a part of his mechanistic ontology (Brandt 1928: 118, 121). If during the 1630s Hobbes had been mainly interested in finding out how local motion could explain perception, by the time he reached Paris he was – at least in part – still attempting to 'reduce the static into the kinetic' (Brandt 1928: 121), and to make of sense perception and knowledge (as movements of the human body) *a part* of his physics.[67] Yet it is still to

[64] It was only partially published as *A Minute or First Draught on the Optics* in the Molesworth edition (EW VII, 467-471). A critical edition of the entire manuscript *MS Harley 3360* of the British Library was made by Stroud 1983 (see EO in bibliography).
[65] It is worth recalling how Descartes in the *Discourse* introduced his method precisely with an architectonic metaphor (AT VI, 11).
[66] 'Sixthly, the opinion that perspective glasses and amplifying glasses are best made of hyperbolicall figures' (EO; EW VII, 469).
[67] It is quite interesting to note that, when Brandt tries to show how in Hobbes's mechanicism matter was from the beginning conceived as *in motion*, although he pinpoints 1641 as the key date (Brandt 1928: 113, 115, 121), he later adds that 'in the year 1641 neither of them [Descartes and Hobbes] had framed their ultimate

be enquired how much the encounter with Descartes affected Hobbes's subsequent philosophical research, in which an epistemology is largely – although quite problematically – displayed. What is clear, their quarrel made a fundamental difference between Hobbes's and Descartes's conceptions of matter emerge: for the 'dualist' Descartes matter was essentially *static* while for the 'materialist' Hobbes it was intrinsically *dynamical*.

Descartes and Hobbes on the static/dynamic characterisation of matter

In general Hobbes's picture of the universe might appear not far from Descartes's, because in it 'when one part is changed a different part will take its place and another part will replace the last-named part, and in this way will be affected in succession, according to the cohesion of the parts, a disturbance – though a slight one – throughout the separate parts' (DM XII.9, 115v-116).[68] Yet there are some apparently minor differences which are not without consequences: many physical issues mark the distance between Descartes and Hobbes on the crucial issue of the activity/passivity of matter, and of the latter's radical identification of matter and motion. And all these differences in fact point towards a basic metaphysical opposition, as I am going to explain.

Particular attention is to be devoted to the different conceptions of what 'natural motion' is, which are made evident by some closely related physical issues. First of all, for Descartes 'by nature' motion is rectilinear, and only a determinate 'quantity' of motion can momentarily pertain to matter as such, while direction (even if only a 'tendency') depends on deviation by contact between bodies and is not directly related to one body's quantity of motion. In fact, light itself is only a 'tendency [*inclination*]' to move: 'And note here that it is necessary to distinguish between motion and the action or tendency to move. […] the action or tendency to move (which, I have said, should be taken for light) must in this respect obey the same laws as motion itself' (AT VI, 88-89).[69] On the contrary, for Hobbes 'by nature' there exist only revolving motions (Mintz 1952)[70] and the motion of a body also

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philosophy of mechanism' (Brandt 1928: 128). Brandt speaks of Hobbes's theory as a 'pure kinetics'. Before him Lasswitz claimed that 'Hobbes's theory of matter is definitely a kinetics' (Lasswitz 1890: II, 219). More recently, Hobbes's philosophy has been defined a 'kinematist theory of power' (Pietarinen 2009: 184). Even more radical is Lupoli: 'matter – as the object of science […] is dissolved into motion; on the other hand, local motion, which is the only object of science […], has no existence out of *matter in motion*: there is a body only as far as there is an *actually moved body*. The absolute epistemological preeminence of *actual motion* as the only explicative principle is counterweighted by its de-ontologisation' (Lupoli 2006: 531).

[68] 'Si omnem cuiuslibet partis motum localem mutationem vocet, verus est, mota enim parte una succedet alia pars in ipsius locum et in huius locum alia, et hoc modo fiet successive propter partium cohaesionem perturbatio saltem levis per partes singulas'.

[69] 'Et remarquez ici qu'il faut distinguer entre le mouvement, et l'action ou inclination à se mouvoir […] l'action ou inclination à se mouvoir, que j'ai dit devoir être prise pour la lumière, doit suivre en ceci les mêmes lois que le mouvement' (Descartes, *Discours*).

[70] Hobbes's 'bias' comes from Galileo's *Discourse*. In this sense Mintz is wrong when he claims that 'Hobbes introduces the principle of inertia, which he adopted with no significant variation from Gassendi and Descartes'; while he rightly states that 'under the impact of mechanistic science and infinity theories, belief in the Circle of Perfection finally broke down. Hobbes' thought contributed generously to the decline of the idea,

has a determinate direction. Therefore, because matter is itself in motion, it has also a 'natural' tendency to preserve not only the quantity of motion, but also its direction, that is the 'kind' of motion with which it is endowed – and ultimately differentiated and defined by.

Consistently with his theory on the propagation of light by 'pressure', Descartes also rejected the existence of an ontological void, because it entailed the possibility of a discontinuity in the medium that contrasted the mechanistic world picture of a universal mechanical causality by contact governed by the laws of motion:

> The action, or inclination to move, [which] is transmitted from one place to another by means of several bodies which touch each other, and which fill all the spaces which is between the two without interruption, follows exactly the same path through which this same action would move the first of these bodies, if the others were not in its path. (AT XI 102-3)[71]

On the contrary, Hobbes hesitated for a long time on this topic and on the connected one of the transmission of light as local motion through an elastic and 'mobile' medium (TO *Hypotheses*; LW 217-18), and he only endorsed his enemy's plenist thesis when he finally adopted ontological determinism, but this choice was not due to exclusively physical issues, as I will explain in Chapter 2.

This contrasting conception of matter is also evidenced by their different explanations of the phenomenon of reflection as a rebound effect. Around this problem of rebound, the hardness and/or the elasticity of bodies also became an argument between the two. All these problems evidently concerned motions so small that they could never be expected to be detected by the senses, and therefore their knowledge was to be accessible only by *suppositio*. Yet to the same problem Descartes and Hobbes provided diametrically opposed solutions, quite consistent with the respective views on matter: for Descartes the cause of hardness was 'static', while for Hobbes 'dynamical'. Descartes explained bodily coherence in terms of the relative rest of particles, while Hobbes explained all kind of static phenomena by the speed of corpuscles: the quicker they rotate, the more relative coherence a body has.[72] Again, for Hobbes the cause was to be found in the natural (circular) internal motion of matter: 'For the cause thereof of hardness, I suppose the reciprocation of motion in those things which are hard, to be very swift, and in very small

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but he himself persisted uncritically in the old belief' (Mintz 1952: 99-100). About Gassendi's version of circular natural motion, see Palmerino 2004.

[71] 'L'action, ou l'inclination à se mouvoir, qui est transmise d'un lieu à l'autre, par le moye de plusieurs corps qui s'entretouchent, et qui se trouvent sans interruption en tout l'espace qui est entre deux, suit exactement la même voie, par où cette même action pourrait faire mouvoir le premier de ces corps, si les autres n'étaient point en son chemin' (Descartes, *The World*).

[72] See Leijenhorst 2004: 174. On the same ground Descartes refused Hobbes's explanation of gravity because he conceived the 'rest' of the internal particles.

circles' (SP V; EW VII, 32).[73] In general, Descartes's and Hobbes's different determination of the causes of phenomena out of the grasp of human senses and therefore explained only by *suppositio* – such as all the phenomena depending on a *materia subtilis* – strongly resembled their opposite views on the inherence of motion to matter. Emblematic of Hobbes's conception of *materia subtilis* as itself in motion was his solution to the problem of the 'individuality' of bodies, which he makes depend on motion only: 'for bodies, as bodies, have no difference; but only from some special cause, that is, from some internal motion, or motions of their smallest parts' (DeCo XXI.5; EW I, 323).

The idea of an external *and* internal incessant motion of bodies was also present in Hobbes's *Tractatus Opticus*, where it is explicitly identified with heat, which was directly connected to the concept of 'conatus' since *De mundo*:

> If someone said, 'The principle of motion is the potential to motion without the act', it will follow that conatus is not an action and does not achieve anything, whether the conatus be inward or outward. Conatus is therefore motion in actuality, even though the motion be very small and indistinguishable by the eye [...] So conatus is nothing but an actual motion, either of the whole body that tends [*corporis conantis*], or of its inner and invisible parts. (DM XIII.2, 118v-119v)[74]

The distance between Hobbes' and Descartes's conception of matter is in effect evident also in the different elaborations of the concept of 'conatus', when treating the connected problem of free-fall. The problem of free-fall was a particularly dividing issue concerning the problem of inertial motion, because it is an example of a natural (and apparently rectilinear) motion caused by no actual clash, and in this sense it seems to contradict the idea that each body's motion is exclusively caused by the clash with another body's motion. Hobbes was soon part of the conjoint efforts carried on by the Mersenne circle to find a mechanical cause for free-fall that could be squared with Galileo's odd-number law.[75] When providing his final solution, however, he used the scholastic term 'conatus' ('endeavour' in the English translation), which originally referred to an *internal* force driven

[73] This determines the different coherence of the parts of a body and therefore hardness and softness 'are not different kinds, but different degrees of quality' (DeCo XXII.2; EW I, 334).

[74] 'Vel si quis dixerit principium motus esse potentiam ad motu sine actu, sequetur conatum non esse actionem, neque quicquam efficere sive ille introrsum sit, sive extrorsum. Est itaque conatus motus actualiter, licet exiguus, nec oculis manifestus […] Omnino igitur conatus est motus actualis, vel totius corporis conantis vel partium eius internarum, & invisibilium'.

[75] Hobbes and Gassendi took it as an indubitable starting point. Other causal explanations of the same law were provided within the Mersenne circle. Because of the impossibility a mechanical-causal explanation of the Galilean law, Huygens, Descartes, and also Mersenne eventually abandoned it (Leijenhorst 2004: 184, 166). On the contrary Hobbes's study of the Galilean formula of free fall goes from *De Motu* (*Ballistica*) to its final account in *De corpore* XVI and XXX (Leijenhorst 2004: 175). In the *Decameron Physiologicum* (1678) Hobbes explicitly provided his final solution to the problem of gravity in opposition to both the scholastic explanation via *vis impellens* and to the 'attractionist' one remounting to Kepler (Leijenhorst 2004: 178): if an 'attractive' action exists, it is due to the downward-pushing force of the ambient air (pockets of air) caused in turn by the Earth's rotation.

by a final causation. Yet, because Hobbes's mechanical causation is by definition exclusively due to actual local motion, therefore conatus as a physical phenomenon *cannot be other than motion*. More precisely, it is the 'insensible' 'first beginning' of all actual motion.[76] Thus Hobbes's final definition of 'conatus' is inspired by Galileo's notion of *momentum*:

> I define ENDEAVOUR [*conatus*] *a motion made in less space and time than can be given*: that is, *less than can be determined or assigned by exposition or number*; that is: *by a point*. (DeCo XV.2; OL I, 177)[77]

This definition evidently depends on Hobbes's 'physical' geometry. Because the science of motion itself resulted from the movement of those parts of human bodies which produce signs in order to construct the geometrical laws that describe the ideal movements of bodies, all objects must be physical – figures, planes, lines, and even points included: 'Hobbes did not see some kind of conceptual gulf between mathematical and physical objects, or between what we would call pure and applied mathematics. Mathematical objects are produced by the motion of bodies' (Jesseph 2004a: 207).[78] Thus Hobbes assumed divisibility of matter as always possible, and in principle if not in practice infinite, so that the geometrical point was in fact for him a quantity as small as possible. It is also clear that in this framework the conatus could only be 'considered as' non-extended and discontinuous, while it actually *was* extended, although 'smaller than any given', and continuous. In this sense the concept of conatus can be said to well represent a main internal problem in Hobbes's research, the tendency 'to differentiate the philosophy of motion from simple geometry', because it helped make Hobbes's dynamics more and more continuous, while his geometry remained 'Euclidian', that is discontinuous (Pacchi 1965: 211).[79] Hobbes's conception of the geometrical representation of motion moved in this sense 'closer to the modern infinitesimal account of motion than did Galileo' (Leijenhorst 2004: 183),[80] and – one might add – than Descartes's algebra. In fact,

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[76] Which Descartes does not fail to explicitly attack: '[He claims inclination to be motion] "for", he says, "the beginning of motion is motion". But who has conceded to him that inclination [*inclinationem*] is the beginning or a part of motion?' (AT III 316; *Letter to Mersenne* 18 February 1641).

[77] 'Definiemus *conatus esse motum per spatium et tempus minus quam quod datur, id est determinatur, sive expositione vel numero assignatur*, id est, *per punctum*'. Hobbes's own English translation is quite longer, as if it aimed to provide further explanation concerning the reference to the geometrical 'point': 'I define *conatus a motion made in less space and time than can be given*: that is, *less than can be determined or assigned by exposition or number*; that is: *motion made through the length of a point, and in an instant or point of time*' (EW I, 206).

[78] On Hobbes's physicalist (kynematic) conception of geometrical constructivism, see also Gargani 1971: 233. In this sense, according to Hobbes geometry can be said to be concerned with both sense and reason: 'Two lines are equal if the difference cannot be discovered by senses or reason' (Corr II, 609).

[79] The matter concerning the concept of conatus is so complex as to require by itself an independent analysis. For a general overview on Hobbes's use of the term, see Barnouw (1992). For some hints on Hobbes's use of the term across physics, ethics, and politics see below, Chapter 2.3.

[80] Although Hobbes opposed the beginnings of modern calculus because of his essentially Aristotelian understanding of mathematics and his personal animosity against Wallis (Leijenhorst 2004: 183).

Descartes refused the Galilean law of free-fall precisely because he refused the ontological discontinuity it seemed to entail, while he was progressively attempting to identify matter and continuous quantity with mathematical description by, on the one hand, postulating the ultimate existence of a *materia subtilis* made of atoms filling any possible ontological void, and, on the other hand, introducing an ontological feature in his notion of *mathesis universalis* that would tend to 'identify mathematical and physical demonstrations' (Sergio 2006: 201).[81]

The perspective opened by the analysis of their different (and in many aspects opposed) theories of motion and the opposite theories of matter they entail, allows us to reconsider the claim that the implicit or explicit attacks on Descartes contained in Hobbes's works and letters always raised issues pointing far beyond that field. It is quite clear that, since the beginning, the opposition between Hobbes and Descartes on optics was not merely a technical one, and what Descartes roughly dismissed was not – or at least, not only – Hobbes's optics, but rather its implications concerning matter, motion and, notably, God and the soul.[82] From the assumption, in optics, that perception is possible as a kind of 'reaction' of the internal motion of the organs of sense to an external motion and clash, it was a short step to conceive the matter compounding the human body as capable of all kinds of motions, and hence to conclude that the entire spectrum of human activities, included the 'highest' ones Descartes would attribute to the soul, could be conceived as an 'internal motion' of human matter (see in particular DeCo XXV). In effect, the theoretical point of divergence had been touched at the outset by Hobbes when – precisely against Descartes's *Dioptrics* – he had claimed that

> here we disagree: for what he calls tendency, I call motion, and what he distinguishes from motion […] I understand as motion. (LO I.10: 151)[83]

On the other hand, against the first and fundamental hypothesis of Hobbes's *Tractatus opticus* – namely that 'every action is local motion in that which acts, such as any passion is local motion in that which is acted upon' (TO I; OL V, 217)[84] – Descartes did not fail to provide a harshly clear and distinct confutation:

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[81] The negation of void, a necessary requirement of the Cartesian synthesis of geometry and physics, is a question around which the discussion on the relation between geometry and physics evolves, and tends to become – as Macherey and Morfino explained in relation to Spinoza and Pascal – a political question concerning the ontology of the social (Macherey 1985, Morfino 2008). On the political relevance of the topic of void in connection with ontological determinism, see below, Chapter 2.3.

[82] See Descartes's quick dismissal of Hobbes's arguments concerning a 'corporeal soul and God' in his *Letter to Mersenne* 21 January 1641 (AT III 287).

[83] 'Hic iam dissentimus; nam quos ille *conari*, ego *moveri* voco, et actionem, quam ille a motu distinguit, ego […] motum esse volo'. Here Hobbes also explicitly argues against the 'vulgar' evidence of a 'conatus without motion' ['facilius recipitur a vulgo posse esse conatum sine motu'] (LO I.10: 151). Stoffel 1987 provides a good account of the implications of the Descartes-Hobbes debate concerning optics on Hobbes's concept of conatus, which is not invalidated by his wrong dating of the *Latin Optical MS* to 1644-46.

[84] 'Omnis actio est motus localis in agente, sicut et omins passio est motus localis in patiente'.

> In his first hypothesis he wrongly assumes that 'all action is local motion'. (AT III, 315)[85]

It is true that Hobbes's initial project of reducing epistemology to an ontology of sense perception required the previous solution of a remarkable series of problems about light that were closely related to mechanical issues concerning motion: the optical problems of the relation between velocity and direction of light, the modality of its transmission through a medium and the velocity of its propagation, were directly connected with other more general physical issues, such as inertia and the relation between movement and direction of bodies, the existence of void and/or of a *materia subtilis*, and the hardness and/or elasticity of bodies.[86] Yet it is clear that a genuinely metaphysical opposition inhabited the clash of their physical optical theories, which made Hobbes aware that he could not maintain his materialistic premises without elaborating an epistemology capable of taking into account the problematic relation between the geometrical representation of nature entailed by mechanical science and the actual nature of matter in motion. Therefore I cannot agree with Brandt's opinion that the core of their struggle lay in the claim for a priority in the elaboration of two different mechanical conceptions of nature which in fact arose simultaneously. In fact, the opposition between a dynamical and a static conception of matter implicitly concerned the subsequent metaphysical quarrel about the existence of the *res cogitans*.

Against Brandt, who claims that Hobbes's *Objections* 'present practically nothing of interest in respect to the mechanical conception of nature' (Brandt 1928: 127), a reading of both Hobbes's *Objections* and Descartes's replies in the *Meditations* makes it clear that what is primarily at stake in the 'optics debate' is a kinematic versus a static characterisation of matter and hence a materialist versus a dualist metaphysics of mechanicism. As explained, Descartes's static, passive account of matter allowed for a separation of motion from matter and its direct connection with God's will as a cause, which justified the necessity of the laws of nature. The regularity of motion was thus not only guaranteed, but also its overall quantity and conservation actively maintained by God:

> It is therefore completely consistent with reason for us to think that, solely because God moved the parts of matter in diverse ways when He first created them, and still

[85] 'In prima sua hypothesi falsum assumit, *quod nempe omnis action sit motus localis*' (Descartes, *Letter to Mersenne* 18 February 1641). In his letter Descartes declares he is replying to 'octo folia', the last part of which, according to Malcolm, corresponded closely to the *Tractatus Opticus* (which Malcolm calls 'Optica'; cf. Corr I, 92-93, n. 2) On Hobbes's lost letter in 'octo folia', see Schuhmann 1998: 70-71. Against Hobbes Descartes recalls the abovementioned hypothesis of the transmission of motion through inclination, on which he founded his theory of the propagation of light.

[86] On these topics see especially Shapiro 1973: 143 ff., who refers to Hobbes and Descartes, and, more in general, Sabra 1967.

> maintains all this matter exactly as it was at its creation, and subject to the same law as at that time; He also always maintains in it an equal quantity of motion. (AT VIII, 61-62)[87]

This was not a late outcome of Descartes's research; it was his project from the outset to found the new physics on the immutability of God's will (AT I, 145-46),[88] and for this purpose he had to purify matter of any hints of autonomous activity. In effect Descartes's matter is basically geometrical and static, so that physical motion entirely follows its 'divine' principles independently of the actual characteristics of matter. The Cartesian body, whose essence is extension, 'lacks the power to set itself in motion' because it is initially set in motion by the immaterial substance of God and, on a smaller scale, by the immaterial substance of human soul. On the contrary, Hobbes's world is in continual motion *because* matter is, as such, in motion: bodies *are* in motion by definition, since they cannot be set in motion by anything but other bodies (Jesseph 2004b: 133). To make it quite simple, for Hobbes existence and motion de facto coincide.

As Hobbes clearly resumes through the famous 'joke' comparing Descartes's 'cogito ergo sum' to the evidently false demonstration that 'I am walking, therefore I am a walk' (AT VII, 172),[89] what is mainly at stake in their quarrel is the idea that for Hobbes matter in motion is itself the essence of all things, and all the 'spiritual' faculties – reason included – *are* in fact the hidden motion of some *materia subtilis* and/or internal parts of the body:

> Reasoning [depends] on names, names [depend] on the imagination, and imagination [depends] (as I believe it does) merely on the motions of our bodily organs; and so the mind will be nothing more than motion occurring in various parts of an organic body. (AT VII, 178)[90]

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[87] 'Unde sequitur quam maxime rationi esse consentaneum, ut putemus ex hoc solo, quod Deus diversimode moverit partes materiae, cum primum illas creavit, jamque totam istam materiam conservet eodem plane modo eademque ratione qua prius creavit, eum etiam tantundem motus in ipsa semper conservare' (Descartes, *Principia Philosophiae*). And of course God's will not only provided the ontological foundation, but epistemological too: 'From God's immutability we can also know certain rules or laws of nature [Ex hac eadem immutabilitate Dei, regulae quaedam sive leges naturae cognosci possunt]' (AT VIII, 62).

[88] 'It will be said that if God had established these truths he could change them as a king changes his laws. To this the answer is: Yes he can, if his will can change. "But I understand them to be eternal and unchangeable." – I make the same judgement about God. "But his will is free." – Yes, but his power is beyond our grasp. In general we can assert that God can do everything that is within our grasp but not that he cannot do what is beyond our grasp. It would be rash to think that our imagination reaches as far as his power' (Descartes, *Letter to Mersenne* 15 April 1630).

[89] '*Nam eodem modo possem dicere:* sum ambulans, *ergo* sum ambulatio.' See also Hobbes's objection to the third meditation: 'My thought, though not separate from me, is distinct from me in the same way in which (as I have said above) jumping is distinct from the jumper. If M. Descartes is suggesting that he who understands is the same as the understanding, we shall be going back to the scholastic way of talking: the understanding understands, the sight sees, the will wills, and, by a very close analogy, the walking (or at least the faculty of walking) walks. All these expressions are obscure, improper, and quite unworthy of M. Descartes's usual clarity' (AT VII, 177).

[90] '*Si hoc sit, sicut esse potest, ratiocinatio dependebit a nominibus, nomina ab imaginatione, et imaginatio forte, sicut sentio, ab organorum corporeum motu, et sic mens nihil aliud erit paeterquam motus in partibus quibusdam corporis organici.*' This is not only something on which Descartes contests Hobbes, it is something

Thus as Hobbes's objections progressively move to the topics of the spiritual substance and to God, Descartes's answers become more and more sharp and their tone more and more dismissive.[91] Finally, he completely misses Hobbes's peculiar distinction between actual 'existence' and 'essence' ('a linking of names by the word *is*'), which, without existence, is 'our invention' (AT VII, 194).[92] In fact their debate on optics, along with their different physics of matter, were part of a struggle between a materialist and a dualist metaphysical foundation of mechanicism, and notably of the relation between physical motion on the one hand and, on the other, the phenomena of perception, knowledge, imagination, reason: in a word, with epistemology.

1.3 Geometry and Physics: The Problem of Method

Once it is clarified that Hobbes's matter is 'in motion' by definition, it is worth following this claim's epistemological implications. I shall therefore try to elucidate the basic epistemology of the different sciences entailed by Hobbes's theory of motion, provisionally taking for granted the unity of his philosophical system in order to analyse the composite methods featuring the different scientific fields. This (fictive) assumption of a methodological unity in Hobbes's oeuvre will guide a brief analysis of *De corpore*, the first part of the *Elementa philosophiae*, Hobbes's 'official' system of sciences which included *De corpore* (1655), *De homine* (1658), and *De cive* (1642). On the basis of such premises, in Chapter 1.4 I will be able to formulate my hypothesis about Hobbes's strategy concerning the relationship between science and political power, thus grounding the analysis of the development of Hobbes's epistemology of civil science I will display in Chapter 2.

Two methods for one science (analytical and synthetical)

In perfect Aristotelian orthodoxy, Hobbes defines science as the knowledge of causes.[93] Two methods must be adopted for the scientific knowledge of causes, synthetical and analytical, that are both necessary to explain the existence of an effect. The synthetical

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that he cannot even accept as an argument: 'When he concludes that the mind is a motion he might just as well conclude that the earth is the sky, or anything else he likes' (AT VII, 179).

[91] 'I think I did give a full enough explanation of the idea of God to satisfy those who are prepared to attend my meaning; I cannot possibly satisfy those who prefer to attribute a different sense to my words than the one I intended. As for the comment at the end regarding the creation of the world, this is quite irrelevant' (AT VII, 181); 'I see nothing here that needs answering' (AT VII, 183); 'All this is completely self-evident' (AT VII, 185). 'As for how we can have an idea of God, I have gone over this *ad nauseam*. There is absolutely nothing in this objection to invalidate my demonstrations' (AT VII, 189).

[92] '*Unde constat essentiam, quatenus distinguitur ab existentia, nihil aliud esse praetor nominum copulationem per verbum*, est. *Ideoque essentia absque existentia est commentum nostrum*.' Descartes does not even consider Hobbes's peculiar kind of nominalism as worth an answer: 'The distinction between essence and existence is known to everyone. And this talk about eternal names, as opposed to concepts or ideas of eternal truths, has already been amply refuted' (AT VII, 194).

[93] For a quite complete account of Hobbes's debts towards Aristotle, see Leijenhorst 2002.

method moves from causes to effects while the analytical one moves from effects to causes. Now, in the exposition and teaching of science only the synthetical method must be used. But in scientific research the two methods actually concur for the discovery (*inventio*) of causes:

> It is manifest, that in searching out of causes, there is need partly of the analytical, and partly of the synthetical method; of the analytical, to conceive how circumstances conduce severally to the production of effects; and of the synthetical, for the adding together and compounding of what they can effect singly by themselves. And thus much may serve for the method of *inventio*. (DeCo VI.10; EW I, 79, italics added)

The same 'mixed' method can be applied to any domain of knowledge with different restrictions, depending on the characteristics of the domain. In this sense Hobbes describes the way human reason can move up and down a chain of related elements by adding or subtracting: 'following' backwards the necessity of their connections or 'building' such a necessity.

Through this same mixed method, in *De corpore* Hobbes links the 'causes or generations' to the 'appearances or phenomena', which are 'internal' movements of mind resulting from the clash of the movements of 'external' bodies against senses (DeCo XXV.2; EW I, 389-91). The movements of external bodies cause the internal movements of human bodies called 'phantasms of sense' or 'imagination' (DeCo VI.1; EW I, 66). Consequently we have a complex system of bodily motions producing different kinds of effects, corresponding to 4 different genres of 'things': bodies, accidents, phantasms, and names (DeCo V.2; EW I, 57-58). Thus physics is concerned with bodily motions as causes and effects of other bodily motions, but a great part of scientific research consists in discriminating – by contrasting these phantasms to geometric models describing 'pure' motion – the accidents, phantasms, and names depending on human senses from the real bodies moving independently of them (DeCo VI.8; EW I, 75-76). This is precisely the repetition, at the epistemological level, of the same task previously carried out by optics at the ontological level, which, according to Hobbes, would permit separating the wheat of the object from the chaff of senses.[94] In fact, both the direct sensation (the internal motion produced by the external moving body clashing against senses) and the subsequent internal image of an external motion continuing after the first sensation, are part of the same understanding of the relation between a cause and an effect, that is two phenomena of local motion. Now, in order to allow the same method to work for both the domains of the 'external' motion of bodies and the internal motion of human bodies that

[94] Cf. also DeCo VI.10; EW I, 79.

produces knowledge, the equivocal use of the terms 'causes' and 'principles' needs to be clarified.

Principles and causes: different epistemologies, same ontology

In *De corpore* Hobbes focuses on the equivocal use of the word 'principle' – putting the blame for it, it goes without saying, on Aristotle:

> The fallacy lies in the equivocation of the world principle; for whereas Aristotle in the beginning of his *Metaphysics*, says, that *the treating of principles belongs to primary science*, he understands by principles, causes of things, and certain existences which he calls primary; but where he says *a primary proposition is a principle*, by principle, there, he means the beginning and cause of knowledge, that is, the understanding of words, which, if any man want, he is incapable of learning. (DeCo V.12; EW I, 63)

Following Aristotle, philosophers would run the risk, then, of using the same term, 'principle', to indicate both some eminent causes of things and the first causes of knowledge, confusing the epistemological value of the 'first principles' of knowledge with the ontological reference to the physical causes of motions. According to Hobbes, although they must have – as any other existing effect – 'all but one universal cause, which is motion' (DeCo VI.5; EW I, 69), we cannot connect the 'names' that refer to these different kinds of 'things' [sic] (the domains of theoretical principles and physical causes) in the same discourse without producing false propositions (DeCo V.2; EW I, 57-58). Hence it is evident that Hobbes's stance entails in physics what Gargani called an '*epistemological indeterminacy*' (*indecidibilità epistemologica*), which was quite in line with Galileo's physics and Descartes epistemology (Gargani 1971: 22, 24), and yet does not entail any ontological separation of the two domains, but just a methodological complication. It is precisely on the basis of this fundamental ontological monism that the same synthetical and analytical methods can be applied both to causes and effects, and to principles and consequences. And yet the very relation between the two domains is – strictly speaking – beyond the grasp of science: it is impossible to have a true and universal knowledge, that is science, of the determinate empirical relationship between a singular physical body and the universal principles of physical science (DeCo V.2; EW I, 58). It is clear that, once the Cartesian epistemological gap entered Hobbes's materialist theory of knowledge, it entailed the assumption of an epistemological dualism de facto.[95]

[95] In a couple of pages that probably represent the most remarkable synthesis of the epistemologies of Descartes and Hobbes in relation to the underlying opposite metaphysical projects, Leijenhorst notes that in his first philosophy 'Hobbes shifts, without explicitly stating it, from the appearance of change (phenomenological perspective) to the physical change of our body as the effect of an external body (realist perspective)' (Leijenhorst 2005b: 117-19). In my interpretation I would like to explain that this epistemological dualism is connaturated to mechanical philosophy precisely because of its passive conception of matter,

In fact, if only local motion can be properly a 'cause' of any phenomenon, we must not underestimate the fact that the principles of knowledge must be themselves effects (phantasms) deriving from 'trains of thought' (imagination), and ultimately relying on movements of 'external' bodies clashing on senses. Therefore Hobbes tries to differentiate the use of the terms 'principle' and 'cause' by referring the first to the bodily movement which produces a phenomenon, and the second to the phantasms of sense and of imagination which are 'principles of science', that is a special kind of *effects* of the same kind of cause: bodily motions. Yet we must follow Malcolm (1990) in admitting that Hobbes is not immune from using the term 'cause' in an equivocal manner.[96] And this is particularly evidenced by the difficulty he experienced in crossing the domains. A few pages after arguing for their radical distinction, Hobbes is obliged to give a causal explanation of the principles of knowledge, whose existence cannot have its origins anywhere else but in motion:

> The first beginnings, therefore, of knowledge, are the phantasms of sense and imagination. (DeCo VI.1; EW I, 66)

Nevertheless, Hobbes's choice appears here epistemologically sound. He states that, though in logic it is not proper to express the relation between premises and conclusions as 'cause', nevertheless it is admitted ('may pass, though it be not properly spoken'), if it is clearly established that 'speech is not the cause of speech', but rather that 'understanding [i.e. a motion in human body] is the cause of understanding' (DeCo III.20; EW I, 43).

In short, although depending on the same ontological 'universal principle' of motion, the principles of knowledge (mathematical or not) and the causes of motion pertain to different epistemological levels, the ontological connection of which is postulated, but not possible to be scientifically known in detail. Therefore the 'internal' *principles* of the knowledge of motion – although they ontologically *must be* homogeneous with any other kind of motion – cannot be epistemologically *considered* the same as the causes of the 'external' motions, which physics is expected to explain. So in the end the two methods of philosophy do not provide the same kind of knowledge, precisely because they rely on two different kinds of theoretical tools. The synthetical method, proceeding 'from the

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independently of what metaphysical project one assumes. In this sense, Hobbes's conception of matter as inherently active can be said to undermine the secure boundaries of the same mechanistic ideology it is part of. See below, Chapters 3.3 and 3.4.

[96] From the consideration that 'Hobbes was sliding […] into an equivocal use of the word "cause"', Malcolm concludes that 'the idea of uniting the knowledge of necessary truths with the knowledge of causes was in the end a snare and a delusion, and this accounts for much of the floundering in Hobbes's later writings on the subject […], not only the chapter on method in *De corpore* [i.e. Chapter 6, which I am discussing here], but also *Leviathan*, where the definition of "science" compromises awkwardly between knowledge of the consequences of names and knowledge of the consequences of facts' (Malcolm 1990: 155). It is worth recalling that Malcolm, who is making his point against the idea of a common foundation of natural and civil science in Hobbes, excludes any possible epistemological explanation of Hobbes's 'equivocal use of the word cause', which is, on the contrary, what I am trying to do here.

generation of things to their possible effects', relies on the 'truth of the first principles of our ratiocination' collectively constituted by the imposition of names,[97] and therefore provides *universal* knowledge. The analytical method, proceeding 'from their effects or appearances to some possible generation of the same', relies on principles 'placed in the things themselves by the Author of Nature' *and* 'by us observed in them', it relies on phenomena, phantasms which provide the *particular* knowledge of natural causes (DeCo XXV.1). The assumption of this twofold methodology eventually allowed Hobbes to define the epistemological distinction of geometry and physics (and all sciences) without rejecting the postulate of the underlying homogeneity of their object: matter in motion.

Overlapping geometry and physics

In fact, for the abovementioned reasons, although the object of all sciences is the same, the different sciences provide a different knowledge of it, according to the varying epistemological relationship between the subject of science and the different phenomena resulting from matter in motion. Thus, although within Hobbes's system of sciences we cannot differentiate geometry and physics claiming that only the second is concerned with bodies, in fact we must consider the different *kinds* of bodies with which they are concerned, and the consequences this entails for the *kind* of knowledge of which they are capable. On the one hand geometry starts from principles and abstract bodies 'built' by reason and imagination, while on the other hand physics is a mixed knowledge of causal chains based on hypotheses chosen thanks to phenomenal observation, by referring to the principles established within the preceding fundamental science. For that reason physics depends on geometry: 'the principles of the science of motion help to frame the hypotheses that the science of the sensible world requires' (Zarka 1996: 73; see also Gartgani 1971: 197).

Such a hierarchical differentiation depends on geometry being a science of abstract bodies entirely depending on the human body (mind), but physics being a science of natural bodies which are instead independent of the human body (mind). In geometry, an exclusively internal movement of mind simply causes another internal movement, such as 'understanding being the cause of understanding': therefore geometrical knowledge is not just *related to*, but also – at the same time – *made of* bodies.[98] In it, principles and consequences are *also* the causes and effects of those phantasms whose construction 'is in the power of the artist himself, who, in his demonstration, does no more than deduce

[97] 'Made and constituted by ourselves, whilst we consent and agree about the appellations of things' (DeCo XXV.1; EW, 388). Names and definitions, of course, can be well or badly chosen according to the motions they are supposed to describe (Jesseph 1996: 100).

[98] 'Because his ontology recognizes only bodies as real, Hobbes concluded that the traditional geometrical definitions of Euclid must be scrapped and replaced by ones defining the objects of mathematical investigation as bodies; points, for example, are bodies whose magnitudes are sufficiently small that they can be neglected, lines are produced by the motion of points, surfaces by the motion of lines, etc' (Jesseph 2004a: 202).

the consequences of his own operation' (SL; EW VII, 183-184). From the point of view of the 'artist', production and demonstration constitute here an identical and unique sequence; therefore 'principles' and 'causes' *coincide* in providing the same kind of explication of consequences and/or effects, because 'the lines and figures from which we reason are drawn and described by ourselves' (SL; EW VII, 184).

Thus, geometry is a *certain* knowledge of abstract principles generated by human mind and of their consequences. It is a synthetical science because its principles are produced by man, but it does not describe phenomenal reality except from those images produced by the human body (as mind) according to the same principles, while physics is a *hypothetical* knowledge of universal relations between causes and effects, but always observing singular causes and effects. It is synthetical only 'in general', because it is related to bodies whose existence is not dependent on man, moved by causes which are not produced by man: therefore physics must refer to geometry for its principles of explanation, analytically choosing – among all the possible hypothetical causes – those that must 'be such as are conceivable' (DeCo XXX.15; EW I, 531), that is more 'rationally' related to the studied effects (phenomena). As any other science concerning natural bodies, then, physics is itself internally 'divided' into an abstract knowledge of principles derived from geometry and a concrete knowledge of a reality which is understandable in the terms of those principles, but not functioning according to that ideal 'perfection', at least at the eyes of our limited knowledge:

> The science, which is here taught, hath its principles in the appearances of nature, and endeth in the attaining of some knowledge of natural causes. I have given to this part the title of PHYSICS, or *Phenomena of Nature*. (DeCo XXV.1; EW I, 388)[99]

In short, geometric construction and physical explanation do not provide the same kind of knowledge. Although the first is the ground of the second, as in fact any actual science is modelled on geometry, the two kinds of knowledge they refer to cannot, at least in principle, overlap. Yet this quite balanced view does not fully account for the complexity either of Hobbes's system of sciences or of his conception of the relation between geometry and physics. Before enquiring the place of civil science in his system of sciences, it is worth explaining in what sense this quite problematic relation in fact hides a more profound adherence to mechanicism.

In effect Hobbes's peculiar overlapping of geometry and physics did not take place through the reference to a God-legislator as happened in Descartes's case. In a certain sense Hobbes's solution appears closer to the early Descartes's hesitation in *Le monde*:

[99] At the end of his work, Hobbes is even more explicit about the different epistemological status of geometrical demonstrative and physical hypothetical knowledge (DeCo XXX.15; EW I, 531).

no warranty of a unifying divinity, but rather a certain independence of the ontological and epistemological level, as witnessed by his assumption of both the existence of atoms *and* the in principle infinite indivisibility of matter. But his postulate of materialistic monism compelled Hobbes to assume also a kind of epistemological continuity between the two fields which required a 'physicisation' of geometry. It is clear that, if local motion causes both movements of external bodies *and* movements in man's body, called phantasms of sense or imagination, there should be no ontological difference between the objects of geometry and physics. It is therefore worth concluding with Jesseph that in Hobbes's philosophy 'the book of nature may be written in the language of mathematics, but the alphabet in which this language is written is nature itself, namely material bodies in motion' (Jesseph 2004a: 208).[100] Yet the alphabet of this 'physicisation' of geometry Hobbes was adopting posed a quite serious foundational problem to his materialistic version of mechanicism, which did not allow for a straight 'geometrisation' of physics, that is a reduction of physical motion to the rules of geometry. On the contrary his purpose arose a whole series of problems which a materialistic metaphysics was not allowed to solve with a simple claim to an immaterial God or Reason. All of which takes us to the strange case of Hobbes's political epistemology.

1.4 The Strange Case of Thomas Hobbes's Political Epistemology

As previously explained, when Galileo attacked Aristotle's qualitative dynamics by means of the ancient Archimedean statics, his geometrisation of local motion was intended to found neither an epistemology nor an ontology of the physical world. His conception of local motion, however, if taken for an ontological principle, entailed an epistemology of relativity that both Descartes and Hobbes tried to exorcize with their metaphysics, by providing a) an epistemological foundation of the scientific point of view consistent with b) the geometrisation of primary qualities required by the Galilean physics of local motion. And, despite the apparent irrelevance for scientific research, the way mechanical philosophers challenged these issues irreversibly shaped the new science which, to the fundamental properties of nature traditionally celebrated by Solomon, had irreversibly added 'motion'.[101]

[100] According to Jesseph 'the centrepiece of Hobbes's new analysis by the method of motion is Chapter 16 of *De corpore*', a chapter that 'was lifted almost straight out of Galileo's *Two New Sciences*' (Jesseph 2004a: 205).

[101] Mechanical philosophers were 'fond of quoting the phrase from The Wisdom of Solomon (11:20) that God "has disposed all things by measure and number and weight", but this traditional ground had to be expanded in order to cover also the unstable and problematical new object of science which motion actually was' (Mayr 1986: 56).

Both Descartes and Hobbes assumed that every single part of matter participates in many motions, transmitted through reciprocal transference. As explained, this creates the problem of which point of view should the subject of science endorse, in order to produce a universal and steady knowledge of its object, matter in motion. Compared to Descartes's solution, Hobbes's difficulties were quite clear: with no *res cogitans* the subject of science is by definition in motion, therefore no absolute point of view on matter in motion can be assumed. Furthermore, the problem of the resistance of matter to a geometrical account cannot be easily solved through a straightforward reference to some kind of divine legislation. And, just to complicate the whole thing, Hobbes was determined to extend mechanicism to the political field where, on the contrary, as in morality, Descartes's metaphysics explicitly denied any possible application of mechanical science, because *res cogitans* introduced an unpredictable element of liberty in the bodily motion characterising the mechanical-physiological functioning of human passions, which made the political field unsuitable for a science of causes.

Hobbes's solution to this set of problems touched, of course, both the subject and the object of his materialistic version of the new mechanical philosophy. And this also in the field of civil science, where he pursued two goals, strictly connected to the epistemological problem inherited by Galileo: a) to build a point of view internal to matter in motion, but – as far as possible – immune from motion; and b) to provide an account of local motion that would reduce the resistance of matter and the threatening unpredictability of motion to geometrical order. On the basis of the previous account of Hobbes's attempt to challenge this problem at the ontological and epistemological level, it is now possible to provide a first glance at the political implications entailed by Hobbes's implementation of Descartes's epistemological approach within a materialistic framework.

Hobbes's civil science in the system of sciences

As should be clear from Chapter 1.3, according to Hobbes a science can be defined by its method (synthetical or analytical), by its theoretical object (principles-consequences or causes-effects), and by the kind of bodies it is concerned with (natural or artificial). The epistemological status of the different sciences, and their relation to their objects, radically change depending on all these factors. This consideration prevents taking Hobbes's *Elementa philosophiae* as the actual achievement of a monolithic, deductive system of sciences. Firstly, because there is no undivided connection between the synthetical and analytical parts of the method. Secondly, because the physical chains of causes and effects, and the logical chains of principles and consequences concern different domains: respectively the motion of different bodies as objects of knowledge, and the a priori structure of scientific (or 'philosophical') deductive discourse. Thirdly, because the variety

of bodies and their relation to human body definitely affects the kind of knowledge one can actually have of them.

After analysing the crucial and paradigmatic relationship between geometry and physics, I shall now enquire after the epistemological status of political philosophy, which Hobbes called *scientia civilis*, through the lens of the larger picture of his epistemology. In effect Hobbes's epistemology was continuously reworked during the quite fast development of his political thought in the 1640s. This development entailed the reconfiguration of the problem of the epistemological status of civil science at each step of its elaboration, *The Elements of Law Natural and Politic* (accomplished in 1640), two editions of *De cive* (1642 and 1647), and the English *Leviathan* (1651). In 1668 Hobbes also published a new version of *Leviathan* in Latin, and wrote an account of the English Civil War he called *Behemoth*, which was not precisely a political treatise: it rather concerned history, a matter the scientific status of which had always been quite problematical for him. The articulated development of Hobbes's civil science will be the object of my analysis in Chapter 2. Here, to cut a long story short, I will provide a synchronic picture of the structure and implication of Hobbes's epistemology of *scientia civilis*, by taking geometry as the starting point, as Hobbes himself did once he had decided – with *De cive* – to govern the domain of moral philosophy as successfully as 'the geometers' had made with their 'province' (DC *Ep.*; OL II, 137).

As said, Hobbes elaborated a materialist and constructivist conception of geometry, which postulated a continuity between the names and principles of geometry, and the physical elements and causes of motion. His peculiar obstinacy to keep this radically materialistic point imposed a price. Not only did this draw the scorn of part of the community of mathematicians, it also conveyed the methodological problems of his geometrical constructivism into the epistemology of *scientia civilis*. In Hobbes's peculiar geometry, points, lines, and surfaces are physical entities, in the same way in which imagination, speech, and all the 'phantasms of mind' are physical effects of bodily motion (of light and sound). In short, the objects of geometry are as physical as any other phenomenon, with the difference that they are entirely under human control. It is precisely starting from the assumption that the possibility to *construct* an object entails the possibility of knowing and controlling it, that Hobbes's epistemological innovation in civil science emerged. He moved from the claim that both geometrical figures and the body politic are artificial, that is a human product:

> Geometry therefore is demonstrable, for the lines and figures from which we reason are drawn and described by ourselves; and civil philosophy is demonstrable because we make the commonwealth ourselves. (SL; EW VIII, 184)

And yet the parallel has a clear limitation due to the different ontological nature of the bodies the two sciences are concerned with. This entails crucial methodological consequences which cannot be overcome by a straight identification of civil science and geometry. While geometry is entirely artificial, civil science concerns an artificial product, the body politic, whose original components are natural bodies, the bodies of men. And these bodies, insofar as they are not built by man himself, are the object of physics, not of geometry. In this sense, it is because of the double nature of its object, natural and artificial, that civil science had to integrate the methods of physics and geometry. And the model of such an integration was of course mechanics.

Civil science and mechanics: same mixed object

Mechanics is quite close to geometry as far as it concerns artificial bodies built by men, and yet the functioning of these bodies is far from the ideal perfection described by geometry. In this sense mechanics can be said to be situated between geometry and physics: it concerns artificial bodies made up of natural raw materials the original structure and functioning of which is independent of men's wills, while their assemblage follows the principles of geometry and can therefore be clearly understood. Now, suppose the raw materials of such artificial bodies are the natural bodies of men, and mechanics becomes a perfectly suitable model for civil science: the artificial bodies it produces are made up of natural components, in principle entirely dependent on – but actually independent of – the producer's control. Only in this sense was mechanics, in the well-known analogy of the 'automatic Clock' Hobbes presented in the preface to *De cive*, the model inspiring a method for a completely new civil science:

> As in an automatic Clock or other fairly complex device, one cannot get to know the function of each part and wheel unless one takes it apart, and examines separately the material, shape and motion of the parts, so in investigating the right of the commonwealth and the duties of the citizens, there is a need, not indeed to take the commonwealth apart, but to view it as taken apart, i.e. to understand correctly what human nature is like. (DC *Praef.*; OL II, 145-46)[102]

Such a privileged relation between mechanics and civil science provided the latter with a quite anomalous methodology. The mixed nature of the bodies with which civil science is concerned gave rise to dramatic questions about its method and theoretical object: was civil science a synthetical deductive knowledge proceeding from first principles (as geometry) or was it an analytical science entailing the observation of facts and the

[102] 'Sicut enim in horologio automato aliave machina paulo implicatiore quos sit cujusque partis rotaeque officium, nisi dissolvatur, partiumque materia, figura, motus seorsim inspiciatur, sciri non potest: ita in iure civitatis civiumque officiis investigandis, opus est, non quidem ut dissolvatur civitas, sed tamen ut tanquam dissoluta consideretur, id est, ut qualis sit natura humana'.

suppositio of hypotheses (as physics)? Civil science was clearly assumed by Hobbes to be a synthetic science, at least in principle, which was to be inscribed into the project of a complete system of science. Thus his *De cive* was supposed to follow *De corpore* and *De homine* along a strictly deductive chain moving from the first principles of philosophy, to natural philosophy, to anthropology and, finally, to the body politic. But Hobbes's decision to publish at the outset *De cive*, before developing the other parts of his system, posed a problem both pedagogical and epistemological, which pushed him to find a possible methodological alternative for civil science. He displayed a possible 'analytical' knowledge for civil science as a partial remedy to the ignorance of those who are not capable of understanding it 'synthetically' starting from the first principles of geometry (DC *Praef.*; OL II, 151), and, I would add, to remedy the impossibility of actually 'taking it apart' into its components, as it would be possible with machines. In fact, this attempt posed further consideration concerning the peculiar epistemological relation between the principles of human nature on which civil science is based and man as the subject of their knowledge. This is something that links civil science to moral philosophy insofar as both primarily concern the knowledge of the principles of human nature immediately evident to all men, through an *internal* evidence which is not far from the one allowed to geometry.

Civil science and moral philosophy: same internal subject

Moral philosophy is in fact concerned, like physics, with the motion of a natural body (man) whose internal motions are impossible for any external observer to grasp. But in this case the natural body object of science is also the subject of the science itself. And this offers to moral philosophy a quite peculiar advantage over physics: moral philosophy can also rely on an 'internal' point of view on the natural mechanisms of the human body, which provides a synthetical 'surplus' beyond the analytical knowledge typical of physics. The privileged internal point of view of the human body studied by moral philosophy allows for a *direct* knowledge of the genesis of the effects from the *internal* causes, even if in this case the causes, that is human passions, are not properly 'built' as in geometry, but only followed along the process of their natural explication. Furthermore, through the understanding of the natural law, moral philosophy can recognize the principles from which right actions can be synthetically derived and, under certain external conditions, produce consequent effects. In short, moral philosophy is a science of natural bodies with some privileges: although by definition not as *certain* as geometry, it is more certain than physics. It can provide the direct knowledge 'from within' of the principles and causes of motions in man's natural body. And, what is more important, among all *natural* sciences, moral philosophy appears to be the only one the functioning of whose object is possibly *dependent* on the science we have of it, as it happens in geometry.

The dual relationship to mechanics and moral philosophy, to the mixed bodies of the first and to the double epistemological perspective allowed by the second, provided the peculiar epistemological shape of the twofold method of civil science. It is thus that the analytical and synthetical methodologies could become in Hobbes's civil science the opposition of two different and *independent* methods for the knowledge of the same object.

Civil science as analytical* and *synthetical

It is precisely in Chapter VI of *De corpore*, devoted to method [*De methodo*], that Hobbes speaks of two possible methods for those who want to build civil science. Firstly,

> they that have attained the knowledge of the passions and perturbations of the mind, by the *synthetical method*, and from the very first principles of philosophy, may by proceeding in the same way, come to the causes and necessity of constituting commonwealths, and to get the knowledge of what is natural right, and what are civil duties. (DeCo VI.7; EW I, 73-74)

This kind of knowledge is based on the 'principles' of human nature, the motions of human bodies and in particular the internal motions of mind (passions and perturbations) and the laws of human reason, that is the 'laws of nature'. Starting from the self evident first principles of motion it proceeds deducing *synthetically* their consequences and thus achieving 'all other knowledge appertaining to civil philosophy' (DeCo VI.5; EW I, 73-74). The problem of this ideally perfect method is that 'universal principles' as such 'cannot be demonstrated': they can only be known 'by nature' (cf. DeCo VI.12; EW I, 80), i.e. 'by themselves' (cf. DeCo VI.15; EW I, 84). Therefore another method is necessary not only as an alternative to the properly scientific synthetical one, but as a *precondition* for it. In fact, on the other hand,

> they also that have not learned the first part of philosophy, namely *geometry* and *physics*, may, notwithstanding, attain the principles of civil philosophy, by the *analytical method*. (DeCo VI.7; EW I, 74)

This second kind of knowledge *starts* from the idea of justice and discovers *analytically* the principles compounding it, 'by subtraction' from the idea of justice, and can eventually be discovered to coincide with those directly experienced by any man observing the functioning of 'his own mind':

> For if a question be propounded, as, *whether such an action be just or unjust;* if that *unjust* be resolved into *fact against law,* and that notion *law* into the *command* of him or them that have *coercive power* […] which may be known to be so by any man's experience, that will but examine his own mind. And, therefore, from hence

> he may proceed, by compounding, to the determination of the justice or injustice of any propounded action. (DeCo VI.7; EW I, 74)

It is clear that the second way eventually turns to a new synthetic operation, which starts this time from a principle extracted from a direct 'internal' experience, thanks to a previous analytical operation. Therefore we must conclude that the first path also had to be at least partially analytical, because it started from principles whose '*inventio*' – by definition non-demonstrable – could proceed only from sense. In fact, this problem of the evidence of the first principles, which Descartes had solved through the self-reflexivity of cogito, expands on the whole of Hobbes's philosophical research, so that a kind of circularity concerns the method of philosophy as such:

> So that it is manifest, by what has been said, that the method of philosophy, to such as seek science simply, without propounding to themselves the solution of any particular question, is partly analytical, and partly synthetical; namely, that which proceeds from sense to the invention of principles, analytical; and the rest synthetical. (DeCo VI.7; EW I, 74-5)

In fact, the principles of any science cannot be 'demonstrated', because the *odos* towards their evidence is strictly individual, as it is, in general, a late result of the action of bodies on the senses. And this indemonstrability makes them depend on pedagogy and ultimately on the power that historically institutes names and definitions. Because there is no rule for choosing the starting point of an analysis, no first principle can be granted by any definitive methodology, not even geometry, the new queen of sciences:

> Because there are many means by which the same thing may be generated, or the same problem be constructed, therefore neither do all geometricians, nor doth the same geometrician always, use one and the same method […]. If the question be much complicated, there cannot by any of these ways be constituted a certain rule […] but the success will depend upon dexterity, upon formerly acquired science, and many times upon fortune. (DeCo XX.6; EW I, 312-314)

One might guess that on this point Hobbes incredibly anticipates non-Euclidean geometries, which do not take into account the 'normal' (related to human perception) conception of three-dimensional space, nevertheless allowing the construction of models that are perfectly functional in understanding and operating on different sectors or scales of physical reality. According to Hobbes the '*axioms of Euclid*' can be entirely demonstrated by the internal logic of the artificial bodies which they permit to be built, without any reference to experience, because they are not 'principles of demonstration' but 'petitions', that nevertheless have 'by the consent of all men gotten the authority of principles', that is power:

> Those *petitions*, or *postulata* (as they call them) though they be principles, yet they are not principles of demonstration, but of construction only; that is not, of science but of power. (DeCo VI.13; EW I, 82)

As a result, geometry was related to power both in its principles and in its effects: its principles depended on the power capable of imposing a common consent upon men through teaching, its effects on a power capable of imposing them upon matter through mechanics.

Civil science as geometry (through mechanics and ethics)

The right way to understand Hobbes's prospected equivalence of geometry and politics in his philosophy, therefore, lies in the fact that they are both constructive sciences based on the 'linguistic' power over definitions and names, that is, entirely dependent on the power which (im)poses their 'principles'. In *De homine*, Chapter X, entitled *De Sermone et scientiis*, after recalling that the use of language 'did not get man better, but improved his power' (DH X.4; OL II, 92),[103] Hobbes goes back to epistemology, explaining how the only sciences demonstrable *a priori* are those 'the generation of which depends on the free will [*arbitrio*] of men themselves' (DH X.5; OL II, 92).[104] These include geometry; exclude physics, which is nothing more than a 'mixed mathematics' based both on *a priori* and *a posteriori* knowledge; and – not at all surprisingly – include ethics [*ethica*] and politics [*politica*], because

> those principles thanks to which we know what are *just* and *fair*, *unjust* and *unfair*, i.e. the causes of justice, and precisely the pacts and covenants, are made by men (DH X.5; OL II, 94)[105]

Neither geometry nor civil science represent the reality of the bodies they are concerned with as it actually is, they just provide *a priori* the formulas of their ideal functioning, starting from which it is possible to plan an intervention on them. Both of them are sciences of abstract motions depending on principles *derived* from senses, *posed* by means of power, and *demonstrating* their strong, practical effectuality if applied to existing bodies. But the analogy with geometry stops here, because the artificial body of civil science is made of natural bodies, as is the case with *mechanics*, and because the knowledge of these natural components is possible from within, as with *ethics*. In conclusion, while geometry is a pure and perfect science of a special kind of artificial bodies, civil science is in fact a science of 'mixed' bodies (artificial bodies made of peculiar natural ones) that constitute at the same time its object and subject. As a consequence, it

[103] 'Homo non melior fit, sed potentior'.
[104] 'Quarum generatio dependet ab ipsorum hominum arbitrio'.
[105] 'Propterea quod principia, quibus *justum* et a*equum* et contra, *injustum* et *iniquum*, quid sint, cognoscitur, id est, justitiae causas, nimirum leges et pacta, ipsi fecimus'.

has to be double-sided, as its twofold connection with mechanics and ethics demonstrates.

Like mechanics, civil science is synthetical, or a priori, inasmuch as its principles are produced by 'geometrical' reason and the reality it is concerned with partially depends on their position. Machines are artificial and made up of natural 'parts', and they can be geometrically known and produced by men. And that also goes for the body politic. But there are crucial limitations for the 'mechanical' analogy: since we cannot actually disassemble the body politic, we are not in a position to control its process of production. And in effect, the analogy between civil science and mechanics is not widespread in Hobbes's writings in a way consistent with his assumption of mechanistic materialism. Because of the patent impossibility of assuming an internal point of view on the causal chains that actually produce the body politic, which presents itself as a ready-made artificial body, a complementary analytical approach was required. And in effect, like ethics, Hobbes's civil science can *actually* gain the advantages of a knowledge *from within*. This is achieved by building an artificial point of view, internal to the body politic, or at least *assumed as such*. This point of view marks the epistemological place Hobbes reserves to the sovereign in his civil science. In this sense one could claim that Hobbes's civil science, conceived as an 'ethical science' of the body politic, based on geometry and close to mechanics, is 'synthetically' accessible only from the sovereign's point of view.

To the epistemological limitations of a 'mechanical' civil science an unexpected efficacy is therefore offered by the epistemological insight of ethics. As a matter of fact, the natural bodies of men are for civil science the medium to enter the causal chains that materially constitute the body politic both at the epistemological and at the ontological level. Although it is not possible for any man to acquire an 'internal' point of view on the body politic in order to build a purely synthetical science, yet by empowering ethics civil science can produce considerable effects on the body politic: under the condition of the exercise of civil power the construction of covenants *can* produce real effects on men's wills. In this sense Hobbes's civil science, a mix of mechanics and moral philosophy, is not to be considered merely descriptive, but rather strongly prescriptive and in fact – at least in principle – *productive* of its own object, according to the model of geometry.[106]

And here comes the big problem, because both geometry and civil science require their principles, the definitions, and the names on which they are based to be steady and, in a certain sense, immune from motion. In Hobbes we have no metaphysical hook for this. As we learn from him, there is no more stable body in his philosophy than a well built and

[106] The problematic epistemological status of a mechanistic civil science will be the core of my argument concerning the epistemological agenda of mechanicism in Chapter 3.3.

ordered commonwealth. In effect, in order to exist, science needed not only *a long term existence* out of the state of nature, but also a particular enforcement by the state: in short, a politics of science was needed. Hence for conjoint epistemological *and* political purposes Hobbes planned an artificial body, the state, a great living machine which would be long-lasting (although not eternal, because *Leviathan* is still a '*mortal* god'), producing perpetual-like effects, and in particular a foundation of science by means of an artificial soul, the sovereign, which – securing the Commonwealth – would politically institute the 'principles and names' on which peace and science (that is philosophy) are ultimately grounded.[107] Within a materialistic framework, only the functioning of such a machine could *embody* (that is make exist) Descartes's metaphysical subject of science, thus fulfilling the purpose to ground scientific research, on the one hand, and also political praxis, on the other, without recurring to the acrobatic performances of Descartes's provisional moral. This point of view, which civil science could produce in theory, only sovereign power could actually endorse and make last. Thus Hobbes increasingly conceived the relation between civil science and power as a circular relation, in which politics had primacy. And the primacy of politics was soon extended to all the domains of philosophy, as it was politics that provided the *material* conditions for the possibility of science itself. Indeed, according to Hobbes's own doctrine, also geometry was in danger:

> For I doubt not, but if it had been a thing contrary to any man's right of dominion, or to the interest of men that have dominion, *that the three angles of a triangle, should be equal to two angles of a square*; that doctrine should have been, if not disputed, yet by the burning of all books of geometry, suppressed, as far as he whom it concerned was able. (Lev XI; EW III, 91)

Consistently with the purpose to save science from the arbitrary powers which would adhere to custom rather than to reason, Hobbes's research eventually generated a subject of science that was entirely dependent on the very power that could grant its own existence. According to the 'genealogy' he presented in *Leviathan*,

> *Leisure* is the mother of *philosophy*; and *Commonwealth*, the mother of *peace* and *leisure*. Where first were great and flourishing cities, there was first the study of *philosophy*. (Lev XLVI; EW III, 666)[108]

[107] As Lebrun 1983 explains, Hobbes's sovereign does not *create* truth, it rather *institutes* it by setting the code for interpretation against the moving background of individual passions. Yet what Lebrun interprets as Hobbes's *solution* to the Platonic problem of stabilising 'significations' is in fact the mark of an aporia: the 'impossibility of keeping Platonic essentialism by maintaining the political and epistemological imperative of fixing sense' (Balibar 1992: 7). See below, Chapter 3.1.

[108] Thus the Commonwealth is the 'grandmother' of philosophy, and the lineage can be further extended, since *fear of death* is certainly for Hobbes the mother of the Commonwealth. On the other hand, it is worth highlighting (as it has been pointed out by Foisneau 1990: 185) that the study of philosophy derives from the desire of knowledge, that in turn determines – in the moderate ones, at least – a tendency towards the submission to a common law. Thus in *Leviathan*: 'Desire of knowledge, and arts of peace, inclineth men to

The shifting subject of civil science

In the next chapter I will study the epistemological development of Hobbes's civil science during the 1640s, on the ground of the assumption that, from *De cive* onwards, Hobbes had to abandon the goal of deducing the principles of civil science from the general principles of motion. During his French self-exile in the 1640s, after his problematic encounter with Descartes and the entering into Mersenne's entourage, his approach became strictly epistemological, and the problem of the access to the first principles of motion, due to his radical materialistic assumption, became central to his epistemology. Thus his main epistemological concern soon became the construction of a point of view internal to matter but in some way immune from motion, whose steadiness and clearness would equal Descartes's *res extensa*: a point of view which could grant the basis of science, giving to 'names' the solidity of the principles characterizing scientific knowledge. Hobbes, who undoubtedly was a metaphysical materialist, rejected any incorporeal foundation for the abstract and universal subject required by Descartes's mechanical science. And yet the necessity to ground the principles of science compelled him to look for a technical-political solution to his epistemological problem. For this purpose he projected a paradoxically transcendental-immanent subject of science, a point of view which science could produce in theory, but only sovereign power could actually endorse and make last.

The strategic role played by the subjects of science and of power is in fact part of a story that goes far beyond the boundaries of Hobbes's enterprise, a story that can be briefly pictured through the permutations of the same simple structure occurring in the works of Machiavelli, Descartes, and Hobbes. When Machiavelli dedicated *The Prince*, the summa of his political science, to De' Medici (the grandson of *the Magnificent*), he was in a way – one might say – anticipating Galilean relativity, and situating the subject of science in the interplay of powers of the different points of view:

> For just as those who draw landscapes place themselves down in the plain to consider the nature of mountains and high places and to consider the nature of low places place themselves high atop mountains, similarly, to know well the nature of peoples one needs to be prince, and to know well the nature of princes one needs to be of the people. (Machiavelli 1532: 4)[109]

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obey a common power: for such desire, containeth a desire of leisure; and consequently protection from some other power than their own' (LEV XI; EW III, 87). Once outside the state of nature, the 'proclivitas' present but frail in human nature would be more and more empowered in the commonwealth, where it might become part of the political organisation itself, according to the fact that not only human nature, but the *laws of nature* are clear evident and, last but not least, still.

[109] 'Né voglio sia riputata presunzione, se uno uomo di basso ed infimo stato ardisce discorrere e regolare i governi de' Principi [Nor do I hold with those who regard it as a presumption if a man of low and humble condition dare to discuss and settle the concerns of princes]; perché così come coloro che disegnano i paesi,

In Descartes's and Hobbes's times this multiplication of the points of view was not at all a consolidated value in natural philosophy, neither could it be in political philosophy, of course.[110] As already explained, with his metaphysical move – the separation of *res cogitans* and *res extensa* – Descartes had saved the subject of science from motion. He had separated the neutral, external, and universal point of view of the subject of natural science from the spectacle of God's clocklike artwork. The price to pay was an ontological gap between the deterministic functioning of nature and the metaphysical liberty characterising human agency. On the one hand Reason was the disembodied external, clear, and distinct look of the subject of science on 'natural motion', and on the other hand Reason was also one of the causes – among others, that is passions – of 'human motion'. But in this case Reason was only partially accessible from the contingent point of view Descartes assigned, in his *Discourse*, to a provisional moral, and in fact no *geometrical* science of morality was possible for Descartes precisely because Reason was – by definition – not accountable for in terms of mechanical motion.[111] And consequently, there was no universal place for the subject of political science either. This is evidenced by Descartes's own variation of the same structure formerly displayed in Machiavelli. It recurs in the advice Descartes offered in 1646 – to the Princess Elizabeth of Bohemia[112] – concerning precisely Machiavelli's dedication ['*préface*' sic] to *The Prince*. In his letter Descartes claimed he did not share Machiavelli's theory, and in particular the way political knowledge was to be drawn according to the latter:

> The pencil only represents things which are seen from afar, but the main reasons for the actions of Princes are circumstances so particular that, if one is not Prince himself […], he cannot imagine. (AT IV 492)[113]

This was like saying that political knowledge cannot be a science precisely because the subject of political science cannot be situated outside of particular political circumstances,

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si pongono bassi nel piano a considerare la natura de' monti e de' luoghi alti, e per considerare quella de' bassi si pongono alti sopra i monti; similmente, a cognoscer bene la natura de' popoli bisogna esser Principe, ed a cognoscer bene quella de' Principi conviene essere popolare' (Machiavelli, *Il Principe*). This Lorenzo De' Medici was the grandson of the better-known Lorenzo the Magnificent, who died in 1492, long before the first draft of *The Prince* around 1513.

[110] See the convincing picture offered by Toulmin 1992.

[111] Descartes sharply separated not only the object, but also the subjects of natural and of human philosophy, and made of moral and *political* science – forcedly concerned (also) with the transcendent liberty of *res cogitans* – a non-geometrical one. And for long time he made of man an empirical-transcendental monster, and of matter a perfectly passive support on which motion had been firstly imposed by God through the laws of nature, and could be imitatively imposed by his partial and quite imperfect image through technological effort. I am not adopting this basic ideological view of technology as simply the 'application' of science, that allowed to make of Descartes the easy target of all the criticisms concerning a techno-scientific male-domination of the female-nature. Although Descartes's philosophy can partially authorise this view, it is also traversed by different kinds of tensions which problematise this too simple picture.

[112] In fact *former* princess: at the time in exile in The Hague.

[113] 'Car le crayon ne représente que les choses qui se voient de loin ; mais les principaux motifs des actions des Princes sont souvent des circonstances si particulières, que, si ce n'est qu'on soit Prince soi-même, ou bien qu'on ait été fort longtemps participant de leurs secrets, on ne les saurait imaginer' (Descartes, *Letter to Elizabeth of Bohemia*, September 1646).

in order to look at them 'from afar'. As a result, Descartes had separated the neutral external universal point of view of the subject of natural science from the internal and contingent point of view of the politically effective subject of political science. It is clear that from Descartes's perspective science and power could not reside in the same subject. This allows us to frame the problem as follows: as long as the subject of knowledge is in motion (as it happens in Machiavelli), the subject of science is not absolute and steady, but it actually *can* produce political effects in the conjuncture; if the subject of science is grounded on a still point of view external to the situation (as it happens in Descartes), scientific knowledge is absolute and secured, but it is also neutralised and no longer effective.

On this basis, it is possible to appreciate Hobbes's own variation on the same structure. We can find it at the outset of *Behemoth*, where the Cyclopic and sovereign gaze of the subject of mechanical science lurks over both the realms of nature ['place'] and history ['time'], conveying them into the unified horizon of objectivity:

> A. If in time, as in place, there were degrees of high and low, I verily believe that the highest of time would be that which passed between 1640 and 1660. For he that thence, as from the Devil's Mountain, should have looked upon the world and observed the actions of men, especially in England, might have had a prospect of all kinds of injustice.

Although the historical moment might be passed, history – conceived as 'the relation' of actions, causes, etc. – appears here the lever that can artificially raise the subject at the height of that past conjuncture, allowing for a sufficiently detached, scientific, 'panoramic' view on human actions:

> B. I should be glad to behold that prospect […]. I pray you set me, that could not see so well, upon the same mountain, by the relation of the actions you then saw, and of their causes, pretensions, justice, order, artifice, and event. (Beh; EW VI, 165)

In order to contrast with Descartes's metaphysical dualism, Hobbes was not only betraying Galileo's principle of the relativity of *natural* motion, he was also radically contrasting Machiavelli's 'political epistemology' of *human* motion. Through a kind of demoniac pact, Hobbes eventually exchanged the *conjunctural efficacy* of a subject of knowledge in motion *within* history, for the *universality* of a subject of knowledge quite steady and – as far as possible – safe *at the margins* of historical and natural motion, on the devil's mountain. But for this pact there was, of course, a price to pay. And in fact this epistemological move eventually made the subject of science entirely dependent on political power.

Where was this move originated, and what did it entail? I think this can be explained at different levels: a) at the level of the *political* agenda, and this is a work the synthesis of which was Skinner's outstanding achievement; [114] b) at the level of Hobbes's *epistemological* agenda, and this is a work yet to be done. Both perspectives concur to give shape to Hobbes's *ideological* choices, motivated as much by the urgencies of his times, and by the opportunities for the theoretical understanding and the actual organisation of the body politic offered by the new philosophy of nature. When Hobbes injected mechanics into the inherited framework of political philosophy, the new science was carrying a whole set of epistemological and metaphysical problems. During the 1640s Hobbes progressively incorporated Descartes's solutions to these problems into his materialistic philosophy. This led him to privilege – also in the new civil science – *one* of the two structural features of modern science: the tendency towards geometrical formalisation, in a word, 'deduction' rather than experimentation.[115] In this sense I believe Hobbes's political philosophy must be read as an ideological response to the non-geometrical and non-mechanical functioning of 'matter' and of 'human matter' evidenced by the threatening *experimental practices* carried on during the first half of the seventeenth century both in the new Galilean science of nature and in the English Civil War.

[114] It is worth pointing out that Hobbes's 'political' agenda as it is understood in Skinner's research – i.e. as the way an individual's interests are influenced by her/his environment – will not be taken as exhaustive of Hobbes's 'ideological' agenda. On the other hand, I will not assume a superstructural determination of Hobbes's thought by class or group interests. From the perspective I am adopting here, an ideological agenda is the intersection of complex processes of which neither the individual nor the social system, however conceived, are the sources, but rather their relation. And in structuring this relation, collective (historical, political, epistemological) and individual processes and exigencies overlap, from which *also* individual or collective 'interests' emerge.

[115] Whether actual or imaginary, the emerging mechanistic world picture would affect the development of political theories and practices during the following centuries. And – as I would like to suggest with my work – the basic features of the early-modern mechanistic world picture, although attacked and destroyed at the level of the natural sciences, still informs our approach to political theory and science (see Conclusion).

Chapter 2

The Development of Hobbes's *scientia civilis*

Hobbes lived in Paris in self-exile for about 11 years, from 1640 to 1652. When he fled from England in November 1640, he had already written (but not yet published[1]) his first political treatise, *The Elements of Law Natural and Politic*. The manuscript had circulated since May 1640 (Corr I, 115), which remarkably added to Hobbes's reasons for leaving immediately after the establishment of the Long Parliament. Once in Paris he wrote *Elementorum philosophiae sectio tertia de cive. Per me reges regnant, et legum conditores justa decernunt*, a first manuscript draft which circulated among friends in 1641 and, thanks to Marin Mersenne, was later printed in a few copies in 1642[2] (only in 1947 the much more diffused definitive edition appeared in Amsterdam as *Elementa philosophica de cive*[3]). A few months before going back again to England in February 1652, he published *Leviathan* (1651).[4] During the whole period he had been working consistently on *Elementa philosophiae*, the lifetime project of a philosophical system he accomplished in 1658 with the publication of *De homine*.

In the preceding chapter I examined Hobbes's philosophy, picturing it as a systematic whole by methodologically leaving alone many of the inconsistencies scholars have focused their criticisms on. My aim was to analyse the theoretical connections between the different fields of his research, and hence to grasp the peculiar epistemological perspective he intended to adopt in civil science. In contrast, I am presenting here the hypothesis of a strong change in Hobbes's approach to the problem of knowledge at the beginning of the 1640s, when he was shifting from an ontology based on the theory of light to an epistemology based on the first principles of science. In this shift the relationship with Descartes's research certainly had an important role to play. In Chapter 1.2 I followed Brandt in introducing the relationship between Hobbes and Descartes through their debate on optics, because it was crucial in order to understand the

[1] And in fact he never did. It was Tönnies who discovered that the 1650 edition of *Human Nature; or the Fundamental Elements of Policy* and of *De Corpore Politico; or the Elements of Law Moral and Politic*, was in fact the unauthorized disjunction of one unitary manuscript Hobbes never intended to publish (Tönnies 1889: v-vii). This editorial trick determined for many commentators the equivocal identification of the two parts of *The Elements of Law* as two parts of Hobbes's philosophical system (*De homine* and *De cive* respectively).

[2] 'Printed' rather than published, since 'these copies were not put on sale at any bookseller' (Tuck 1998: XIII; see also Warrender 1980: 40).

[3] A French version appeared in 1649 by Hobbes's friend Samuel Sorbière. An English version, called *Philosophicall Rudiments concerning Government and* [*Civill*] *Society*, appeared only in 1651. The translation was signed C.C., whom Malcolm identifies as the young poet Charles Cotton (Malcolm 2002: 241 ff.).

[4] Only in 1668 a quite re-managed Latin version of *Leviathan* appeared, when Hobbes was also writing *Behemoth*, a historical treatise on the English Civil War. With these texts I will mainly deal in Chapters 3.2 and 3.3.

emergence of a new problem in Hobbes's theory of knowledge at the beginning of the 1640s. The encounter with Descartes injected into Hobbes's research the anti-sceptical exigency that led him to adopt a new epistemological approach which prolonged for more than ten years the gestation of *De corpore*, the starting piece of his whole philosophical system, and resulted in the premature birth of the third piece of the system, *De cive*, which was presented in complete epistemological autonomy. Hence – going farther than Brandt – I am now enquiring what in this change was at stake for Hobbes's *political theory*. As a matter of fact, it was precisely while his political thought underwent its major development that Hobbes had crucial philosophical disputes: not only with Descartes, but also with Thomas White and with John Bramhall on topics such as materialism, optics, human nature, liberty, and determinism. Along this path, Hobbes's radical materialism could not avoid challenging the Cartesian solution concerning the epistemological foundation of mechanics, and reviving the ancient problem of the relation between science and power. These conjoint issues eventually made epistemology and politics the two sides of the same research project.

On these grounds I shall consider the eleven years that run from *The Elements of Law* to *Leviathan*, in order to articulate Hobbes's philosophical project with the main shifts in his epistemology of civil science. To this end, the peculiar positioning of *De cive* at the crossing of two 'lines' of research – epistemological and political – will allow us to 'calculate' the impact of Hobbes's *systematic* project on the development of his political theory. Firstly, I shall display the ontology of the body politic contained in *The Elements of Law*, trying to show its connection with Hobbes's early researches on natural philosophy through the lens of his physics of light. Secondly, I shall explain how in *De cive* Hobbes abandoned a merely ontological level of the discourse in order to found civil science on its own principles, yet firmly refusing Descartes's metaphysical assumptions. My aim is to show that the 'epistemological shift' of *De cive* transformed Hobbes's political theory from an *ontology* of the body politic based on the mechanics of light to an *epistemology* of the laws of nature conceived as the principles of right reason. The analysis of this transition will pinpoint two connected issues, the concepts of 'law(s) of nature' and 'right reason', evidencing the discontinuity in the use of these concepts between *The Elements of Law* and *De cive*.

Hence I shall enquire into Hobbes's progressive consolidation of *determinism* during the 1640s, when he made of it an ontological postulate (the guarantee of the neutrality and objectivity of science) that would grant the actual power of reason once it was implemented with civil power. This ideological development I shall sketch by enquiring into the state of the art of Hobbes's research in natural philosophy at the middle of the 1640s

(particularly as it results from the pages of *De motu* and the *Treatise of Liberty and Necessity*), in connection to the conceptual framework he was adopting in civil science. This research was strictly intertwined with Hobbes's subsequent reformulation of his views concerning the themes of liberty and power, and progressively brought him to adopt ontological determinism as a postulate of his mechanical philosophy and to endorse its consequences in political theory.

Although Hobbes's purpose of establishing an equilibrium between science and civil power remained relatively unvaried throughout his political research, the epistemological shift of *De cive* raised in his civil science apparently insurmountable problems of consistency about the political power of reason. As I am going to explain, the new approach compelled Hobbes to intensify rather than to abandon the reference to a geometrical foundation of civil science, thus determining a fatal tension in his philosophy between the perfection of the epistemological model and his ontology of physical motion. This entailed a definitive commitment of civil science to the incarnation of right reason in the representative function of the state through a deliberate fiction, the sovereign as a '*persona*', who would be an adequate cause of social order in substitution for the powerless perfection of science.

From this perspective *Leviathan* will appear an 'ideological synthesis' of the questions that the epistemological shift of *De cive* had left wide open. This ideological synthesis Hobbes achieved with a twofold move. On the one hand he made of 'determinism' a methodological postulate (the guarantee of the neutrality and objectivity of science) and the ontological foundation of the effective power of the laws of nature and of the existing political state of things. On the other hand, and at the same time, he emptied the concept of 'right reason', by postulating the absolute absence of (divine) justice and its coincidence with the exercise of power *de facto*. These conjoint assumptions reduced Hobbes's civil science to both an ideological neutralisation of scientific knowledge and an unconditional apology for state power. On these grounds, I shall explain in Chapter 3 that Hobbes's ideological synthesis entailed an entire political pedagogy perfectly consistent with Descartes's mechanistic metaphysics.

2.1 From the Ontology of *The Elements of Law* to *De cive*'s Epistemology

Motion-optics-knowledge in The Elements of Law

The letters on optics, along with the metaphysical dispute portrayed by the *Objections to the Meditations*, constituted a battlefield in which Descartes and Hobbes debated the

relation between ontology, epistemology, and metaphysics, both being aware of not having found a theory of light which could be a consistent solution to their physical *and* epistemological problems. To both of them the theory of light, because of its clearly geometrical structure, offered the perfect model for a possible explanation of vision in entirely mechanical terms. And, because vision was a matter of local motion and pressure by contact between particles, the model was in principle fit for all processes of knowledge depending on sense perception. Nevertheless, the model did not easily allow them to explain the highest activities of mind, like memory, imagination, and reason. Most of these processes were largely explored in mechanical terms by both Descartes and Hobbes, and the latter never gave up to the postulate that all of them had to be in principle reducible to a mechanistic account. In fact it was only for 'Reason' that Descartes had an alternative solution which, although clear since the *Meditations* (1641), was fully displayed a few years later in *Principia Philosophiae* (1644). His metaphysical solution definitively cancelled the hypothesis that a theory of light could be the model for a possible foundation of rational knowledge, and providing his epistemology with a sound metaphysical foundation on *res cogitans*. Hobbes followed a quite different path, which was in fact double sided. On the one hand he kept seeking in optics the key concepts for a materialistic explanation *of knowledge* through the mechanisms of human perception. On the other hand he shifted towards the study of civil science, which he progressively trusted to be *also* the epistemological domain where he could find a solution to the problem of a more general foundation *of scientific knowledge*.

Thus *The Elements of Law Natural and Politic* was intended to be a scientific treatise on the local motion of bodies, both in the first section devoted to the functioning of human nature[5] and in the second about the body politic. In this sense it should be read as an attempt to provide a mechanical ontology of the matters concerned, human body and the body politic, which also contains an ontology of knowledge, as part of the internal motions characterising the human body. In effect, the possibility of a physical explanation of knowledge itself, as a motion which exclusively starts from sense and arises, through memory and imagination, to reason and science, was postulated by Hobbes's radical materialism. If the local motion of matter explains the constitution of any kind of body, it will explain all motions, included the 'mental' movements of human bodies we call 'knowledge'. Consequently, Hobbes analyses sense, imagination, memory, passions, and reason itself, as man's 'powers', that is movements in the internal parts of human bodies which, by means of sense, react to movements taking place in the outside world, thus producing images, concepts, passions, etc. Conversely, the effects of these internal

[5] In fact, as I will note, the expression 'human nature' is totally absent from the text, and referring to man's 'motions' Hobbes does not use the word 'law', but speaks only of 'powers'.

motions are the external motions of human bodies (actions and speeches), which impact on the motions of the external bodies. That is why physics, logic, and civil science can be all conceived as relying 'in the last instance' on the same fundamental mechanisms of local motion, an assumption Hobbes carried on in different terms within all his different works.

At the moment Hobbes was writing *The Elements of Law* his physics was still a plain ontology which was supposed to *entail* a complete epistemology. The science of optics provided the model which displayed the possibility for a scientific correction of sense by sense itself, a kind of entirely mechanical 'transformation' of sense into reason: 'the great deception of sense, which also is by sense to be corrected' (EL II.10). Although one cannot concede to Brandt that in his first political treatise Hobbes succeeded in marking 'the foundation of modern empirical psychology' (Brandt 1928: 151), it is possible to assume that – even if it was not directly concerned with the mathematical and physical topics that fifteen years later would finally constitute *De corpore* – *The Elements of Law* already conveyed a systematic project, part of which was certainly Hobbes's attempt to solve the epistemological problem of the relationship between reason and sense through optics.[6] What is more interesting for the current research, in the same work this problem was inextricably linked to the consideration of motion and knowledge as *political* problems.

Natural/artificial motion in politics and logic

It is clear that, in Hobbes's philosophy, there can be no qualitative distinctions among bodies, but only differences in motion: all bodies constitute a homogeneous whole divided into different parts exclusively depending on different kinds of 'motions' taking place according to the Galilean principle of inertial movement and impact. In this sense each 'individual' body – whether natural or artificial – exists as a coherent compound of matter whose existence depends on the combined motions of its 'internal' parts and of the 'external' bodies it collides with. We have thus in *The Elements of Law* a whole set of bodies whose motion is – at least in principle – perfectly suitable for a mechanistic description. Yet, although human bodies constitute no ontological exception, it is their regular kind of natural motion that produces the artificial kind of motion characterising the body politic. This fact makes the artificial motion of the body politic depend on the natural

[6] Tuck clearly recognises the closeness of *The Elements of Law* to Hobbes's optical ontology, but because of his static conception of Hobbes's philosophy, he does not analyse the epistemological consequences of Hobbes's declining faith in the possibility that optics could be a definitive alternative to Descartes's solution (Tuck 1988: 37-39). In general, scholars claiming that Hobbes was already building his *Elementa philosophiae* system within the text of *The Elements of Law* still have to counter Tönnies's discovery that the 1650 edition of *Human Nature* and *De Corpore Politico* was not Hobbes's, and that the complete text of *The Elements of Law* 'had been drawn up independently, from and without any regard to the systematic plan, which probably did not yet occupy the philosopher's mind at the time when he wrote it' (Tönnies 1889: VII).

motion of the human body, and hence civil philosophy depend on a physical theory of human nature. This fact entails considerable epistemological and political consequences.

To the general question about what keeps a body in existence (that is its parts moving *as one*), Hobbes's answer is clear: the continuity of motion. Yet, while the continuity of natural motion does not depend on human will, art, or technics, the continuity of an artificial motion does. A further distinction should be made between simple machines, which could be considered (at least in Hobbes's times) the product of a single human individual, and complex machines which, like the body politic, have their collective origin in a covenant between men. In particular, as far as the body politic is concerned, Hobbes's answer to the question 'What keeps them in motion?' is quite clear: the respect of covenants. If the covenant is broken the body politic dissolves, such as natural bodies die and machines break down. The breaking of covenants is what breaks down the artificial body itself. To this political evidence a further 'epistemological' consequence can be drawn.

In Hobbes's world entirely made of matter in motion, bodies 'political' and 'of knowledge' are both artificial bodies whose coming into existence and preservation depends on men's collective wills, discourses, and actions, the coherence and continuity of which is ultimately granted by covenants. Thus we witness in politics the rising phantom of the state of nature just as, in logic, the unsolvable conflict of opinions. And therefore the problem posed by the very existence of the artificial bodies is in both fields the same: the problem of the collective preservation of their artificial motion. This assumption would explain why in *The Elements of Law* political bodies and sciences are so strictly connected in their origin and nature. Both in logic and in politics a covenant produces a single artificial consistent motion out of many different natural motions. Such 'technical' operations are performed by fixing a normativity which structures, respectively, a system of names, principles, and deductions, and a system of individuals and corporations. This explains why, like any other artificial body, the body politic has a 'logical' consistence both on the side of the subjects, who contradict themselves if they desire liberty,[7] and on the side of the sovereign, who cannot even actually contradict itself.[8] In conclusion, what

[7] 'He therefore that desireth to live in such an estate, as it is the estate of liberty and right of all to all, *contradicteth* himself' (EL XIV.12, italics added).

[8] 'When he or they that have the sovereign power, give such exemption or privilege to a subject, as is not separable from the sovereignty, and nevertheless directly retain the sovereign power, not knowing the consequence of the privilege they grant, the person or persons exempted or privileged are not thereby released' (EL XXI.13). This is a less immediate argument, because we are confronted here with a kind of 'performative' contradiction. In the case of a sovereign exempting citizens from subjection, such an act – whether of course in the rights of the one who owns the sovereign power – is in fact contradictory with the exercise of sovereignty. From such premises the conclusion could be easily drawn that the sovereign cannot actually contradict himself, as Hobbes recalls in a previous statement according to which when a man 'signifieth two contradictory opinions' the derived one is to be considered invalid, because it could proceed 'from error in the deduction, or ignorance of the repugnancy' (EL XIII.9).

menaces the persistence of a body politic is equated to what menaces the existence of a coherent discourse, and therefore injustice and contradiction are the same:

> There is a great similitude between that we call injury, or injustice in the actions and conversations of men in the world, and that which is called absurd in the arguments and disputations of the Schools. For as he, that is driven to contradict an assertion by him before maintained, is said to be reduced to an absurdity; so he that through passion doth, or omitteth that which before by covenant he promised not to do, or not to omit, is said to commit injustice. And there is in every breach of covenant a contradiction properly so called; for he that covenanteth, willeth to do, or omit, in the time to come; and he that doth any action, willeth it in that present, which is part of the future time, contained in the covenant: and therefore he that violateth a covenant, willeth the doing and the not doing of the same thing, at the same time; which is a plain contradiction. And so injury is an absurdity of conversation, as absurdity is a kind of injustice in disputation. (EL XVI.2)[9]

The parallel foundation of logical and moral error on (the lack of respect for) covenants confirms not only that all artificial bodies are the product of covenants among many different human wills, but also that the respect of such covenants is the condition of possibility for the continuation of their existence. Now, because what has been said works for both political *and* logical artificial 'bodies', then natural philosophy itself – with its whole set of concepts for a causal explanation of the mechanical functioning of nature – cannot be considered but a kind of artificial body, in fact a 'power cognitive' the existence of which is the product of men's covenants on names, principles, and definitions and which can *continue* only under the condition of their respect. And because also civil science is a product of men's powers and covenants, the regularities it is supposed to 'discover' in nature depend in fact on men's nature in a double sense: the bodies of men are both the natural cause of the 'tools' for scientific knowledge (geometrical representation, deduction, etc.) *and* the natural bodies whose motion and functioning such tools should describe. Thus the 'laws of nature' are both part of human nature and the object of one of humanity's highest forms of knowledge, civil science. According to their nature men have the 'natural right' to continue their lives, conceived as a way of enacting the powers of their bodies. These powers clash, determining a situation of conflict or, rather, a situation in which men experience the permanent threat of the conflict Hobbes calls the 'estate of nature'. Among such powers there is also the scientific knowledge of the 'laws of nature',

[9] *Absurditas* and *injuria*, in the matching passage of *De cive* (III.3; OL II, 182-83). Hobbes did not repeat the same remark in *Leviathan*. In *De Corpore*, however, he stated again that 'names have their constitution […] from the will and consent of men. And hence […] men pronounce *falsely*, by their own negligence, in departing from such appellations of things as are agreed upon' (DeCo V.1; EW I, 56).

that is civil science. Following the laws of nature some men can understand that it is better to abandon their power to all things (their 'natural right'), in order to preserve the individual bodily motion called life (which is the material condition of all other powers); the majority of them do not understand and nevertheless – willing or not – they do adapt: in the end all of them make covenants in order to acquire peace, and so on and so forth until the well-known establishment of the commonwealth through civil laws.

The consistency of the whole argument of Hobbes's first political treatise was based on both the assumption that men's 'powers' actually *are* naturally independent motions, and that these motions can and must be artificially made converge into a peaceful, physically consistent collective motion which is a perfect model of logical coherence.

The stability of science and politics depends on the power of covenants

Hobbes actually *intended* to adopt a purely ontological perspective. He presupposed a fundamental homogeneity of the object and therefore of the method of all sciences, treating political bodies as *a particular kind* of artificial body, still suitable for the geometrical and mechanical knowledge he reserved to natural bodies. It is clear that – as far as *The Elements of Law* was concerned – all processes *can be explained*, at least in principle, through an exclusively physical account of motion. Yet this does not mean that he actually *succeeded* in providing complete 'physical deduction' of the body politic from the knowledge of matter in motion. On the contrary, he experienced there the problematical limitations of his ontological approach for such an enterprise.

As it was evident when he mocked 'this device therefore of them that will make civil laws first, and then a civil body afterwards, (as if policy made a body politic, and not a body politic made policy)' (EL XX.14), in *The Elements of Law* Hobbes was postulating not only an ontological continuity from nature to artifice (which he never abandoned), but also an *epistemological* continuity between the natural and human sciences. In Chapter VI – where he explains his own anti-Cartesian theory concerning the link between evidence and truth, and introduces for the first time his own anti-Cartesian 'method' (the four steps of science) – Hobbes clearly differentiates science and history,[10] but mentions no separation at all between natural and civil philosophy (Skinner 1996: 5, n. 22). This assumption of a basic epistemological continuity becomes even more evident when we look at Chapter XIII, where Hobbes marks the distance between mathematical and dogmatic knowledge (EL XIII.4), thus indirectly confirming the presupposition of an homogeneity of all sciences as such. This initial stance allowed Hobbes to maintain in

[10] Both are 'remembrance' of experience registered in books, but experience can be differently conceived: as experience of 'nothing else but sense' (history) or 'experience of the proper use of names and language' (science) (EL VI.1). Which is like saying that science concerns the established 'universals' of experience, history the particular experiences, accordingly to Aristotle.

these ‘epistemological’ chapters of *The Elements of Law* a fundamental faith in the *physical* power of reason, referring to ‘powers and acts of the mind, both cognitive and motive’ (EL XIII.1) and in particular to the powers of speech. With perfect circularity, from the motion determining sense evidence starts the path towards any ‘experience’, including the perfect ‘evidence of truth’ Hobbes calls ‘wisdom’ (EL VI.3-4), and to the external motion the internal motions of the human body return, thanks to the *effective* power of the mind on body:

> That power of the mind which we call motive, differeth from the power motive of the body; for the power motive of the body is that by which it moveth other bodies, which we call strength: but the power motive of the mind, is that by which the mind giveth animal motion to that body wherein it existeth. (EL VI.9)

It seems therefore possible to argue that in *The Elements of Law* the attribution of a ‘motive power’ to reason (that is what makes us ‘differ from the wildest of the Indians’ EL XIII.3), depends on the ontological perspective Hobbes was assuming, and was therefore strictly related to the postulate of ontological uniformity of the objects of civil and natural philosophy, a stance Hobbes still believed he was able to ground on the unifying power of the model of optics.

This ontological homogeneity of the objects of all sciences does not mean that civil philosophy had no peculiar methodological characterisation. In fact it was, for Hobbes, the only science really concerned with effective ‘laws’. While the abstract propositions of natural science are not proper ‘laws’, because they are not capable of producing any *effects* in their objects (that is natural bodies), the propositions of civil philosophy, on the contrary – by prescribing laws to the *natural* minds-bodies of men – can actually influence their motions and, in the end, they can actually influence the *artificial* motion of the body politic, thanks to the obedience to the civil laws that civil philosophy prescribes. In this sense the natural laws civil science relies on can exercise their rational power on human natural motion and, through it, onto the artificial motion of the body politic. As a matter of fact, through the study of *The Elements of Law, Natural and Politic*, men *could* attain the knowledge of the means suitable to arrange the concurrent persistence of their own natural body motion (that is life) *and* of the political bodies that allow it. A coherent logic prescribes there the means of preservation of the ‘natural’ motion of the individual body by linking it to the preservation of the ‘artificial’ motion of the collective body politic, and therefore logically connects natural and civil laws. This logic is inscribed in human ‘nature’, and therefore Hobbes calls it ‘law of nature’: its existence is eternal, but its knowledge is not. In fact, because any kind of knowledge, science included, is naturally in motion and dependent on men’s wills and passions, Hobbes is forced to conclude that a sort of

artificial counterpart of it is needed, the coherent motion of which should not depend on men's changing wills, submitted to the natural variability of passions. This stable counterpart is civil power: as a result of his first political treatise, Hobbes had thus irreversibly intertwined the epistemological issue of the *stability* of scientific knowledge with politics.

By linking science to civil power he was indirectly bypassing a whole set of epistemological problems that haunted his project of providing a mechanistic political theory: How is it possible for reason to scientifically grasp the 'laws of nature'? How can the 'dictates' of reason be founded, given that reason is a motion of the human body? This structural lack of foundation was probably what gave such an importance to Hobbes's encounter with Descartes's fable of *Le monde* as a set of 'phenomena'. Thanks to his confrontation with Descartes – who had directly challenged (and was metaphysically solving) the problem of founding precisely the scientific knowledge of mechanical motion which Hobbes seemed to have left unquestioned – the structural limits of the 'physical' epistemology contained in *The Elements of Law* (little more than a 'fancied' realistic ontology) became soon evident to its author. From this perspective, his writing of *De cive* can be read as a first attempt to solve the epistemological problem by providing a new kind of foundation for the entire system, precisely starting from what he considered – from a properly scientific point of view – a completely untouched field of research: *scientia civilis*. In his words ten years later:

> Natural Philosophy is therefore but young; but Civil Philosophy yet much younger, as being no older […] than my own book *De Cive.* (DeCo *Ep.*; EW I, IX)

De cive*: an epistemology of the law of nature*

After one year in Paris Hobbes had quarrelled with Descartes on optics, written the fourth set of *Objections* to the *Meditations*, and mostly composed *De cive*. Within little more than one year he abandoned the naïve ontological approach he had adopted in *The Elements of Law*. His *De cive* was no longer intended to be a straight ontology of human and political bodies: it was the third part of a philosophical system (that is a system of sciences) aiming to provide a complete set of *Elementa philosophiae*, in which every science had to be founded on the general principles, definitions, and names established by first philosophy according to the model of geometry. Epistemology had now gained primacy over ontology, and all sciences required the pre-establishment of a solid epistemological ground.

This move accentuated the internal tensions of Hobbes's philosophy, generating a new set of problems. Although in his *Elementa philosophiae* he kept the postulate that everything was 'but' matter in motion, Hobbes was well aware of the necessity and

difficulty of *founding* sciences on a geometry of motion based on the 'names' established by first philosophy. In fact, although relying on the general principles of motion, civil philosophy needed further principles, specific for the peculiar kind of bodies it was concerned with, and consistent with the particular point of view one could gain on them. As a result, *De cive* was much more a foundation of civil philosophy on its own principles than on the general principles of matter in motion. But it was, in Hobbes's intentions, a strong and definitive one. In effect, at the moment of writing *De cive* Hobbes's faith in the power of reason was probably at its apex, and the limitations proper to civil science were therein attributed only to its 'youth', and inscribed in the optimistic stance that characterised the whole *Epistola dedicatoria* (1641).[11] This faith was grounded on the assumption of Geometry as the undisputed model for all sciences on the basis of a presupposed methodological continuity between all the different domains accessible to human reason.[12] It was on the same ground as physics – yet along a different but parallel path – that new optimistic perspectives of development were opening for civil science by mirroring the model of geometry:

> The Geometers have managed their province outstandingly [….] What we owe to Physics, Physics owes to Geometry. If the moral Philosophers had done their job with equal success, I do not know what greater contribution human industry could have made to human happiness. For if the patterns of human action were known with the same certainty as the relations of magnitude in figures […] the human race would enjoy such a secure peace that it seems unlikely that it would ever have to fight again. (DC *Ep.*; OL II, 137-38)[13]

Carrying on these hopes, during the short period between *The Elements of Law* and the first edition of *De cive* Hobbes's civil philosophy steadily went through a methodological shift. From a physics of the body politic based on 'human nature' conceived as a set of clashing *powers*, Hobbes moved towards a foundation of civil philosophy on 'lex naturalis [natural law]', conceived as a set of *principles* the scientific knowledge of which would definitively allow men to exit the fearful conditions characterizing their life 'in statu mere naturali' (DC I.10; OL II, 164). In *The Elements of Law* human nature was redefined,

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[11] See above, Chapter 1 note 58.

[12] 'Philosophy is divided into as many branches as there are areas where human reason has a place, and takes the different names which the difference of subject matter requires. In treating of figures it is called *Geometry*, of motion *Physics*, of natural law, *Morals*, but it is all *Philosophy*; just as the sea is here called British, there Atlantic, elsewhere Indian, so called from its particular shores, but it is all Ocean' (DC *Ep.*; OL II, 136-37).

[13] 'Et geometrae quidem provinciam suam egregie administraverunt […] Nam quod physicae debemus, id debet physica eidem geometriae. Si philosophi morales munere suo pari felicitate functi essent, non video ad felicitatem suam in hac vita quid amplius contribuere humana industria posset. Cognita enim, pari certitudine, ratione actionum humanarum, qua cognoscitur ratio magnitudinum in figuris […] fruretur gens humana pace adeo constante, ut non videatur, nisi de loco, crescente scilicet hominum multitudine, unquam pugnandum esse'.

against Aristotle, as a jumble of 'faculties and powers', postulated as mechanical:

> Man's nature is the sum of his natural faculties and powers, as the faculties of nutrition, motion, generation, sense, reason, &c. For these powers we do unanimously call natural, and are contained in the definition of man, under these words, animal and rational. (EL I.4)

This identification of what the tradition called 'facultates' and mechanical 'power' is also explicitly stated by Hobbes: 'By this power I mean the same with the faculties of body and mind, mentioned in the first chapter, that is to say, of the body, nutritive, generative, motive; and of the mind, knowledge' (EL VIII.4).[14] And again, it recurs in the fourteenth chapter as a brief summary of what previously displayed, where the reference to 'faculties' completely disappears:

> In the precedent chapters hath been set forth the whole nature of man, consisting in the powers natural of his body and mind, and may all be comprehended in these four: strength of body, experience, reason, and passion. (EL XIV.1)

On the contrary, in the matching chapter of *De cive* (the crucial, introductive one), Hobbes turns back to the Latin term 'facultates': '*the faculties of human nature can be reduced to four kinds: Physical force, Experience, Reason, Passion*'.[15] Since the outset of *De cive* it is clear that Hobbes had abandoned a straight ontological approach, and adopted an entirely epistemological one. In *De cive* Hobbes was not primarily referring to *physical* powers, but rather to *logical* conditions of possibility as the adequate starting point for a theoretical construction of the body politic through the logic of covenants, according to 'the fundamental laws of nature'. For these reason, it was not only a question of human nature as a set of ontological powers, but primarily of human nature as a model from which to draw a doctrine providing 'the conditions of society and peace among men' (DC I.1; OL II, 158).[16]

In effect, *De cive* was intended to be the complete *deduction* of civil science – the science of the body politic – from the principles of human nature – which Hobbes called laws of nature.[17] Because deduction was now unmistakably its aim, civil science could even be considered superior to natural philosophy, as far as it was immune from the

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[14] In Hobbes the body/mind distinction is never ontological, of course, because he always refers to effective 'powers of the mind' cognitive and motive (e.g. EL XX.7-8). This distinction he will completely abandon in *Leviathan*, where the term 'faculty' serves only the differentiation between 'natural' and 'acquired' powers. (Marquer 2005: 30).

[15] 'Naturae humanae facultates ad quatuor genera reduci possunt, vim corpoream, experientiam, rationem, affectum'.

[16] 'Societatis sive pacis humanae conditiones'.

[17] Pacchi correctly observes that in *The Elements of Law* there is no explicit reference to a 'unique explicative principle or to a unique deductive chain' (Pacchi 1965: 220). And this is due to the fact that with the word 'deduction' he is referring to a logical operation, which is not what the ontological approach of *The Elements* is specifically concerned with.

epistemological limitations characterising physics, tied to the necessity to recur to hypothesis or '*suppositio*'. From what he explicitly states in his *Latin Optical MS*, in Hobbes's intentions civil science clearly stands on the 'safe' side of geometry:

> The treatment of natural sciences differs greatly from the treatment of the others. In the latter nothing is needed nor admitted, other than definitions of terms by which ambiguity is excluded, as foundations and as first principles of demonstration. […] While in the explanation of natural causes another kind of principles must be adopted, called Hypothesis or Suppositio. (LO I.1: 147)[18]

In contrast with Tönnies (1969) and Tuck (1988), who adduced philological evidence for an earlier date, Skinner (1996) dates the *Latin Optical MS* after *The Elements of Law*, precisely on the basis of this hierarchical distinction between the natural sciences and the others (civil science included), still absent in the sixth Chapter of Hobbes's first political treatise, and therefore presumably not assumed by Hobbes when he started writing it.[19] In this sense the *Latin Optical MS* would prelude to how civil science was eventually transformed in *De cive*, according to this programmatic statement, in a deductive science quite far from natural science.

From the ontological to the epistemological perspective: oscillations

Perhaps, as I am trying to point out, it is neither necessary nor possible to assume a strictly linear development in Hobbes's epistemology, and it would be more convincing to consider it a work in progress open to different and even contradictory hypotheses. In this perspective *The Elements of Law* should be considered a text in which a physical-ontological stance, as far as we approach the end of the draft, steadily mixes to an emerging epistemological one, which eventually appears dominant when, once he completed the book, Hobbes wrote *The Epistle Dedicatory* in May 1640, no more than a few months before starting *De cive*. This brief text is, as a matter of fact, crossed by contradictory tensions. More than a shadow spreads there on the postulate of the *actual* efficacy of civil science. It is sufficient to note, for instance, how Hobbes pictured it as epistemologically far away from the perfection of geometry ('to reduce this doctrine to the principles and infallibility of reason there is no way', EL *Ep*. XV), and seemingly defended it only for its edifying value ('it would be an incomparable benefit to commonwealth, if every man held the opinions concerning law and policy here delivered', EL *Ep*. XVI). And

[18] 'Rerum naturalium tractatio a caeterarum scientiarum tractatione plurimum differt. In caeteris enim fundamenta sive principia prima demonstrandi alia neque requiruntur, neque admittuntur, quam definitiones vocabulorum, quibus excludatur Amphibologia […] Sed in explicatione Causarum naturalium, aliud genus principiorum necessario adhibendum est, quod vocatur Hypothesis sive Suppositio'.

[19] 'If we assume that Hobbes completed the manuscript before writing Chapter 6 of *The Elements*, it seems strange that *The Elements* makes no use of the important distinction drawn in the manuscript between two different types of science, and instead treats the so called steps of science in an undifferentiated way' (Skinner 1996: 5, n. 22).

nevertheless, despite such limitations, Hobbes still claimed he intended to 'put such principles down for a foundation' in order to make civil science 'inexpugnable' (EL *Ep*. XV).

In the light of the contradictory tensions inhabiting the epistle dedicatory of *The Elements of Law*, it is possible to figure out Hobbes's approach when, a quite short time after closing his first political treatise, he was going to provide a new start to his political theory with *De cive*, and moving from an ontology of the body politic to an epistemology of civil science. By this I do not mean that in *De cive* Hobbes abandoned his project to integrate political theory into a physics of motion: he clearly intended to pursue this project, as it seems confirmed by some newly added physical analogies he presented in the text in order to explain human behaviour.[20] But, as a matter of fact, he had bracketed the problem. Because his urgency was to secure the new civil science on an *epistemological* ground alternative to the transcendent one Descartes was exploring, Hobbes was abandoning the attempt to reduce all epistemological questions to a physics of sensation and, ultimately, to the optical model of a theory of light. He was rather definitively embracing the powerful model of geometry. This shift and its consequences I am going to trace by focusing on a couple of classical concepts that play a key role in the problematic connection between the fields of natural and civil philosophy: 'laws of nature' and 'right reason'.

2.2 'Laws of Nature' and 'Right Reason'

The concepts of 'laws of nature' and 'right reason' carry a heavy load of equivocal connotations that they have inherited from their articulated history. Their meaning crosses a complex set of different functions they played in classical philosophy, in Medieval theology, and in modern philosophy, often moving between the different fields of philosophical research. A brief clarification of Hobbes's use of these concepts will allow me to track the shift of Hobbes's research from the ontological to the epistemological level. Firstly, I shall enquire into the variations in Hobbes's key concept of 'laws of nature', clarifying its epistemological implications in the light of the epistemological shift represented by *De cive*. Secondly, I will adopt the concept of 'right reason' as a 'marker', in order to show how Hobbes in *De cive* consolidated its usage as a reference for scientific *modelling* in civil science, thus opening an epistemological gap between the issue of the neutrality of science and the need for its actual foundation. The two issues will allow me to picture the fatal tension that arose with *De cive* in Hobbes's epistemology of civil science: a tension structural to a perfect science endowed with no physical (or

[20] See below, Chapter 2.2.

political) power at all. As I will explain in Chapter 2.3, this tension later resulted in an ideological solution in which the development of determinism plays a major role, by mirroring at the ontological level the epistemological perfection of right reason.

Laws of nature

Because of the commonly accepted opposition between *nomos* and *physis*, the idea itself of a law (*nomos*) governing nature (as *physis* [from *phyo*]) was completely nonsense for the Greeks, and such it remained as long as the Aristotelian framework resisted – except for the reference to a moral 'law of *human* nature' which, on the contrary, hailed from the Stoics and was widely re-elaborated by Thomas Aquinas. In Francis Bacon the physical meaning of 'law' was superposed, although often inconsistently, to the concept of 'form' or formal cause, that is a concept still permeated with Aristotelianism (Milton 1998: 680-81, 685-86). In general, during the first part of the seventeenth century the use of the word 'law' referring to natural regularities was still quite rare. Even Galileo and Mersenne did not speak of laws about the regularities they discovered in nature (Roux 2001: 55 ff.), and it was only Hobbes's main philosophical enemy, Descartes, who officially started a 'technical' use of the term by referring in *Principia Philosophiae* (1644) to the fundamental principles of motion as 'rules, i.e. laws of nature', whose knowledge was founded on God's immutability (AT VIII, 62).[21] As a matter of fact, Descartes was a kind of exception. His research had already been for a long time oriented towards attributing a foundational role to God. The above displayed quotation from the letter to Mersenne of 15 April 1630 (AT I, 145; see above, Chapter 1.2), clearly demonstrates that Descartes was aware that the centrality of the word 'law' would grant both the triumph of his mechanistic view of nature and the metaphysical foundation of its principles, well settled in man's mind by God himself and therefore very close to being eternal.

As explained in Chapter 1, it was the metaphysical reference to a God legislator as the founder of nature conceived as a created machine that allowed for a generalisation of the expression 'laws of nature' and its extension – through the legal metaphor – over the domain of the new physics. And apparently, once accepted that for Hobbes there is nothing else but moving bodies made up of 'matter in motion', the title of *The Elements of Law Natural and Politic* would leave no doubt about 'law' being the key concept linking together the motions of natural and political bodies:

> The true and perspicuous explication of elements of laws, natural and politic [depends on] the knowledge of what is human nature, what is a body politic, and what it is we call a law. (EL I.1)

[21] 'Ex hac eadem immutabilitate Dei, regulae quaedam sive leges naturae cognosci possunt'. Cf. also *Le monde* (where yet the 'rules' are confined in the phenomenal horizon of the fable): 'The rules [*règles*] by which these changes take place I call "laws of nature"' (AT II, 37).

But if we abandon the *incipit* of the book and go through the whole text, we discover that the word 'law' is hardly used at all by Hobbes to describe any movement of natural bodies, even the human ones. And only in the last chapter of the book the promised explication 'of the nature and sorts of law', finally appears:

> All laws are declarations of the mind, concerning some action future to be done, or omitted. And all declarations and expressions of the mind concerning future actions and omissions, are either promissive, as I will do, or not do; or provisive, as for example, If this be done or not done, this will follow; or imperative, as Do this, or do it not. In the first sort of these expressions, consisteth the nature of a covenant; in the second, consisteth counsel; in the third, command. (EL XIX.1)[22]

The definition of law as a 'declaration of mind' discharges the term of any straight relevance for natural philosophy, and eventually allows Hobbes to use it to refer to two different kinds of laws: the 'law of nature', that is reason,[23] and the 'civil law' of the sovereign. The first, depending on God's will, is 'unalterable' (EL XVIII.4), the second, instead, changes depending on the changing will of the sovereign. However, both of them have the same effect of compelling a body to act according to a certain pattern of motion (natural, that is individual, or artificial, that is collective), and both can be disobeyed: which clearly renders nonsense any attempt to think about the 'law' in the title as non-problematically related to some supposed eternal 'laws of motion'. Following this argument, it is not consistent with the theoretical premises of *The Elements of Law* to think of nature 'in itself' as a Cartesian machine depending on 'laws'. On the contrary, what Hobbes calls 'laws of nature' are in fact laws of *human* nature. In short, it is possible to assume that it was perfectly consistent with Hobbes's historical context and philosophical references – not to mention his opposition to Descartes – to banish the word 'law' from the philosophy of nature he was elaborating during the 1640s. And in effect, in the whole of his work the use of the word 'law' was always linked to the formula 'law(s) of nature' or 'natural law', which can be considered laws only as 'commands' of God, eternal but nevertheless – as commands – always breakable by men.

Therefore, if we limit our considerations to *The Elements of Law*, the whole book cannot be said to establish any deterministic conception of nature, at least if this idea should rest on the concept of 'law of nature'. However, this does not mean that the hypothesis of a natural determinism was completely out of Hobbes's horizon. On the contrary, the idea of a natural necessity was probably part of Hobbes's key convictions, substantiating the mechanistic conception of science as a science of causes. And nevertheless, a general

[22] In general, the concept of law indicates – as Hobbes defines it in EL XIII.6 – a command 'sufficient to move us to action', whether it derives from civil laws or from the natural law.
[23] 'There can therefore be no other law of nature than reason' (EL XV.1).

theory of determinism was not yet the object of Hobbes's speculation: it was neither a basic assumption in his physics nor a principle for his civil science. In effect in *The Elements of Law* he never referred to any kind of regularity or even principle of motion through the expression 'law', exception made for the only sentence one can find in the whole text, in which the word 'law' concerns a natural phenomenon and, quite notably, an optical one: 'the laws of refraction' (EL II.8). The claim that refraction is subject to 'law' fully corresponds to his epistemological program, inspired by ontology of light, of 'geometrically' correcting sensations, in order to know 'the things that really are in the world without us, […] those motions by which these seemings are caused' (EL II.10).

The approach Hobbes adopted in *De cive*, instead, entailed a disjunction of epistemology and ontology. The resulting 'double sight' is evidenced by his conjoint adoption of the geometrical method of deduction from the first principles on the one hand, and the more and more frequent reference to physical motion as a paradigm for the explanation of human behaviour on the other. In *De cive*'s Chapter III, *On the Other Laws of Nature*, Hobbes repeatedly returns to a definition of the laws of nature, inclining more and more towards a clear assumption of their superiority in relation to any civil law: 'the laws of nature are *immutable* and *eternal*' and yet accessible by human reason independently of any civil law (DC III.29; OL II, 195).[24] At the same time, as he abandons a straight identification of the perfect science of human nature with a physics of the natural motion of men's bodies, Hobbes's reference to natural analogies becomes more and more diffused. The whole set of new physical metaphors Hobbes displays in *De cive* seems in this sense to compensate the geometrical immutability and perfection connecting the laws of nature to reason by recalling the underlying postulate that there must be no ontological distance between natural and human motion.

These metaphors recur precisely where Hobbes aims to show the analogy between the compelling power necessitating human behaviour, that is liberty, and physical phenomena. Here and there in the text Hobbes equates the human power to move to the natural tendency of a stone to fall or of water to expand, once the impediments are removed, and hence he defines human liberty as 'the absence of impediments to motion' (DC IX.9; OL II, 259).[25] All these similitudes concur in *De cive* to reassert the relation between human motion or the 'collective' motion of the body politic, and the more general

[24] 'Leges naturae *immmutabiles* et *aeternae* sunt', also restated by referring to the 'law of nature' (in the singular) in DC IV.20. To this claim of 'eternity' he will later add a bend of unavoidability: 'There are some things in these [civil] laws whose omission […] seems rather to be a fulfilment than a violation of natural law' (DC III.27; OL II, 195).
[25] 'Absentia impedimentorum motus'.

'motion of natural bodies' (DC XII.1; OL II, 284).[26] But it is in the opening chapter of the first section (on *Liberty*) that Hobbes uses the 'law' of free fall as more than a metaphor for describing man's natural strive for self preservation: 'this happens by a real necessity of nature as powerful as that by which a stone falls downward' (DC I.7; OL II, 163).[27] It is worth noting that, beyond the metaphor, the 'necessity' dictated to men by their nature, to avoid death at all costs, carries the same ontological characterisation of the mechanical conatus of any natural body, and this 'natural' necessity is not at all a 'law of nature'. This shows again – if needed – that there is no unproblematic connection between the Hobbesian law of nature as the fundamental principle of civil science and the Cartesian 'laws of nature' regulating the natural motion of bodies.

Thus Hobbes can go back to what he had earlier clarified in *The Elements of Law*, namely that 'properly speaking, the natural laws are not laws, in so far as they proceed from nature. But in so far as the same laws have been legislated by God in the holy scripture […] they are properly called by the name of laws' (DC III.33; OL II, 198; see EL XVII.12).[28] Within the boundaries of civil science what is taken as eternal are in fact the laws of *human* nature and, consequently, what reason can scientifically conclude from such principles: 'what we call the laws of nature are nothing other than certain conclusions, understood by reason, on what is to be done and not to be done' (DC III.33; OL II, 198).[29] In fact, laws are completely indifferent to the rest of nature, since they only pertain to man: 'law as a species is coeval in nature and time with the human species' (DC XIV.14; OL II, 322).[30] And in *De cive* this is carried on so far as to transform nature itself into something outside the very boundaries of the reign of God, to which only human beings (and not even all of them) would belong, thanks to their faculty of understanding:

> God so rules all men through power that no man can do anything which He does not want done; yet this is not Reigning in the precise and proper sense. Reigning is said to those who rule through *speech* rather than *action*, i.e. if they rule by *precepts* and *threats*. In the kingdom of God therefore we do not count inanimate bodies or things without reason as subjects (though they are subject to divine power), because they *do not understand* God's *precepts* and *threats*. (DC XV.2; OL II, 332)[31]

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[26] 'Motu corporium naturalium'. The analogies of the stone and of water recur once again in DC III.9 and DC XIII.15 referring to the artificial collective motion of the body politic. For my discussion of Hobbes's conception on liberty, see below, Chapter 2.3.

[27] 'Idque necessitate quadam naturae non minore, quam qua fertur lapsis deorsum'.

[28] 'Non sunt illae proprie loquendo leges, quatenus a natura procedunt. Quatenus tamen eadem a Deo in Scripturis sacris latae sunt […] legum nomine propiissime appellantur'.

[29] 'Naturae autem quas vocamus *leges*, cum nihil aliud sint quam conclusiones quaedam ratione intellectae, de agendis et omittendis'. And this knowledge corresponds to what was legislated by God 'in the holy scriptures', of course.

[30] 'Legum enim genus omne et natura et tempore coaevum est generi humano'.

[31] 'Quamquam autem Deus homines ita per potentiam regat, ut nemo possit quidquam facere quod ille factum nolit, non est tamen hoc, proprie et accurate loquendo, regnare. Regnare enim dicitur, non qui *agendo*, sed

In effect, despite their eternity and necessity, the laws of nature 'are not obligatory'. More properly, it is only their knowledge, which entails such a difficult deduction, that makes of the laws of nature actual 'laws': 'for laws do not oblige unless they are known, and are not in fact laws' (DC III.26; OL II, 194).[32]

This patently makes of the laws of nature some kind of fundamental principles the power and efficacy of which are not grounded on any natural tendency, nor can be incontrovertibly grounded on any civil law. The physical power exerted by the body politic depends on human nature as much as the intellectual power of reason does, and yet the two powers do not match anymore. Literally, in *De cive* they are not situated at the same level: reason as a physical power of the human body is part of the physical motions of the human matter that concur to the actual functioning of the body politic, while reason as the principle of true knowledge perfectly fits the exigency of founding a deductive system of sciences. Human nature (and reason itself) is consequently split between its actual physical tendency and the rational laws it also depends on, and the new civil science is born crossed and dramatically tense because of the exigency to keep the two instances together. This shift of Hobbes's civil science from the analysis of reason as a physical power to reason as *also* a theoretical model is clearly marked by the way the very foundation of the laws of nature, the 'dictates of *natural* reason' (EL XVIII.1), become throughout *De cive* the 'dictates of *right* reason' (italics added).[33] This conceptual 'translation' responded to a foundational purpose that was hardly compatible with Hobbes's materialistic ontology of motion.

Right reason

The Greek concept of 'right reason' (*orthos logos*), a Stoic concept, indicated a sort of ethically 'purified' reason working at the same time in the fields of theoretical and practical philosophy. In Cicero, being associated to 'natural right', the concept of *recta ratio* assumed a more clearly juridical blend without abandoning its constitutive relation of foundation with the divine mind, and its privileged accessibility by the mind of the Wise: 'just as the divine mind is the highest law […] so too it is fully developed [*perfecta*] in the mind of the wise man' (Cicero, *De legibus* II.9).[34] The progressive absorption of the

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qui *loquendo*, id est, *praeceptis* et *minis* regit. In regno igitur Dei, pro subditis habemus, non corpora inanimata, neque irrationalia, licet potentiae divinae subjiciantur; quia *praecepta* et *minas* Dei *non intelligunt*'. Hobbes is here commenting on the Psalm 96.1, 98.1. On this passage as representative of the political agenda of mechanicism, see below, Chapter 3.4.

[32] 'Etenim leges, nisi cognitae, non obligant, imo non sunt leges'.

[33] 'Dictatae rectae rationis' is a recurrent expression in *De cive* that never appears in the English of the *The Elements of Law*. In EL XVIII.2 Hobbes refers to the laws of nature as 'descriptions of natural reason', while in the matching paragraph of *De cive* he speaks of 'descriptions of right reason' ('descriptionis rectae rationis') adding that 'it has been shown before that the natural laws are its dictates' ('cujus dictamina leges esse naturales ante ostensum est') (DC IV.2; OL II, 200).

[34] 'Divina mens summa lex est, item quom in homine est perfecta in mente sapientis'. In effect 'Reason existed, derived from nature, directing people to good conduct and away fro crime; it did not begin to be a law

concept in Christian philosophy (accomplished by Thomas Aquinas) explicitly made of it a theological issue related to God's perfection, while the possibility of connecting it to human reason was always highly disputed and particularly criticized within the Ockhamist tradition. The reference to *recta ratio* eventually became of general usage in political theory as a rhetorical tool and, as such, during the seventeenth century it was also extended to the field of mechanical philosophy, e.g. by Boyle.[35] The structure of the argument is not far from the one still displayed in the *Eikon Basilike* – the autobiography purportedly written by Charles I before his execution. It was from the very link between right reason and God's Word that the condemned king Charles I – or whoever wrote in his behalf – still deduced the necessity to obey his own command:

> No man can be more forward than My self to carry on all due Reformations, with mature judgement, and a good Conscience, in what things I shall (after impartiall advise) bee, by God's Word, and right reason, convinced to be amisse, I have offered more than ever the fullest, free'st, and wisest Parliaments did desire. (*Eikon Basilike* XIV, 116)[36]

In this sense one can argue that the path covered by Descartes when founding the clarity and distinctiveness of reason on the substantial homogeneity of human reason as *res cogitans* and God's immateriality was a quite traditional one. Completely different was Hobbes's conceptual and rhetorical path, although it did not provide completely different results. In his original project – at the epoch of *The Elements of Law* – Hobbes rather put the emphasis on human *natural* reason and on wisdom as 'evidence of truth'. In fact, at the very beginning of the 1640s Hobbes was assuming 'wisdom' as a knowledge entirely accessible to man by his own strength, thanks to the principles of modern science, and possibly compatible with the sacred texts.[37] Yet in *The Elements of Law* the expression

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only at that moment when it was written down, but when it came into being; and it came into being at the same time as the divine mind. And therefore that true and original law, suitable for commands and prohibitions, is the *right reason* of Jupiter, the supreme god' (Cicero, *De legibus* II.10, italics added).

[35] Cf. Hoopes 1962 and Mulligan 1994.

[36] A few chapters later 'right reason' reappears in order to state the necessity to obey the king's 'divine' word: 'And not onely in Religion, of which, Scripture is the best rule, and the Churches Universall practise the best commentary, but also in right reason, and the true nature of Government, it cannot be thought that an orderly Subordination among Presbyters, or Ministers, should be any more against Christianity, then it is in all secular and civill Governments, where parity breeds Confusion and Faction' (*Eikon Basilike* XVII, 152-53). Referring to this book Mulligan explains that 'Charles invoked "Right Reason" – inspired by God and confirmed by conscience and inner experience to justify his own rationality. Equating God with eternal "Reason" was exactly how Gerrard Winstanley, writing, probably at exactly the same time, early in 1649, expressed his basic beliefs: "In the beginning of Time, the Great Creator Reason ... did make and preserve all things." He described "Reason" as "that spiritual power, that guides all men's reasoning in right order and to a right end" and referred to it also as the "King of Righteousness and Prince of Peace." In both these usages "Right Reason" was inspired from above and entailed Christian moral ends as the outcome of its action' (Mulligan 1994: 237). It is not clear to me why Mulligan takes for granted the identification of 'right reason' and 'reason' *tout court* without providing any justification for this choice.

[37] According to Larmore, when referring to right reason Hobbes provides no direct reference to divine will, although the text of *Leviathan* (namely Lev XIV and the last paragraph of Chapter XV), 'misled some

'right reason' occurs only twice. In the fifth chapter it appears almost as a rhetorical issue, representing the model of a perfect act of ratiocination with the function of negatively defining contradiction and absurdity as a patent diversion from it.[38] But when it appears for the second and last time in the concluding chapter, it is finally declared a 'common measure' not existent 'in *rerum natura*', the *function* of which has therefore to be supplied by sovereign power:

> In the state of nature, where every man is his own judge, and differeth from other concerning the names and appellations of things, and from those differences arise quarrels, and breach of peace; it was necessary there should be a common measure of all things that might fall in controversy […]. This common measure, some say, is right reason: with whom I should consent, if there were any such thing to be found or known in *rerum natura*. But commonly they that call for right reason to decide any controversy, do mean their own. But this is certain, seeing right reason is not existent, the reason of some man, or men, must supply the place thereof; and that man, or men, is he or they, that have the sovereign power, as hath been already proved. (EL XXIX.8)

This almost sarcastic 'call into inexistence' of right reason and its pragmatic commitment to the artificial will of the sovereign concluded *The Elements of Law*. And nevertheless, once he had assumed the epistemological approach of *De cive*, Hobbes needed principles of human nature as much evident as the principles of motion were for natural philosophy. And since the complexity of human nature could not be easily deduced from the first principles of motion – or at least Hobbes believed he was not able to do this before completing *De corpore* – he pursued a shortcut towards a different kind of foundation: 'the natural law [*lex naturae*]' was now, quite plainly (*hoc est*), 'the dictate of right reason [*rectae rationis dictamen*]' (DC I.15, II.1; OL II, 167, 169). Thus, no more than one year after having explicitly expelled right reason from nature in *The Elements of Law*, Hobbes openly reincorporated it into man's powers, namely in philosophy itself. In the *Epistola dedicatoria* to *De cive* he could thus ground the science of truth on right reason, with no appeal to any transcendent guarantee:

> True Wisdom [*sapientia*] is simply the science [*scientia*] of truth in every subject. Since it derives from the remembrance of things, which is prompted by their fixed and definite names, it is not a matter of momentary flashes of penetrating insight,

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commentators' (Larmore 1998: 1186-87, n. 100). In my reading this does not depend on 'confusion', but rather on the actual transformation of Hobbes's approach.

[38] 'Now when a man reasoneth from principles that are found indubitable by experience, all deceptions of sense and equivocation of words avoided, the conclusion he maketh is said to be according to right reason; but when from his conclusion a man may, by good ratiocination, derive that which is contradictory to any evident truth whatsoever, then is he said to have concluded against reason: and such a conclusion is called absurdity' (EL V.12).

but of right reason, i.e. of Philosophy. (DC *Ep*.; OL II, 136)

This might explain why, along with the concept of Wisdom – which, opposed to eloquence, conjugates theoretical (truth) and practical (deliberation) knowledge[39] – the expression 'recta ratio' becomes surprisingly diffused in *De cive*, where it counts 28 occurrences.[40] Although it sometimes functions as a rhetorical device, right reason appears to correspond here to the ideal of a perfect science of the natural law accessible to men *independently of* the civil law. In *De cive* Hobbes was still endorsing the 'ideal' anteriority of science to political power, and the assumption that in *scientia civilis* one could find the *neutral* theoretical power of 'right reason' itself. This divine perfection of the law of nature posed the problem of the relation between the natural law 'of commonwealths [*civitatum*]' and the only properly 'natural' law 'of *men* [*hominum*]' (DC XIV.4; OL II, 316). The second was, at least in principle, anterior to the first and accessible by human reason: 'the natural law did give rise to obligation in the natural state […]. Therefore the obligation to observe those laws is older than the promulgation of the laws themselves' (DC XIV.9-10; OL II, 319).[41]

The contradictory status of right reason in De cive

Although the new perspective had increased the epistemological power of reason, in practice 'reason' could not be more powerful than any other of men's 'powers', because – just as in *The Elements of Law* it was part of human powers – in *De cive* 'right reason' never ceased to be 'a part of human nature as any other faculty or passion of the mind' (DC II.1; OL II, 169).[42] And, indeed, a quite fragile one, also at the epistemological level because, as a matter of fact, the laws of nature displayed in the philosophers' books (such as the jurists' laws) cannot be properly considered written 'laws' outside of the consent of the sovereign (DC XIV.15; OL II, 323). As a matter of fact, in *De cive* the concept of law was doubled, or better, split: on the one hand it was the perfect model of true science, and on the other hand it was the truth actually instituted by civil power.[43] This derived from the

[39] 'The art of the one [Wisdom] is Logic, of the other [Eloquence] Rhetoric; the end of the one is truth, of the other victory. Both have their uses, the one in deliberation, the other in exhortation. For one is never separated from wisdom, the other almost always is' (DC XII.12; OL II, 294-95).

[40] I have counted 28 occurrences, summing the phrases 'recta ratione' (2), 'rationis rectae' (1), 'recta rationis' (1), 'recta rationem' (10) and 'rectae rationis' (12). Yet of course the expression 'dictamina (humanae) rationis' covers the same meaning.

[41] 'Lex naturalis obligabat in statu naturali […] Cum ergo obligatio ad leges illas observanda antiquior sit quam ipsarum legum promulgatio'.

[42] 'Non minus sit pars naturae humanae, quam quaelibet alia facultas vel affectus animi'. 'While Hobbes preserves this familiar terminology, however, he is far from viewing recta ratio in traditional terms as an unerring intuition or faculty' (Skinner 1996: 294).

[43] When he comes to the classification of laws in *De cive*, Hobbes goes back to the identification of the divine and natural laws displayed in *The Elements of Law* ('As for the division of law into divine, natural, and civil, the first two branches are one and the same law' EL XIX.7), along with their explicit imputation to God as the author of nature and of human nature. But in *De cive* Hobbes feels the need to specify the division of the divine and human laws as respectively depending on the scripture and the 'divine' natural reason (DC XIV.4; OL II, 315-16). This evidently allows for a more neat and safe separation of theology and philosophy, but also

epistemological ambiguity of 'right reason'. Right reason outside of the identification with civil laws existed, but as a purely formal model deprived of any power in itself; yet right reason *also* existed and was effective in the body politic, but quite far from the promising perfection it aimed at as a scientific model. In short, although the theoretical purity of right reason was, in Hobbes's intentions, a major force towards political pacification, yet it posed a huge problem to the newborn civil science: the problem of implementing science with political practice. It is therefore not a surprise that it took a quite short time for Hobbes's concept of 'right reason' to precipitate, from this precarious equilibrium, along with the events of the English civil war during the 1640s.

In the manuscript called *De motu*,[44] which Hobbes completed soon after *De cive*, we can find a more accurate terminological definition, that probably allows for a more plain solution to the problem of understanding the concept of 'right reason' in relation to 'reason', 'right reasoning', and the 'civil laws'. In *De motu* 'reason' is merely a human faculty, a power at the service of each individual's striving for preservation, and there is no evident connection between the 'critical faculties' of human nature (that is intellect and reason) and what *is* true and right in itself. Yet there is 'right reasoning', an actual capacity of some men in determinate occasions to produce a 'true' chain of propositions:

> Again, *reason* is nothing but the faculty of syllogising, reasoning being merely a continuous linking of propositions, or their gathering under one head, or (to put it more briefly) the calculating of names […]. It must also be understood that there is right reasoning. *Right reasoning* is that reasoning which, commencing with an accurate explanation of names, proceeds by means of the syllogism, or through an unbroken linking of propositions that are true. (DM XXX.22, 348r-v, italics added)[45]

And only 'right reason' is the ideal model and the actual ground of a continuative and correct exercise of right reasoning, independent of the existing civil laws:

> Right reason (if such exist) is the potential [*potentia*] to do, or the faculty of doing, this as often as we please: and herein lies the infallibility of reasoning. (DM XXX.22,

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complicates the relation between the law of nature (divine and human) and the civil laws, since 'all human law is civil law' and yet 'there are no laws beyond the dictates of right reason, which is divine law' (DC XIV.5; OL II, 316).

[44] The MS 6656A (Fonds latin of the BNF) was an analytic critique to Thomas White's *De mundo*, where Hobbes displayed most of the physical doctrine he later poured in the text of *De corpore*. The manuscript was found during the 1970s and first published in the original Latin as *Critique du* De Mundo *de Thomas White* (1973). The English translation appeared in 1976 with the title *Thomas White's* De Mundo *Examined*. I will mainly follow this translation, although, as usual, modifying it on the basis of the Latin original, when needed.

[45] 'Ratio iam nihil aliud est quam facultas sillogisandi, ratiocinatio enim nihil aliud est quam continua connexio sive collectio propositionum in unam summam, vel – ut brevius dicam – calculus nominum […] Subaudiendum autem est ratiocinationem esse rectam. Est autem recta ratiocinatio quae, initium sumens ab accurata nominum explicatione, procedit per syllogismum seu ab accurata nominum explicatione, procedit per syllogismum seu connexionem continuam propositionum verarum'.

348v)[46]

Because 'civil laws' are separated by an epistemological gap from the 'ideal' perfection of 'right reason' ('if such exists'), the importance of 'right reasoning' consists precisely in providing the only possible connection between natural reason and right reason in the light of the latter, a connection Hobbes's own civil science in *De cive* was intended to provide through deduction from the laws of human nature:

> Certainly those who live in a body-politic and are placed under its laws, *by virtue of right reason* must, in the interests of peace and the public good, *consider the civil laws as concurrent with right reason*. (DM XXX.22, 348v, italics added)[47]

In fact, 'right reason' still embodied here as in *De cive* the ideal of autonomous existence and accessibility of the natural law *outside of* the domain of the civil law. But this theoretical superiority, once revealed materially ineffective, had to progressively redefine its material conditions of possibility.

At the beginning of 1646 Hobbes made some important revisions to the text of *De cive*,[48] adding a *Praefatio ad lectores* and a few explanatory notes, among which one he expressly devoted to the concept of 'right reason'. This appears his only methodological attempt to clearly define 'right reason' as existing 'in men's natural state', outside the safe boundaries of civil law: 'outside of a Commonwealth, where no one can distinguish right reason from false except by making comparison with his own'. And what Hobbes does here is to identify right reason with the 'act of reasoning' [*ratiocinandi actum*]. In this sense, as an 'act of reasoning', right reason cannot be a mere faculty among the others, simple 'reason', and yet it is 'not [even] an infallible faculty'. The 'act of reasoning' is a real process, which deserves to be called 'true': 'the act of reasoning, that is, a man's own true Reasoning' about the effects of his actions (DC II.1; OL II, 169).[49]

This attempt to find in a 'true' and 'right' *act of reasoning* a mediation between 'right reason' as a model and 'reason' as a material faculty inscribed in human nature, was later absorbed in *Leviathan* in the more famous definition of human 'reason' as an operation of 'addition and subtraction', or better an act of 'reckoning' which clearly recalls the definition of reason as 'the calculating of names' provided in *De motu*. In fact in *Leviathan* the

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[46] 'Recta ratio (si qua talis existit) est potentia vel facultas ita faciendi quoties volumus; quae est ratiocinandi infallibilitas'.

[47] 'Iis certe qui sub legibus, et in civitate vivunt, pro recta ratione pacis & utilitatis publicae causa leges civiles pro recta ratione habendae sunt'.

[48] In spring of 1646 he allowed Sorbière to use this version as a basis for the Amsterdam edition of 1647. This means that 'by early 1646 Hobbes had made all the substantive changes that he thought necessary' (Malcolm 2012: 2; see also Skinner 1996: 330).

[49] 'Ratiocinandi actum, id est, ratiocinationem uniuscujusque propriam et veram circa actiones suas, quae in utilitate, vel damnum caeterorum hominum redundare possint'. Hobbes does not abandon here also a more 'formal' definition of 'true seasoning' as the correct deduction of conclusions 'from true principles correctly stated' (DC II.1; OL, 170)

expression 'right reason' becomes quite rare and confined, with only 9 occurrences, 6 of them concentrated in Chapter V, 'Of Reason and Science', in a book more twice as large as *De cive*. Although the expression is used in a way which partially recalls Chapter XIX.22 of *The Elements of Law*, the existence of right reason is not denied here. On the contrary, after explaining that the possibility of error is always there, Hobbes clarifies that 'reason itself is always right reason, as well as arithmetic is a certain and infallible art'. In short, (right) reason actually exists as a perfect model (as in *De cive*), and nevertheless the perfection of this *existing* model is now assumed as definitely far from human cognitive powers, which cannot go beyond a neutral operation of 'reckoning'.

As a matter of fact, in *Leviathan* there is no more actual 'empty space' that human reason can approach in order to achieve (even if from time to time) perfection: right reason is fully existent as a divine command *and* also completely absent as a possibility for individual men. Because of its intrinsic perfection, it cannot ever coincide with any 'one mans reason', thus compelling, in case of controversy, the need 'to set up for right reason, the reason of some arbitrator' (Lev V; EW III, 31). This passage evidently repeats the one in *The Elements of Law* XIX.22, yet now in the light of the saturation of the empty space of right reason with God's command, the divine 'dictate of right reason', that is one of the ways through which God declares his laws and 'governeth as many of mankind as acknowledge his providence' by commanding obedience (Lev XXXI; EW III, 345). In fact this dictate appears to human reason as a purely negative criterion, through which right reason finally assumes the only possible form it can assume as a universal truth: the paradoxical acknowledgment of its own elusiveness.[50]

Powerless superiority of right reason over civil power

Skinner interprets Hobbes's use of the expression *recta ratio* in the light of a supposedly unvarying methodological path for his civil science, eventually implemented, notably in *Leviathan*, by an *ars rhetorica* systematically employed to 'supplement and enforce', to 'amplify and underline the findings of reason and science', once the method of *recta ratio* alone had revealed its pedagogical inefficacy (Skinner 1996: 3-4). Skinner's account is driven by the desire to demonstrate a strong anti-humanist continuity between *The Elements of Law* and *De cive*, in order to explain the rationalist and resolutely anti-rhetorical epistemological stance assumed by Hobbes in civil science at the outset, and the subsequent withdrawal to the complementarity of rhetoric to science in *Leviathan*. This pushes him to overlook the epistemological gap that separates *The Elements of Law* and

[50] This 'pure' function of right reason is perfectly exemplified by its only other recurrence in *Leviathan* as a *negative* criterion for the 'wise man' to discern reports on reality from fancies: 'it is the part of a wise man, to believe them no further, than right reason makes that which they say, appear credible' (Lev II; EW III, 10). On the ideology of neutrality of science entailed by this conception of right reason, see below, Chapter 3.

De cive. *Recta ratio* therefore appears, from his perspective, the unproblematic 'addition', in *De cive*, of a certain Baconian blend to the scientific method earlier displayed in *The Elements of Law*, a kind of alternative label for the same path (meth-*odòs*) made of 'footsteps' or *vestigia* to be followed (Skinner 1996: 294, referring to EL VI and DC *Ep*.). On the contrary, the theme of *recta ratio* marks, in my view, a decisive epistemological turn that is taking place in *De cive*.

Both in *The Elements of Law* and *De cive* it was as if Reason could actually produce the body politic *through* the king. But *De cive* was not conceived as an *ontology* of the body politic: it was primarily a treatise on the first principles of the new civil science. In the epistemological perspective Hobbes adopted in *De cive,* the structure and functioning of the body politic was therefore to be understood from the point of view of 'right reason', which was in fact the perfect view on civil science precisely because it entailed the possibility of *theoretically* producing the geometrical *model* of a civil body, with no relation to political practice. In fact *De cive* assumed the same mechanistic connection between the 'power cognitive' of the mind and its 'power motive', and therefore between the principles of civil science and political practice, and yet it could not grant this connection on the basis of the ontological continuity assumed in the former treatise between the laws of nature as 'principles' and the same laws of nature as 'causes'. In effect, it appears that Hobbes initially adopted the same equivocal identification of the 'principles' of knowledge and the 'causes of things' he later imputed to Aristotle (DeCo V.12; EW I, 63).[51] Yet once he had shaped *De cive* according to the model of geometry, it was evident that civil science could not provide the actual *causes* of a body politic, but only the universal *principles* of its knowledge, in which neither 'the Justice of particular actions', nor the 'particular laws', nor the classical decision on the form of government was due (DC *Praef.*; OL II, 152).

Following the Cartesian dualist solution to the problem of providing a foundation for the new mechanical science, Hobbes had separated the realm of civil science with its principles, definitions, and names from the realm of the actual causes of the object of that science, the body politic. Civil science was thus born as a kind of non-prescriptive, neutral form of knowledge, according to the Cartesian model. What mechanical philosophy allowed for was a separation of the epistemological domain of principles and the ontological domain of causes. *De cive* was the transposition of this theoretical structure into the domain of political philosophy, which marked the origin of political science and, as I will explain in Chapter 3, of its ideology of 'neutrality'. With this move right reason gained a larger, and in principle complete, autonomy, and hence it became more powerful (in the

[51] See above, Chapter 1.3.

theoretical domain), but less effective in the practical one. It was the touchstone of any true reasoning and the actual model of perfect science. Perfectly mirroring the Cartesian *res cogitans*, it had scarcely any practical efficacy. As long as the rational laws of nature were directly embodied in the complex amount of the human 'powers of the mind' cognitive and motive, they could be easily conceived as actual causes of motion, but since they were assumed as principles of knowledge, the problem of granting their efficacy became crucial. In effect, once the dictates of right reason had become principles of knowledge and knowledge had lost any peculiar power as a physical cause, the problem first raised by *The Elements of Law* and therein solved by the intertwining of civil power and rational power came back with further complication.

From the perspective adopted in *De cive*, more than ever, in order to become science, knowledge needed to gain stability. But, if 'power' is a *motion* of matter, there is no evident *physical* compatibility between ontological power and epistemological stability. The concept of power indicates in Hobbes's mechanics the local motion of a body as far as it can be transferred to another body by contact. This assumption drove Hobbes's political research and strongly conflicted with the new epistemological approach he adopted in *De cive*. Although he never called into question the ontological unity of his object, matter in motion, he maintained the separation of the method of civil science based – as geometry – on the dictates of right reason, from the actual ontological account of physical and political motion. Thus Hobbes was compelled to move civil science closer to the efficacy of mechanics rather than confining it in the universal but hardly effective perfection of geometry: the material conditions of possibility of civil science had to be at the same time theorised and practically provided through actual power, as the sword and the crosier of *Leviathan* later prescribed. Thus from *De cive* onwards a new task for Hobbes's philosophy was set: the recruitment of new theoretical and practical means of production and conservation of the power of civil science over the body politic. In order to fill the gap between the theoretical perfection of science as 'right reason' and the actually 'small power' Hobbes eventually acknowledged to sciences in *Leviathan*,[52] a specific conceptual apparatus was needed.

In fact, the new mechanical philosophy was not intended to have local, limited effects: it was born fit for treating the entirety of Nature and, similarly, all political issues, on the ground of the universality of human nature. The new science was expected to be effective at the order of magnitude of mankind, also at the political level. A political treatise could thus not grant the all-encompassing objective efficacy mechanical philosophers were dreaming of by merely being a *speculum principis*: 'right reason' had to be *systematically*

[52] 'The sciences are small power' (Lev X; EW III, 75).

re-connected to civil power as a universal and effective cause. In the previously recalled note of *De cive* concerning 'right reason', we must notice that Hobbes was opposing there science to false reasoning, 'stupidity', and 'ignorance' of the laws of nature as the same kind of departure from the 'principles of right reasoning laid down in chapter I, articles 2-7' (DC II.1; OL II, 170).[53] If we go back to the concluding paragraph of the set Hobbes was there referring to, we can find that 'right reason' can be the measure of 'right' precisely on the ground of the knowledge of the 'desire' (*appetitum*) that draws men towards what is good and away from what is bad as 'a real necessity of nature as powerful as that by which a stone falls downward' (DC I.7; OL, 163).[54] It was as if right reason could find an adequate and effective counterpart of its perfection only in the ontological connection of causes stated by a 'lawful', deterministic account of nature, human nature included. Hobbes's materialistic epistemology was not so easily reducible to such an account as the one elaborated by Cartesian mechanicism, yet this reduction actually took place in Hobbes's philosophy during the 1640s as a conjoint physical, political, and theological enterprise.

2.3 On *Vacuum* and *Conatus*: The Consolidation of Ontological Determinism

Around 1642-43, soon after *De cive*, Hobbes went back to natural philosophy and wrote *De motu*, a critique to Thomas White's *De mundo*.[55] In the spring or summer of 1645, at the house of the exiled William Cavendish, Marquess of Newcastle, he started a long-term dispute with his new acquaintance Archbishop Bramhall.[56] This debate brought him to provide a 'Treatise' *Of Liberty and Necessity* in response to Bramhall's 'Discourse' on the same subject.[57] At the same time Hobbes was also writing *A Minute or First Draft on Optics* (1646) and took part in the discussions about the nature of void that – following Torricelli's and Pascal's experiments – were carried on also within Mersenne's circle in those years. All these variously stimulating inputs brought Hobbes to define his thesis on the nature of void during the period 1646-48, in close connection with the explicit formulation of a theory of necessity in the *Treatise*, and the 'return to Civil Science'

[53] 'Principia autem rectae ratiocinationis circa ejusmodi officia, ea sunt quae capitis primi articulis 2, 3, 4, 5, 6, et 7 explicata sunt'.
[54] 'Idque necessitate quadam naturae non minore, quam qua fertur lapis deorsum'.
[55] On *De motu*, see above, note 44.
[56] For the dating of this 'live debate', see Jackson 2007, chap. 3.
[57] In fact the title of Bramhall's paper composed in 1645 was *A Treatise of Liberty and Necessity upon Occasion of some Opinions of Thomas Hobbes about these*. I adopt the commonly accepted nomenclature employed by Chappell 1999: 'Discourse' for Bramhall's treatise and 'Treatise' for Hobbes's *Of Liberty and Necessity*, composed as a letter to Newcastle in August 1645 and published in 1654. Its publication was immediately followed by Bramhall's *A defence of true Liberty* (1655) and, again, by Hobbes's *The Questions concerning Liberty, Necessity, and Chance* (1956).

through the additional notes and the new *Praefatio ad lectores* he wrote for the second edition of *De cive*.[58] This complex set of issues scattered across different writings testifies to the wide range of interests involved in Hobbes's systematic project. In taking them on, my analysis aims at highlighting once again the close connection between metaphysics and politics animating Hobbes's philosophy. This time I will show how the conjoint exigencies emerged in both spheres induced an ideological development: the adoption of what I shall call 'ontological determinism'.

Before I can proceed, it is worth clarifying the sense in which I use the expressions 'ontological determinism' and 'epistemological determinism', referring the first to a mechanistic metaphysics of nature and the second to a methodological issue that constitutes the innovative core of mechanics. This will lead to an explanation of Hobbes's entanglement of the ontological issue of determinism with the political need of an adequate cause that would grant the continuous and regular functioning of the body politic.

Ontological and epistemological determinism

Ontological determinism is the fundamental belief in a global causal net connecting all existing phenomena, and thus making of the universe a machine-like totality in which the motion of each part directly or indirectly causes effects in all the other parts. This fundamental belief in determinism is perforce accompanied by the admission of the limitation of human understanding, and of scientific knowledge itself, to some parts of the whole causal net, and the asymptotical projection of absolute knowledge in an infinite intellect representing absolute knowledge, capable of foreseeing any future event on the basis of the perfect knowledge of the present state of the universe. It can be emblematically grasped through Laplace's formula:

> We may regard the present state of the universe as the effect of its past and the cause of its future. An intellect which at a certain moment would know all forces that set nature in motion, and all positions of all items of which nature is composed, if this intellect were also vast enough to submit these data to analysis, it would embrace in a single formula the movements of the greatest bodies of the universe and those of the tiniest atom; for such an intellect nothing would be uncertain and the future just like the past would be present before its eyes. (Laplace 1814: I, 3)[59]

[58] This second edition was published in the Netherlands in 1647. According to Skinner its accomplishment probably also contributed to nourish Hobbes's decision to write a new political treatise, that is, *Leviathan* (Skinner 1996: 330-31).

[59] 'Nous devons donc envisager l'état présent de l'univers, comme l'effet de son état antérieure, et comme la cause de celui qui va suivre. Une intelligence qui, pour un instant donné, connaîtrait toutes les forces dont la nature est animée, et la situation respective des êtres qui la composent, si d'ailleurs elle était assez vaste pour soumettre ces données à l'analyse, embrasserait dans la même formule les mouvements des plus

In short, reality is deterministically conceived and – at least in principle – fully knowable, although such a knowledge is never actually complete. This definition I assume as the ideal-type of modern mechanical philosophies, as far as they refute any ontological meaning to the concept of chance, and assume it only as the limit-case indicating the shortage of the ideally complete knowledge of causes which is the essential postulate of the scientific method.

On the other hand I name 'epistemological determinism'[60] the adoption of the postulate of determinism to ground both the methodology and the ethics of scientific research – based on the refusal of all non-causal (in the sense of the efficient cause) hypotheses of explanation of phenomena – without directly concerning the *ontological* status of reality in itself. In short, reality has to be deterministically *understood* in order to be accessible to science, but, at the same time, the difference between real processes and their scientific representation is never cancelled, and therefore the complexity of reality must not be a priori *reduced* to any deterministic representation. This approach would entail the use of statements concerning a purely 'local' determinism, in contrast to the ontological assumption of reality as deterministic in itself. Early-modern mechanicism was precisely the reduction of reality to some quite simplistic tools of geometrical representation, which provided a representation of matter in motion sufficiently universal and appearing sufficiently impersonal to be taken for reality itself. The effort to provide a metaphysical foundation to determinism – a theoretical tool neatly differentiating the method of the new science from the Aristotelian one – was precisely what led to the adoption of the ideological representation of the universe as a perfectly 'geometrical' – that is imagined – machine. My working hypothesis is that mechanicism played a major role in producing this ideological shift, and Hobbes was – willing or not – an active part of this enterprise.[61]

Does vacuum exist? Hobbes's epistemological stance

It was only in the middle of the 1640s that Hobbes achieved a complete and theoretically detailed justification of ontological determinism. Once again, the analysis of an apparently marginal issue will allow me to track this change: Hobbes's change of mind on the question of void will lead to the understanding of how the issue of natural determinism surpassed the actual exigencies of Hobbes's materialistic physics of motion, and had a striking relevance for Hobbes's political theory.

The concept of void was a traditional battle-horse of the Epicurean tradition, and the

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grands corps de l'univers, et ceux du plus léger atome: rien ne serait incertain pour elle, et l'avenir comme le passé, seraient présents à ses yeux'.

[60] Indeed, I am adopting the expression 'epistemological determinism' following Bachelard's suggestion of taking it in a sense deprived of any metaphysical presumptions (Bachelard 1951: 223).

[61] All these points will be reworked in my Conclusion, where I will argue that in fact ontological determinism still nourishes the 'spontaneous 'ideology' of scientism also in political theory.

declared enemy of Descartes's mechanics. The existence of void had to be rejected by Descartes, because it entailed the possibility of a discontinuity in the causal chains and revived the Epicurean 'monstrosity' of chance events, with potentially devastating effects on his deterministic theory of the 'laws' of motion. Hobbes long hesitated on the subject of void, which he debated in his optical and physical writings, particularly during the 1640s, at times adopting the Epicurean distinction between sparse microscopical void (*vacuum disseminatum*) and localised macroscopical void (*vacuum coacervatum*) in order to accept the first and deny the existence of the second (Shapin and Shaffer 1985: 83). The possible and 'imaginable' existence of void was asserted by Hobbes since the early *Latin Optical MS* in order to explain the multidirectional propagation of light from a 'pulsating' luminous source (by systole and diastole) through an elastic medium (LO I.4: 148).[62] And around 1646, in his last optical treatise, Hobbes still explicitly stated that he could 'find no impossibility, nor absurdity, nor so much an improbability in admitting vacuity' (EO II.2.2: 96).

The *De motu* clearly displays Hobbes's persisting ambivalence about void in the first half of the 1640s, along with his 'epistemological' stance concerning the hypothesis of natural determinism, and the growing awareness of some of its political implications. According to Hobbes there is one way out of the difficulties entailed by the doubt about whether nature admits vacuum or not, by assuming that 'the quantity of vacuum in the whole world is fixed and limited' (DM II.9, 24).[63] This is clearly just an hypothesis ('*suppositio*') that works for many different purposes, such as 'to admit [the existence of] vacuum in the way I have suggested can despatch the difficulty of [explaining] the compression of the air in the *guns* newly invented' (DM II.11, 24v).[64] Yet it is a consistent hypothesis, while the opposite one, i.e. 'that a vacuum cannot exist [*non posse esse vacuum*]', is, according to Hobbes, simply and openly 'wrong' [falsam] (DM V.4, 30). In general, although this open stance could in principle authorise any kind of monstrous hypotheses produced by human imagination, de facto it only authorises hypotheses that comply with the geometrical theory of motion: hypotheses that do not comply with it must be plainly and simply declared 'wrong'. Non-decidability is in fact a circumscribed scientific achievement, and not at all an undifferentiated label applying to any unknown matter. Claims that cannot comply with the geometrical theory of motion are simply rejected as 'wrong', while claims that are compatible and yet by definition out of reach of human experience are scientifically proclaimed non-decidable. At the same time, this epistemological stance

[62] 'Id quod neque fieri potest neque concipi, nisi concedatur posse dari vacuum, saltem per vim; dari autem vacuum facile est imaginari neque non posse dari hucusque a quoquam demonstratum est'. On this point see Gargani 1971: 221-223.
[63] 'Video […] quantitatem vacui quod in toto mundo est, esse certam et determinatam'.
[64] 'Eadem vacui suppositione expediri potest difficultas de compressione aeris in *sclopetis* nuper inventis'.

entails a kind of analytic depuration of scientific language from the terms, mainly inherited from Aristotelian Scholasticism, that are in fact nonsense, precisely because they do not comply with a mechanical representation of reality.

The same 'epistemological' stance he adopted concerning void can be easily detected in Hobbes's discussion in *De motu* of other topics as well as connected with the problem of determinism. In effect, there are several concepts that he provisionally adopts in *De motu* and he will never accept elsewhere as scientifically founded. All these concepts can be admitted there as hypotheses as far as they comply with the geometrical representation and imagination of matter, as if in *De motu* Hobbes, precisely because of the epistemological status attributed to this concepts, could more freely adopt them as working hypotheses. This is what he does with the concept of the 'infinity' of the universe (DM XXVII.6, 297v), and the attribution of a possible scientific status to astrology, depending on the fact that 'the sum total of all the causes within the stars is the sum total of all the causes within the universe' (DM XXXVI.4, 400v).[65] Quite ambiguously, in *De motu* astrology is neither excluded from the domain of philosophy nor included in it. It rather appears a plausible hypothesis 'at the margins of scientific knowledge, projecting it in the dimension (de facto unreachable) of the totality of the physical system of the universe' (Paganini 2010: 41). In this sense it is legitimate to conclude with Leijenhorst that Hobbes maintains in *De motu* an 'epistemological autonomy' of the secondary causes, although he cannot conclude for their 'ontological autonomy' from a supposed first cause (Leijenhorst 2005b: 116). In fact, it seems he cannot 'conclude' at all, since he cannot discharge any of two contradictory hypotheses if both are imaginable in the terms of the geometry of motion. And coherently, no conclusive *scientific* statement is possible on void such as on any topic by definition out of the horizon of scientific knowledge, as the knowledge of the totality of the causes is. And in effect, explicit claims *against* the existence of void and other issues directly or indirectly concerning the hypothesis of an 'ontological' determinism can be hardly detected in Hobbes's writings in the first half of the 1640s – a stance perfectly consistent with the epistemological stance he had explicitly adopted at the beginning of the decade in *De cive*.[66]

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[65] 'Collectionem omnium causarum quae sunt in astris esse collectionem omnium causarum quae sunt in universo'. According to Foisneau, this passage exemplifies the contrast between Hobbes's explicit assertion of the epistemological independency of the different causal chains from global causality, and his assumption of an ontological systematic interconnection of causes in *De motu*. He names this the 'paradox of the integral cause' (Foisneau 2000: 110 ff.). The same argument could be applied on Hobbes's *Treatise of Liberty and Necessity*, where Hobbes explains that 'the influence of stars is but small part of the whole cause, consisting of the concourse of all agents' and then hooks everything on 'the first link God Almighty' (LN II.11: 20). On the theological presuppositions entailed by Hobbes's ontological determinism, see below.

[66] This epistemological stance was indeed never completely abandoned by Hobbes. In *De corpore*, that is in Hobbes's physical *summa*, we can still find the assumption of both the existence of atoms *and* the infinite indivisibility of matter. In this sense one might extend to the whole of Hobbes's physics (as a science of phenomena) what he says about Sidereal Philosophy: 'though the causes I have here supposed be not the

In effect the hypothetical status of void as of all the connected issues really became 'dangerous' for Hobbes when determinism was definitively assumed as one of the articles of faith of his theological-political orthodoxy. As a matter of fact, a solution to the problem of void was not perceived by Hobbes as crucial before 1646-48, when he openly proceeded in the direction of Descartes's plenism. Two subsequent letters to Mersenne concerning Etienne Noel's *Le plein du vuide*, an account of Torricelli's experiment with mercury, appear to perfectly display Hobbes 'plenist turn'.[67] In the first letter of 17 February 1648 Hobbes sums up his opinion about vacuum as follows:

> I still think what I told you before: that there are certain minimal spaces here and there, in which there is no body, and that these spaces occur because of the nature, or natural actions, of the sun, fire, and other heat-producing bodies […]. Certain small empty spaces are necessarily formed by this action. (Corr I, 167)[68]

A few months later, on 25 May, still to Mersenne and concerning precisely the same topic, he argues:

> All the experiments which you and others have made with mercury do not conclude that vacuum exists. (Corr I, 173)[69]

This sequence quite emblematically represents the end of most of Hobbes's epistemological oscillations. In fact, physics never acquired in Hobbes's system the actual status of a perfect knowledge as geometry was, and, given the premises, it could not: there was no full access to the internal motions of bodies, and therefore to the internal causes of bodily motion, as was the case with the objects of geometry. This level of knowledge – the one concerning what was not accessible to human senses – had forcedly to remain hypothetical. On this ground there was no scientific reason for Hobbes to so suddenly and conclusively reject the hypothesis of void. And nevertheless this is what he eventually did. In *De corpore* the arguments 'partly made by the followers of the doctrine of Epicurus' and 'delivered by Lucretius' concerning the existence of void are conclusively rejected (DeCo XXVI.2-5, EW I, 414-27). And in Hobbes's subsequent works the hypothesis of void will not surface as a plausible hypothesis any more.

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true causes of these phenomena, yet I have demonstrated that they are sufficient to produce them, according to what I at first propounded' (DeCo XXVI.11). In effect, also when in Chapter XXVII he speaks about 'intersidereal bodies', the different explanations are always provided in term of 'possible causes'.

[67] On the whole affair, see Sergio 2001: 227-43. On the basis of the two letters Sergio establishes the 'turn' around February-April 1648. He explains that 'it was neither from a fully convicted Mersenne, nor from a perfectly Mersennian compact group that Hobbes draw the reasons for his "conversion"', and concludes suggesting the existence of a connection between Hobbes's and Roberval's 'conversions' (Sergio 2001: 239, 243).

[68] 'Summatim idem quod ante censui, esse nimirum loca quaedam, nunc haec nunc ilia, in quibus corpus nullum inest, et [haec] contingere ex natura siue actione naturali solis, ignis, aliorumque, si qua sunt, corporum calefacientum […] [ex] qua actione vacua quaedam spatiola necessario oriuntur' (Corr I, 165).

[69] 'Toutes les expériences faites par vous et d'autres, auec l'argent vif, ne concluent pas qu'il y a du vuide' (Corr I, 172).

Interpreters adduce some good physical and epistemological reasons for Hobbes's 'turn'.[70] But they generally add to their explanations a note concerning a general tendency of Hobbes's thought towards – as it was posed by Shapin and Shaffer in their *Leviathan and the Air Pump* – 'protecting' knowledge. Paganini, for instance, claims that prudential reasons brought Hobbes to close the 'openings' he presented in the 'audacious stance' of *De motu* (Paganini 2010: 42). Since it is not clear what theoretical reasons would bring Hobbes to this defensive stance, it appears quite reasonable to conclude that it was prudence (both theological and political) or even fear that inspired Hobbes's more conformist choices. Other scholars suggest a more profound connection between the two agendas, epistemological and political, such as Sergio, who concludes that Hobbes's epistemological strategy was to reduce all phenomena to a 'general mechanical lawfulness' of a Cartesian kind (Sergio 2001: 263-64; 270). Quite explicitly, Shapin and Shaffer claim that Hobbes's *epistemological* turn towards 'plenism' was connected to a wider project to solve the *political* problem of closing the public space of debate opened by epistemological dissent, as perfectly exemplified by his quarrel with Boyle around the experiments with the air-pump carried on within the Royal Society during the 1660s.[71] In effect, the idea that inspires my whole research is that the analyses of the two agendas have to be kept together in order to provide a satisfactory understanding of the shifts occurring in Hobbes's political theory during the 1640s. And, precisely for the same reason, the connections and *tensions* between Hobbes's two agendas have to be searched out precisely in that period.[72]

In my view Hobbes's 'turn' concerning the issue of void can be clearly understood only if we connect it with the wider theme of determinism he had been challenging during the 1640s. In my reconstruction Hobbes's exigency to unconditionally adopt the 'plenist' hypothesis was closely connected to his necessity of adopting ontological determinism. As explained, if natural causality was to be only the effect of local motion, the ontological existence of void, however minimal, would introduce a gap between body and body that left undecided the question of whether and how the conatus of an individual body could be

[70] Bernhardt, for instance, points to Hobbes's physics of light: 'At first Hobbes thought that the "vacuists" were right, because his theory of illumination required the possibility of a vacuum. But when he abandoned this heart-like schema and chose the motus cribrationis instead, there was no more need of any vacuum. Then, Hobbes adopted a "plenum" theory, as a consequence of his theory according to which light is propagated in a medium, that is, a real substance supporting light as a mode, for instance in the experience of the "empty" tube, carried out by Charles Cavendish (1648) and probably decisive in Hobbes' mind after 1649, mainly for experimental reasons' (Bernhardt 1993: 225).

[71] Against all disputes on spirits and subtle matter, only a strictly ontological conception of the causal-effect relationship could definitely dispel the dangerous contrasts so terrifically reflected by the political troubles of England (Shapin and Shaffer 1985: 107-109). I have discussed in detail Shapin and Shaffer's sociological interpretation of Hobbes's 'from of life' in my Introduction.

[72] The research of Shapin and Shaffer does not cover this period and, precisely because of its exclusive focus on *Leviathan*'s 'political epistemology', it can hardly grasp the internal tension between Hobbes's dualist epistemology and his monist political ontology.

preserved through an empty space and transmitted to another body. In this sense Hobbes's eventual solution of the problem of void can be seen as the mark of the accomplishment of an ideological process of reduction of motion to its mechanistic representation.

And from this perspective it is not surprising that Hobbes's need for a definitive solution to the problem of void emerged precisely after the 1645 dispute with Bramhall had raised the exigency of discussing necessity as a theological issue concerning *human* liberty. In this sense Hobbes's discussion with Bramhall is the key to understanding the ideological reasons for Hobbes's endorsement of ontological determinism because of its relevance for political theory, as far as it directly concerned the genuinely political theme of human nature. This need for a definitive solution of the anthropological problem – later revived in the *failed* synthesis of *De homine* – was initially triggered by the way in which the epistemological stance assumed in *De cive* – along with the vicissitudes of the on-going civil war – strongly affected Hobbes's faith in the power of reason during the 1640s.[73] The epistemological shift of *De cive* contributed to transform the issue of determinism from a formerly unreflected ontological assumption coupled with a methodological claim, to a key philosophical issue that Hobbes soon endorsed in all its theological and political relevance.

From epistemological to ontological determinism through the idea of God

The dispute with Bramhall was not the first debate among the deaf Hobbes went through. The clash between the two theories can be said once again to be pre-determinate precisely by the metaphysical opposition between Bramhall's dualism and Hobbes's materialistic monism. Bramhall's dualism was indeed quite far from the precise world of mechanicism. According to Bramhall, if human beings enjoy some 'liberty from necessity' (LN I.4: 1), it is because the universe is the mixed, approximate world where 'God leaves many things indifferent […] so still there is liberty' (LN I.23: 12). In Bramhall's scheme 'necessity' is clearly attributed to physical 'outward' objects which nevertheless cannot destroy human (or divine) 'true liberty' (LN I.22: 11). The latter is in fact independent of 'the complexion and temperature of the body' (LN I.21: 19), because it ultimately relies on the existence of a soul in all the 'free agents' in whom intellect and will are not predetermined (LN I.23: 13). In his reply Hobbes immediately individuates the issue of free agency as crucial and symptomatic. Although he initially claims the question is ill posed ('The question therefore is not whether a man be a free agent' LN II.3: 16), when he finally displays his 'opinion about liberty and necessity', he concludes: 'lastly, I hold

[73] As explained in the introduction, my interpretation endorses, although in a different perspective, Skinner's idea that during the 1640s Hobbes's political theory changed along with his decreasing faith in the political efficacy of reason.

that ordinary definition of a free agent, namely that a free agent is that which, when all things are present which are needful to produce the effect, can nevertheless not produce it, implies contradiction and is nonsense' (LN II.32: 38-39). Consequently, the point for Hobbes is not what the free-agency imagined by Bramhall in humans is, but rather what definition of liberty could be consistent with his materialism. And this question could not be answered without providing the metaphysical background of his deterministic conception of nature.

In Hobbes's universe there is definitely no space for an ontological difference between human beings and nature, nor there is difference between man on the one hand, and animals, children, 'fools[,] and madmen', who 'manifestly deliberate no less than the wisest men' (LN II.8: 19). 'Election' or 'choice' follows from the process of deliberation as an effect, and of course there can be no ontological difference between the actions (that is motions) of the different kinds of bodies. In this sense the issue of human liberty is necessarily inscribed in the more general one of natural necessity:

> Natural efficacy of objects does determine voluntary agents, and necessitates the will, and consequently the action; but for moral efficacy, I understand not what he means by it. (LN II.11: 20)

The case, however, is not as simple as it might seem. Hobbes's universe is indeed a complex set of an 'innumerable number of [causal] chains' which concur with the 'whole cause of an event'. The event 'does not always depend on one single chain, but on many together'; and therefore the whole set of causes is hardly accessible to human knowledge, if even 'the foreknowledge of God' 'cannot be truly said' a cause (LN II.11: 20). In fact, in the *Treatise* Hobbes explicitly adheres to an epistemology founded on the validity of internal experience: hence truth, when experience and matter of fact is concerned, cannot be more than verified 'by every man's own sense and memory' (LN II.33: 39). Such a stance might appear to make of a global determinism a kind of 'epistemological' working hypothesis as far as the *Treatise* is concerned.

But this is not the case. At the time of the *Treatise* the die was cast, and the concepts of fortune and contingency were rejected as the marks of mere boundaries of knowledge on the ground of a solid ontological belief: 'by contingent, men do not mean that which has no cause, but that which has not for cause anything that we perceive' (LN II.16: 28).[74] At the end of the day, although Hobbes openly states that 'we ought not to dispute of God's nature; he is no fit subject of our philosophy' (LN II. 38: 42), all the different events

[74] Bramhall's stance can be thus connected by Hobbes to a kind of natural illusion: 'when we see and know the strength that moves us, we acknowledge necessity; but when we see not, or mark not, the force that moves us, we then think there is none, and that it is not causes but liberty that produces the action' (LN II.20: 32; cf. also LN II.24: 35 and LN II.34: 40).

produced by the different kinds of agents and actions Bramhall had imagined contributing to the overall beauty of the cosmos were drawn back to an equally 'divine' necessity: 'though there be three sorts of events, necessary, contingent, and free, yet these may be all necessary without destruction of the beauty or perfection of the universe' (LN II.16: 28). Also in Hobbes's professed materialism the whole set of the causal chains, 'joined together, not in all parts, but in the first link God Almighty', hung together from God as the first cause: 'this concourse of causes […] may well be called (in respect they were all set and ordered by the eternal cause of all things, God Almighty) the decree of God' (LN II.11: 20).

Indeed, it had been Hobbes's stable conviction that 'predestination' in itself should not be a matter of philosophical enquiry, because it exclusively concerned the nature of God (by definition out of human knowledge), while, on the contrary, the issue of free-will was:

> This whole controversy concerning the predestination of God, and the freewill of man, is not peculiar to Christian men. For we have huge volumes of this subject, under the name of fate and contingency, disputed between the Epicureans and the Stoics, and consequently it is not matter of faith, but of philosophy; and so are also all the questions concerning any other point, *but the foundation before named* [on God's predestination]. (EL XXV.9, italics added)

In principle, no *theological* foundation (either positive or negative) to the philosophical issue of natural necessity was allowed. On this basis Hobbes refused also in *De cive* both the Stoic solution of God as a pervasive reason,[75] and the Epicurean one of God as indifferent to the world (DC XV.14; OL II, 340). And nevertheless, these repeated claims do not seem to exhaust all the assumptions implicit in Hobbes's systematic enterprise, which made of his materialism a metaphysical doctrine hardly safe from theological presuppositions. It is true that the reference to the existence of God is often used in *De cive* with rhetorical purposes rather than to provide a proper demonstration (DC II.21; OL II, 179) (DC XIV.19; OL II, 326); and this is also true for the conception of God as 'first cause'.[76] Even though it was something that 'may rightly be inferred', he never assumed it was possible to transform this 'philosophical belief' into a proper demonstration: 'I cannot therefore commend those that boast they have demonstrated, by reasons drawn from natural things, that the world had a beginning' (DeCo XXVI.1; EW I, 412-13). Furthermore, one might even extend to the very *idea* of God as first cause Hobbes's own condemnation of any attempt 'to confine him [God] within the limits of our imagination [*phantasiae*]': 'nor

[75] On a possible Stoic influence on Hobbes concerning the understanding of the physical world as an organic unity pervaded by right reason because imposed by God's absolute will, see Oakley 2005: 30-31.
[76] For instance when he states that *right* and *exercise* of sovereign power are (and have to be) separated he makes the example of the way, *as the king*, 'God the first mover of all things, produces natural effects through the order of secondary causes' (DC XIII.1; OL II, 298).

does it reflect honour on God to say that the idea of him is in our minds, for an idea is a concept of ours' (DC XV.14; OL II, 341-42).[77] And nevertheless, in Hobbes's system the idea of God clearly functions to mark the horizon of physical knowledge and, as a matter of fact, it grounds the underlying belief in nature as a mechanistically conceived whole.

Rejecting the claim that Hobbes felt no need to ground his physics on metaphysics, Lupoli (2006) tries to explain how Hobbes's physics of local motion entailed a metaphysical foundation even from a materialistic point of view. His argument is quite clear: for Hobbes matter in motion is the only existing reality, and local motion is the *only* possible object of a science *of causes*. Therefore, given that we have no actual knowledge of any 'causes' of the *existence* of matter, there can be no scientific knowledge of the paradoxically 'ingenerated matter' named God.[78] Whether sharing this view or not, from Lupoli's argument one can understand how Hobbes's system did not escape all the annexed metaphysical implications of Descartes's epistemology. On the contrary, it incurred the same metaphysical consequences both of conceiving matter within the horizon of a deterministic ontology and of grounding physics on God as a first cause and the very mythical origin of matter in motion.[79]

As a matter of fact, by the time Hobbes completed *De corpore*, ontological determinism was definitively incorporated into his doctrine. It was there synthetically demonstrated and widely motivated through the full and systematic assumption of the unity of the 'whole cause' he had sketched as an hypothesis in *De motu*, and the reduction of 'contingency' to the limits of knowledge he had fully anticipated in the *Treatise*[80] (DeCo IX-X; EW I, 120-

[77] 'Eum limitibus nostrae phantasiae circumscribere'; 'Neque dici de Deo honorifice, quod *idea ejus* animo nostro insit; *idea* enim conceptum noster est'.

[78] Lupoli is explicitly following here Brandt's interpretation of Hobbes's mechanicism as a 'pure kinetics', which makes of motion the proper object of a science of causes and brings to a 'deontologised' conception of matter, metaphysically founded on a quite peculiar 'materialistic dualism' (Lupoli 2006: 556; Lupoli takes this expression from Boyle's attack on Hobbes's 'corporeal God' in his *Animadversions* 1674). According to him, the problem of an ingenerated (that is non-caused) matter would throw Hobbes's philosophy back to the metaphysical, extra-scientific problem of the 'First Mover' and therefore compel him to conclude for the necessity of an original 'creation' of the solid body particles called 'atoms' (Lupoli 2006: 541-54). Hence the equivocal meaning (both physical and theological) of the term 'creation' in Hobbes's works, to be explained by the peculiar identification of the God of religion and the philosophical God in a single metaphysical principle. This principle would constitute the – a priori unknowable – basis of Hobbes's entire philosophy (Lupoli 2006: 571): 'Creation […] far from being collocated outside physics, is in fact a necessary postulate of Hobbesian physics. It presupposes a scientifically unexplained transition from a sort of *pre-world* made of absolutely fluid matter, to a mechanical world which can be actually known' (Lupoli 2006: 565-66). See also Pacchi 1988, which Lupoli takes his start from. Lupoli explicitly contrasts Giancotti, according to whom 'matter in motion does not need the God creator' (Giancotti 1990: 25). But also implicitly Garber, according to whom Hobbes and Gassendi – differently from Descartes – 'felt no need to ground their physics in metaphysics [and] Hobbes seems to leave God out altogether' (Garber 1992a: 62).

[79] Zarka even leads Hobbes back to the medieval 'theory of theological voluntarism', claiming that although in his system 'an explicitly recognized theology is excluded […] yet, when one turns from statements of Hobbes's own doctrines to polemical writings (involving Descartes, White, and Bramhall), where Hobbes is obliged to take account of other philosophical views, a theological presupposition reasserts itself. The presupposition consists of a theology of omnipotence' (Zarka 1996: 77-79).

[80] 'By contingent, men do not mean that which has no cause, but that which has not for cause anything that we perceive' (LN II.16: 28).

32). Although these concepts did not appear in Hobbes's 'first philosophy', the themes of ontological determinism and theological necessity had been demonstrated as being inextricably connected and conjointly relevant in all the domains of philosophy and, more relevantly, both at the epistemological and at the political level. In effect, it was in the controversy concerning human liberty carried on with Bramhall that the impossibility of knowing the nature of God was apparently overcome, in contradiction to the sceptical stance Hobbes in fact never abandoned on this topic. This was not a change of mind, but rather the mark of the political nature of Hobbes's concern with determinism:

> Hobbes's reinterpretation of the divine attributes of prescience and omnipotence in the terms of his own determinism does not provide a theological foundation for natural philosophy, but rather supports a different theological purpose, that is, in Hobbes's case, a political purpose. (Leijenhorst 2005b: 97)

On Hobbes's changing conception of human liberty

From this perspective, the 1645 dispute with Bramhall on liberty and necessity appears both grounded on Hobbes's ontological and epistemological research and – as far as it explicitly connects human nature to the physical and metaphysical framework – influential to his ongoing elaboration of civil science. Nevertheless, most commentators have tended to focus exclusively on Hobbes's anthropology and on his political agenda, concentrating on its influence on his conception of human liberty, and rarely connecting this issue to the wider theoretical background in which the dispute was also inscribed. Although the dispute was primarily endowed with theological-political implications and related to the dramatic context in which it took place, my aim is to explain how Hobbes's ongoing attempt to provide an epistemology of civil science consistent with both his materialistic premises and the epistemological shift enacted by *De cive* strongly contributed to his adopting the ontological determinism that shaped his conception of human liberty.

In commenting on the dispute, Jackson (2007) notes no substantial change at the conceptual level in Hobbes's reduction of liberty to natural necessity.[81] Yet he highlights that the Preface and notes to the 1647 edition of *De cive* might well be read as replies 'to some of the theological and political criticisms' Hobbes received from Bramhall since the beginning of their dispute in 1645 (Jackson 2007: 123). Hood holds a similar thesis concerning a substantial continuity in Hobbes's understanding of liberty, grounded on his invariant conception of power: 'From first to last Hobbes had substantially the same conception of liberty as liberty to do or to forbear in accordance with one's own last appetite' (Hood 1967: 159) because there was no relevant change in his conception of the

[81] In his deeply documented book, Jackson (2007) unveils all the connections of this metaphysical topic to the different undertones inhabiting the royalist and anti-royalist causes, in particular during the 1640s, in connection with the Hobbes-Bramhall debate.

underlying physical power, 'the power whose exercise was subject to impediment' (Hood 1967: 156). And, although he cannot avoid noting the anomaly represented by the 'change in his definition of liberty' in *De cive*,[82] Hood concludes that this was only due to a kind of momentary 'mistake': 'He was untrue to this conception when he relied in *De Cive* on a concept of arbitrary impediment; but he corrected this mistake before he wrote *Leviathan*' (Hood 1957: 159).

Taking on Hood's remark, Skinner builds a much more articulated account of the development of Hobbes's definition of liberty. He shows that the concept of liberty changes its function within the general argument displayed in the three political treatises, and, accordingly, he explains it is initially 'described' and 'circumscribed' in *The Elements of Law*, then 'defined' in *De cive*, and finally 'redefined' in *Leviathan*. These labels I interpret as consistent with my hypothesis of an epistemological shift taking place in *De cive*. In *De cive* liberty is still negatively connotated as it was in *The Elements of Law*: as the frontispiece of *De cive* clearly demonstrates by representing the alternative between *libertas* and *imperium*, 'liberty' stands on the side of natural war and disorder, and clearly opposed to the side of artificial peace and order. And nevertheless it is as well treated as one of the founding concepts of the whole theory, and as such neutrally 'defined'. Skinner's explanation for this shift points to Hobbes's political agenda, that is his rhetorical strategy for the defence of absolutism: 'His new analysis enables him to present his defence of absolute sovereignty in a far more conciliatory and less inflammatory style' and therefore 'to insist that, even after we perform our act of submission, we continue to enjoy a substantial amount of what he now feels able to describe as *libertas civilis* or civil liberty' (Skinner 2008: 116-17). As a consequence, in Hobbes's political theory natural liberty is no longer described as completely 'lost' by the subjects within the body politic as it was in *The Elements of Law*[83]: in *De cive* liberty is not the 'bad' alternative to subjection, but appears rather a power 'absorbed' in the 'libertas civilis' of the citizen almost entirely entrusted to sovereign power, although a part of it remains active as a threatening background (Skinner 2008: 122-23).

In my view, along with a new epistemological approach, in *De cive* Hobbes sought to redefine the conceptual tools of political theory. As explained, these new tools had to be formulated both according to the specific principles of the new civil science, and to the general principles of the science of motion. Consequently, liberty stopped being a concept

[82] 'It was, however, mainly on a concept of arbitrary impediment that Hobbes relied in his attempt to establish prudential obligation in *De cive*. The change in his definition of liberty in 1646 consisted simply in the restriction of impediments to external impediments' (Hood 1967: 155). For an analytical account on the role played by the internal/external impediments in Hobbes's changing conception of liberty, see Skinner 2008: 132 ff.

[83] In *The Elements of Law* subjection to the sovereign is absolute except for what is not covered by the civil law (Skinner 2008: 54-55).

only apt to describe human nature in its natural condition, in order to become a more comprehensive one, suitable to describe motion in general, and in particular referring – within political theory – to a peculiar kind of natural 'motion', conatus, which defines, although not exclusively, human nature. Thus if we can find no 'definition' of liberty in *The Elements of Law* it is because Hobbes did not even feel the need to theoretically circumscribe what was not yet a problem at all for civil science. Only with *De cive* does liberty become a problem: and it becomes a problem because therein the concept of liberty is supposed to keep together the 'good' scientific principles (the 'laws of human nature') and the 'bad' actual human natural motion that disrupts the artificial body politic. A unified definition of liberty is needed in *De cive* to keep together the two aspects: human free action within the body politic as prescribed by the laws of nature, and the natural necessity and powers characterising human nature in itself. As a consequence, human nature has to be ordered according to its own rational principles against its natural tendency.

From *De cive* onwards Hobbes had to explicitly pose the problem of this relation between a 'natural' and an 'artificial' liberty that haunted his political theory since the beginning. He had to, because in *De cive* the epistemological level and the ontological one were disjoint and therefore liberty was at the same time a principle, a theoretical model, and a cause, an actual physical power which appeared in the light of that model as a constraint.[84] As this internal contradiction of the concept arose, liberty was to be defined in 'internal' differentiation to the deterministic laws of nature, *and* as a part of them. Hence it is clear that the problem of liberty compelled Hobbes to link human natural motion to the artificial motion of the body politic, where will, choice, decision, had become collective issues, and – once again – an epistemological problem had assumed political centrality.

Natural and human conatus: individual agency as cause

The concept of 'conatus' or 'endeavour' had always played the strategic function of connecting the physical and ethical-political domains in Hobbes's works.[85] As explained above, Hobbes's philosophy allows for no direct identification of the motion of natural bodies to the individual human motions that compose the peculiar 'artificial' motion of the body politic; and, least of all, for a direct collection of all these issues under the label 'laws of nature'. Yet the individual specificity of the different kinds of bodies, not only inanimate and animal bodies, but the body politic too, could not be conceived in ontological terms: it was rather to be defined in terms of the specificity of the different kinds of motion. Thus it

[84] As I will explain in Chapter 3.2, *Leviathan* was intended to solve the problem: the superposition of a (transcendental) epistemology and an (empirical) ontology of human nature marks there the place of the typically modern ideological solution to the problem of scientific knowledge.

[85] As Barnouw notes, the use itself of the term conatus obliges to face the problem of the relation between the different parts of Hobbes's philosophy (Barnouw 1992: 103).

is precisely going deep into the physical concept of conatus, which displays the non-linear connection between the fields of the natural and political sciences in Hobbes's philosophy, that we encounter Hobbes's difficult anthropology in relation to both domains. The concept of liberty, and consequently the relation between political will, decision, and action, can be therefore translated in terms of Hobbes's more general understanding of the relation between conatus and the motions it describes. And here we can notice a remarkable shift in Hobbes's treatment of the issue at the beginning of the 1640s and at the end of his epistemological development in *De corpore*.

In *De motu*, although defined as 'the principle of motion [*motus principium*]', conatus is also itself 'an actual motion [*motus actualis*]' that results from another motion: 'So conatus lies in the fact that a body that tends [*conans*] is being moved' (DM XIII.2, 119).[86] This uninterrupted chain of local motions makes hardly distinguishable the individual bodies, and poses a problem concerning individual and collective identity and agency. The ontological homogeneity from the flow of the river to the individual human body and the body politic is assumed to be more or less self-evident. Motion is what all bodies have in common, and its uninterrupted flow is what defines the individual bodies:

> Since the motion and the flow are one and the same, the river will also be one and the same. Likewise if one asks: 'Is a man, when old and young, the same being, *ens*, or matter, in number?' it is clear that, because of the continual casting of [existing] body-tissue and the acquisition of new, it is not the same material [that endures], and hence not the same body; yet because of the unbroken nature of the flux by which matter decays and is replaced, he is always the same man. The same must be said of the commonwealth. When any citizen dies, the material of the state is not the same, i.e. the state is not the same *ens*. Yet the uninterrupted degree [*ordo*] and motion of government that signalise a state ensure, while they remain as one, that the state is the same in number. (DM XII.4, 111v)[87]

It is evident that it is precisely motion that *specifies* matter: matter is homogeneous and the different kinds of motions are what identifies the individual bodies. But it is far less evident in *De motu* how motion works in general, and what precisely allows the identification of individuals. It is true that, because the problem of void was not yet solved, the idea of an empty space separating the different bodies could have made sense of the individuality of bodies. Nevertheless, Hobbes never assumed this point. On the contrary,

[86] 'Conatus ergo in eo consistit quod conans moveatur'.

[87] 'Cum motus sive fluxus sit unus & idem, erit quoque unum & idem flumen. Similiter si quaeratur an homo sit idem numero *Ens*, sive *corpus*, senex & infans, manifestum est propter continuam materiae iacturam, & novae acquisitionem, quod non est eadem materia, neque ergo idem *corpus*, tamen propter unitatem fluxus qua materia expirat & redintegratur, eundem semper esse hominem. Idem dicendum est de civitate, mortuo enim quocunque cive, civitatis materia non est eadem, id est civitas non est idem *Ens*. Continuus tamen ordo & motus regiminis, propter quem vocatur civitas, dum unus existit, facit ut eadem numero sit civitas'.

as we have said, he always resolutely rejected the idea of a macroscopical void. Indeed it was the definitive cancellation of void and the assumption of ontological determinism that carried on also a more strict definition of the individual based on the concept of conatus. The point is made by the passage of the later *De corpore* concerning the same problem of the 'principle of individuation', where the stress is on conatus conceived as the 'beginning' of motion, or the 'institution' in the case of the commonwealth:

> [I]f the name be given for such form as is the beginning of motion, then, as long as that motion remains, it will be the same *individual* thing; as that man will be always the same, whose actions and thoughts proceed all from the same beginning of motion, namely, that which was in his generation; and that will be the same river which flows from one and the same fountain, whether the same water, or other water, or something else than water, flow from thence; and that the same city, whose acts proceed continually from the same institution, whether the men be the same or no. (DeCo XI.7; EW I, 137-38)

The concept of conatus as the 'beginning of motion' – already partially theorised by Hobbes in his optical works and an earlier motive of quarrel with Descartes[88] – had eventually become sufficient to explain the individuality of a body, precisely when bodily motion was entirely reduced to a deterministic consequence of its beginning as a cause. When all consequences depend on the very beginning of motion, the individual itself is defined by it, whether it is a natural or an artificial individual. In this sense the ontological chain was restored, and each ring could be separately considered in the different fields of philosophy. The continuity between natural and human motion, and therefore between the objects of physics, psychology and politics that the epistemological turn of *De cive* had put in crisis, was eventually restored thanks to Hobbes's final return to the straight ontological determinism he had abandoned in front of Descartes's epistemology. In fact, few scholars deny that Hobbes had always been a metaphysical determinist. And nevertheless they have to cope with the fact that through his whole work Hobbes slips into the hesitations and contradictions that the difficult path of materialism requires. The problem is that most scholars take as an invariant determination of Hobbes's philosophy what was systematically achieved through a development that took place during the 1640s following his flight from England and his philosophical clash with Descartes's metaphysics. In fact, determinism was patently inconsistent with Hobbes's materialistic metaphysics:

> Like most mechanical philosophers, Hobbes is convinced that nature follows a deterministic course. And nevertheless, as I am going to explain, differently from Descartes, Hobbes cannot legitimate this necessity in a theological and

[88] See above, Chapter 1.2.

transcendent way. (Leijenhorst 2005b: 91)[89]

To this crystalline evidence I have added that determinism acquired a more and more philosophical centrality in Hobbes's system as the development of his 'political' epistemology took form. After the crucial epistemological shift represented by *De cive* had transformed civil science into a non-effective form of knowledge, which could not grant the safe control of the functioning of the body politic it had promised, natural determinism helped restore Hobbes's hopes of settling the condition that would reproduce in the (artificial) political field the inner rationality of nature. It is on this basis that the withdrawal from a definition of individuality as itself in motion to individuality defined by the beginnings of motion could fully display the ethical, juridical, and political implications that Hobbes had to challenge in political theory: above all it opened up the possibility of planning and producing an artificial individuality even more consistent and durable than the natural ones. In this sense the adoption of a deterministic metaphysics of nature appears perfectly complementary to Hobbes's adoption of the theological-juridical concept of '*persona*', which allowed him to pose to civil science the problem of producing a collective agency capable of connecting the 'neutral' perfection of right reason to the actual efficacy of political power.

2.4 Empowering Reason: The Artificial *Persona* as a Cause

The request for a *definitive and guaranteed* foundation of reason outside the safe boundaries of the Cartesian metaphysical framework brought about an exponential drive towards security in Hobbes's political theory. As the more and more intractable problem of founding science firmly within a materialistic framework resurfaced in Hobbes's natural philosophy, his civil philosophy encountered decisive contradictions. The problem was two-sided, both epistemological and political. Firstly, because reason was always in motion and the principles of the sciences were structurally dependent on the changing wills and covenants of men, how could civil philosophy and its principles (the laws of nature) find an absolute and stable foundation? Secondly, because the effectiveness of reason could hardly exceed the perimeters of geometry, how could civil philosophy be capable not only of planning, but also of materially contributing to the production of the body politic? To the difficulties encountered in trying to solve this epistemological and political puzzle, Hobbes responded with a double move. On the one hand he modified the classical (and scholastic) concept of 'right reason' by assuming the absolute absence of

[89] 'In this sense, the argument of medieval determinists, who proposed a purely logical identification of the sufficient cause and of the necessary cause, must have appeared quite seducing to Hobbes.' Following this argument Leijenhorst concludes that 'the result was some awkward combination of a "material" mechanistic model of causality with a "formal" definition, ultimately Scholastic, of necessity' (Leijenhorst 2005b: 91).

divine justice from the body politic. This entailed a definitive commitment to its incarnation in the representative function of the state through a deliberate (and indeed effective) fiction, the sovereign as a *persona*, who would impose social order as a substitute for divine justice. On the other hand 'determinism' became for Hobbes both an ontological postulate (the guarantee of the effective power of the laws of nature) and a theoretical means of justification of the neutrality and objectivity of civil science, committed to plan and provide the rationale of the 'whole cause' that – once effected by sovereign power – would grant the long term existence of the artificial body politic. This double attempt of founding *scientia civilis* on the laws of nature as the clear and distinct dictates of 'right reason' and of founding their efficacy on the natural powers and mechanisms characterising human nature grounded Hobbes's progressive elaboration of the concept of *persona* along with his explicit endorsement of ontological determinism.

***The person in* Leviathan**

The scholarship on Hobbes's political theory has usually focused on the way he elaborated the concept of person in *Leviathan*. Although it has been noted that the associated expressions of 'natural person' and 'civil person' (or *persona civilis*) already appear in *The Elements of Law* and *De cive*, yet Chapter XVI of *Leviathan*, entitled *On Persons, Authors and Things Personated*, has been considered, and with no mistake, the first place where Hobbes explicitly defines and widely theorises the function of the concept. In *Leviathan* Hobbes would provide the first clear account of it, which he would develop and refine in *De homine* and in the Latin *Leviathan*.[90] It has been widely demonstrated that the concept refers to the original etymological meaning of *persona* as a mask for theatrical representation (according to Hobbes's own presentation of the argument), to ancient Roman law for legal representation, and, last but not least, to theology.[91] And this reference to representation eventually allows Hobbes to point to the concept of authorisation, as both the attribution and legitimation of an act. This finally makes him able to square the key issue of his political theory: the production and justification of the artificial person of the body politic made up of the natural bodies of the individuals. The whole argument can be resumed in a few steps. We have the person:

> A PERSON is he, *whose words or actions are considered, either as his own, or as representing the words or actions of an other man, or of any other thing to whom they are attributed, whether Truly or by Fiction*.

[90] Skinner's *Hobbes and the purely artificial person of the state* (in Skinner 2002: 177-208) is an exemplar summary of the debate on the concept of person focused on its development. For what we are concerned here, the Latin *Leviathan* will not be called into question, since on these issues 'in the Latin version of 1668 [Hobbes] was content to offer a simplified version of essentially the same argument' (Skinner 2007: 157).

[91] On Hobbes's theological sources for the concept, see Martinich 1992: 165-66. My argument will necessarily hint at the relation between the political-juridical and the political-theological function of the concept.

The person performs representation:

> To *personate*, is to *act*, or *represent* himself, or an other; and he that acteth another, is said to bear his person, or act in his name.

Therefore the person is the actor, automatically endowed with authority:

> Then the person is the *actor*; and he that owneth his words and actions, is the AUTHOR: In which case the actor acteth by authority.

The authority to act is immediately the power and, of course, the right to act:

> And as the right of possession, is called dominion; so the right of doing any action, is called AUTHORITY. So that by authority is always understood a right of doing any act.

This scheme has been read as the paradigmatic construction of the rhetoric of authorisation underlying the modern conception of sovereign power, which makes the power of the sovereign appear as founded on the free divestiture of the citizens' individual rights and liberty to a superior authority capable of granting those citizens the safe boundaries within which they can enjoy the only possible liberty, that is a limited and protected one. In short, Hobbes's conception of the state as a person would correspond to the modern political novelty per antonomasia of the king as no more the representative of God on earth, but the representative of the many to whose artificial body he confers the unity of a people.

This sequence is so emblematic that commenting on it might appear unnecessary. And yet, commentators have usually overlooked the underlying meaning of this argument, which cannot be correctly understood without connecting the concept of person to the physical concept of 'cause'. In fact, Hobbes never abandoned the basic postulate of his materialistic mechanicism, that all is 'but' matter in motion. Although Hobbes's political discourse cannot evidently be reduced to a *physical* account of the body politic, it is also clear that this was also the implicit postulate of his civil philosophy, and therefore all the concepts Hobbes adopted in civil science *also* had to comply with this basic principle and with the basic principle of its explanation: the unity of the motive cause. Hence I shall now try to explain how it is possible – within Hobbes's mechanistic framework – to conceive the artificial motion (power) of the body politic as an outcome of the natural motion (power) of bodies. This will allow me to show in Chapter 2.5 how the 'small power' of civil science should be, according to Hobbes, implemented by the artificial body of the 'state', and, incidentally, to explain why assuming the concept of 'natural person' in an exclusively 'political' or juridical sense does not make full sense of Hobbes's discourse. I shall therefore start focusing on the concept of person as the signifier of a defined and effective causality.

From the person as a physical cause to the power of representation

In the first part of *The Elements of Law* the term person is indifferently referred to 'natural' persons (EL X.4, 11; XII.7; XIV.13), to imagined or perceived persons (in dreams, EL III.3, III.9; pictured, EL V.6; desired, EL IX.13) or to their characteristics ('beauty of person' EL VIII.5; 'worth of the person', EL IX.11), and it usually hints at the right to defend and preserve one's physical or juridical body (EL VII.9; XII.3; XV.2; XVI.8, 10). It is only in Chapter XIX, *On the Necessity and Definition of a Body Politic*, that the specific use we are concerned with appears, along with Hobbes's very first definition of the 'body politic':

> This union so made, is that which men call now-a-days a BODY POLITIC or civil society; and the Greeks call it polis, that is to say, a city, which may be defined to be a multitude of men, united as one person by a common power, for their common peace, defence, and benefit. (EL XIX.8)

And immediately after, he adds: 'This union into a city or body politic, is instituted with common power over all the *particular persons*' (EL XIX.9, italics added). It is clear that the theory of a collective civil person that gives unity to the bodies of the individual natural persons is not a late achievement of Hobbes's political theory. On the contrary, it is situated at its very beginning. It is in fact the final purpose of the second part of *The Elements of Law*, devoted to *De corpore politico*, to explain 'lastly how a multitude of persons natural are united by covenants into one person civil or body politic' (EL XX.1).

And already in *The Elements of Law* 'a person civil' can be indifferently 'either one man', in which case the sovereign would be at the same time also a 'natural' person, 'or one council', the will of which includes and involves 'the will of every one in particular' (EL XXI.11). The person is crucial to defining the unity of the will, because the latter cannot be the outcome of a concurrence ('the concord') of different wills, but must be one will, that is the will of the 'union of many men' in one person.[92] It is the outcome of the unity of the person – whether natural or civil – that makes of the will a unitary power, a motion which can be an effective cause. Each person bears its power, which is nothing but 'motive' power, the power of moving. This power is exercised by the natural and civil persons through their wills, that is the result of deliberation and the beginning of action (and speech), and can also be transferred from one to another: 'For no person, natural or civil, can transfer unto another more power than himself hath' (EL XX.18). So in Hobbes's first treatise most of the issues connected to the concept of person have already emerged, although Hobbes does not seem to notice any problem in his argument, since, as already explained, *The Elements of Law* consistently works as an ontological description of the

[92] 'The error concerning mixed government hath proceeded from want of understanding of what is meant by this word body politic, and how it signifieth not the concord, but the union of many men' (EL XXVII.8)

dynamics of individual and collective powers, that is of the transmission of local motion from one body to another.

Apart from a more diffused and crucial use of the concept of person, which is fully justified by the very structure of a book more strictly focused on the body politic, in *De cive* no substantial change can be noticed regarding its use. The purpose of Chapter V, *On the Causes and Generation of a Commonwealth* [*civitas*], is still to display 'how and by what stages, in the passion for self-preservation, *a number of natural persons* from fear of each other have coalesced into *one civil person* to which we have given the name of *commonwealth*' (DC V.12; OL II, 215).[93] The point is, more precisely, how to explain the mechanism of unification of the motions of the human persons as natural powers into the artificial power of a collective person 'whose *will*, by the agreement of several men, is to be taken as the *will* of them all, to make use of their strength and resources for the common peace and defence' (DC V.9; OL II, 214).[94] And in the end, despite Hobbes's self-confident claims, a *physical* explanation of how it comes that 'multiple wills are *contained* [*continetur*] in the will of one' (DC X.5; OL II, 268)[95] is definitively lacking.

As demonstrated above, it was the concept of conatus that allowed Hobbes to extend the mechanistic explanation onto the whole of the existing bodies, human will included, and therefore allows us to grasp the problematic connection between the objects of the natural and the political sciences. In both cases the unity and coherence of bodily motion depends on the system of causes that produces it. Yet it has different origins in the natural and artificial bodies. While in the case of natural bodies the system of causes depends on what we would call a natural 'pattern', in the case of artificial bodies, motion is a compound of natural 'patterns' *and* of human conatus. In this sense, the peculiar kind of conatus characterising human bodies is also one of the concurring causes characterising the conatus of the artificial bodies: an artificial motion is constituted by assembled natural motions, among which are human ones. So, while natural bodies are machines set in motion by natural movements of bodies independent of men's individual conatus, artificial bodies are machines whose motion is caused by the concurrence of human mental and physical powers or 'faculties', which eventually converge in the last deliberation, will, whose effects are action and speech, that is actual physical causes of motion.[96] Now, in

[93] 'Quo modo et quibus gradibus *multae personae naturales* in *unam personam civilem*, quam *civitatem* appellavimus, studio sese conservandi mutuo metu coaluere'.
[94] 'CIVITAS ergo, ut eam definiamus, est *persona una*, cujus voluntas, ex pactis plurium hominum, pro *voluntate* habenda est ipsorum omnium, ut singulorum viribus et facultatibus uti possit ad pacem et defentionem communem'.
[95] '*Persona* autem *una* est […] quando plurium voluntates unius voluntate continetur'.
[96] It is clear that what counts in the juridical structure of *De cive* is the beginning of action and not the interplay of appetites, which nevertheless Hobbes cannot expel from his 'geometrical' consideration. The abstract definition of will as not 'voluntary in itself', but the principle (or beginning [*principium*]) of voluntary actions ('for we do not will to will, but to *act*', DC V.8; OL II, 214), explains that the internal process of deliberation is what

order to come into and to persist in existence, each body needs to combine its internal motions with the external motions it is concerned with. The persistence of the unity of a body is thus related to the persistence of a coherent motion, and therefore, in the case of the (artificial) body politic, to the persistence and coherence of many (natural) human wills. And these are individual wills which respond each to a different 'internal' conatus. The specificity of the artificial body politic thus posed the problem of its lack of an internal, natural conatus, and consequently the need for an adequate artificial substitute. The solution was provided by Hobbes in *Leviathan* thanks to the concept of representation:

> A multitude of men, are made one person, when they are by one man, or one person, represented […]. It is the *unity* of the representer, not of the *unity* of the represented, that maketh the person *one*. (Lev XVI; EW III, 151)

The concept of representation (along with the connected one of 'authorisation'[97]) is in effect the real novelty of Hobbes's third political treatise, notably the way this polysemous term (at once optical, theatrical, epistemological, and juridical) had to be injected into the old concept of *persona*. And the connection of a *new* understanding of representation in this *old* concept is what allowed scholars to detect a radical novelty in the concept of person as it is presented by Hobbes in *Leviathan.* So it is possible to claim, as most scholars do, that, compared to *The Elements* and *De cive*, *Leviathan* develops the concept of representation, while it is hardly sustainable that Hobbes conceives the concept of person differently in *Leviathan* than in the other treatises.[98] When in *Leviathan* Hobbes refers to natural human beings as 'natural' persons as distinct from 'artificial' or 'feigned' persons, this fact cannot be accounted for within the exclusive boundaries of Hobbes's political theory, strictly conceived as a theory of sovereignty, as is usually done by those scholars who impute to Hobbes an equivocal use of the term person.[99] Instead it is my argument that the difference between natural and artificial, when the person is concerned, does not affect the way representation takes place, and does not affect the

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produces the will as the outcome of the internal motions bringing to deliberation and therefore to the beginning of the external action.

[97] Skinner sees in 'authorisation' the crucial concept of 'one of the most important theoretical advances he made between the publication of *De cive* in 1642 and *Leviathan* nearly a decade later, and arguably embodies his most original contribution to the theory of the state' (Skinner 2002: 183). In fact in my view the concept of authorisation would rather depend on the one of representation: authorisation is nothing more than the translation in formal, human, and juridical terms of the physical concept of the unification of the different natural powers of men into one cause, that is one coherent motion.

[98] 'The most important way in which that book [*Leviathan*] went beyond the theories of its predecessors, *The Elements of Law* and *De cive*, was in its development of two related concepts: representation and the person' (Malcolm 2002: 223).

[99] Tricaud 1982; Skinner 2002: 190 ff. In fact, as Skinner notes, Hobbes himself differentiates the common use of the term ('we use the world in English vulgarly') from the 'exact meaning of the word *persona*' (Hobbes, *An Answer to a Book Published by Dr Bramhall, late bishop of Derry, called the Catching of Leviathan*; EW IV, 311). Yet it is not necessary to suppose this lexical continuity hides a radical conceptual opposition: the 'technical' use of the term is more likely to be intended as a specification of its use in the domain of civil science that does not cancel the conceptual correlation with the larger picture of Hobbes's philosophy.

fact that the person is the actual *cause* of the action.

To represent means to provide artificial unity to a collection of natural individual bodies by 'bearing' their persons, acting in their names. While the natural body *is* one person, the artificial body politic needs to be unified by a person in order to acquire a unitary will. So the commonwealth needs some sovereign power in order to be able to act (that is to exist): 'a commonwealth, without sovereign power, is but a word without substance, and cannot stand' (Lev XXXI; EW III, 343).[100] Yet for Hobbes it is not the sovereign that acts. It is the '*persona civitatis*, the person of the commonwealth', the *one* who acts, making the law, that is the command, 'civil' (Lev XXVI; EW III, 251). In this sense the Commonwealth (as any other 'thing personated'[101]) can be truly said to be 'one person' whenever it acts *through* a person endowed with sovereign power, whether the 'natural' person of a king or the 'artificial' person of an assembly. From this scheme plenty of questions arise: how should we conceive this unifying power of the Civil Person? How does it produce effects? What is the ontological status of the peculiar person that acts *as* a 'representer'? What does it mean to act '*by fiction*' as a '*feigned* or *artificial person*' (Lev XVI; EW III, 147)? And crucially, what is the ontological status of this act of representation?

There is no doubt that the representative function is not affected by the 'nature' of the person. As far 'as the civil use of the term is concerned' the person can indifferently be either a '*natural*' or 'a *fictitious* [*fictitia*] one' (DH XV.1; OL II, 130).[102] And this can only be explained by referring to what Hobbes means by imagination. Imagination is for Hobbes '*sense decaying*', whose products – phantasms – 'are not [all] images' (DeCo XXV.7; EW I, 396), and are the continuation of the motion of senses. So imagination is endowed with no less motive power than sense itself, and in effect 'the perpetual arising of phantasms' is an internal motion of bodies 'common to men with other living creatures' that 'we commonly call discourse of the mind' (DeCo XXV.8; EW I, 399). In short imagination is for Hobbes part of the physical causes originating will and therefore bodily motion; or, better, as Hobbes puts it in *Leviathan*, 'imagination is the first internal beginning of *all* voluntary motion (Lev VI; EW III, 39, italics added).[103] In fact, in Hobbes's theory imagination is the motive power of most human actions, and it is precisely in this sense that in Hobbes 'representation is always concrete, even in the case of a covenant which creates

[100] The phrase 'cannot stand' recurs in *Leviathan* connected to the issue of division (EW III, 168, 276, 316, 702)

[101] It is worth recalling that in the title of Lev XVI either 'Persons', 'Authors', and 'Things Personated' appear. As Hobbes will explain in *De homine*, 'even an inanimate thing [i.e. a non-living body] can be a person [i.e. personated], that is, can have possessions and other goods and be able to act at law [i.e. be an author through an actor]' (DH XV.4; OL II, 132). This works for 'temples', 'bridges', and for the commonwealth too.

[102] 'Quod autem ad usum personae civilem attinet, definiri potest hoc modo; *persona est, cui verba et actiones hominum attribuuntur vel suae vel alienaei*: si suae, persona *naturalis* est; si alienae, *fictitia* est'.

[103] 'And because *going*, *speaking*, and the like voluntary motions, depend always upon a precedent thought of *whither*, *which way*, and *what*; it is evident, that the imagination is the first internal beginning of all voluntary motion' (Lev VI; EW III, 39).

sovereignty: it is a material transfer of power' (Balibar 1996: 224). The point is that an 'artificial person' is fictitious, that is 'imaginary', yet not as we conceive the term in a sense opposed to 'real'. The person is '*fictitia*' in the same sense in which the political bodies are 'artificial, and fictitious bodies' (Lev XXII; EW III, 213), endowed with a peculiar kind of causality, but still – of course – a physical one.[104] And in Hobbes's intentions, the material power of imagination explains both the physical power the *persona fictitia* derives *from* the individual powers of those who 'personate' it, and the physical power of the *persona fictitia* – as a representation – *on* the internal motions and hence on the actions of the citizens.

As a result the unity of the civil person is not at all a merely linguistic one, as it happens, on the contrary, with the 'soul'.[105] Either natural or fictitious, the 'representer' performs the convergence of actual powers into one powerful will: 'to confer all their power and strength upon one man, or upon one assembly of men, that may reduce all their wills, by plurality of voices, unto one will' (Lev XVII; EW III, 157). It is thus a consistent set of natural or/and artificial causes (powers) that – concurring with the other 'external' causes – produces deliberation and hence the will and consequently the action of the body politic. The act of representing is so effective that when the different wills are 'represented' as convergent their action is de facto made 'one', because it depends on a unitary cause. The civil person – either natural or artificial – is a *physical* unity of natural individual wills which acts as a unitary cause of motion.[106] Furthermore, as Hobbes's civil science is intended to demonstrate on the basis of the laws of nature, although the individual wills might diverge 'in principle', they are in fact part of a represented unitary motion (collective and artificial) to which their natural conatus not only has no power to escape, but ultimately finds it rational to be submitted. The convergence of the civil law and the rational laws of nature is thus physically effected by representation, which actually makes of the civil law 'the will and appetite of the state' (Lev XLVI; EW III, 681).

Despite this sound achievement, Hobbes was well aware that *no law* – either natural or

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[104] In this sense I can see no conceptual difference, as Skinner does, between the '*feigned* or *artificial person*' of the English *Leviathan*, the '*fictitious* one' of *De homine*, and the '*representative*' person of the Latin *Leviathan* (Skinner 2002: 189). Not to mention that the Latin adjective 'fictitius' bears the double meaning of 'fictitious' and 'artificial'. In this perspective the point is not even whether the state be an organic community or a '*persona ficta*' since it is none of them.

[105] In the *Treatise* Hobbes clearly opposes the actual existence of the group (a commonwealth or a family) in opposition to the purely imaginary status of the human soul, when he refers to 'that metaphorical speech of attributing command and subjection to the faculties of the soul, *as if* they made a commonwealth or family among themselves and could speak one to another, which is very improper in searching the truth of the question' (LN II.20: 32, italics mine).

[106] And *therefore* the citizen, as such, is also juridically imputable for the act: 'Hobbes's political theory, which is explained in physical (or quasi-physical) terms, in reality relies upon fundamental categories which belong to juridical anthropology and depend on the metaphysical decisions it imposes. As a consequence, the dualisms which had been eliminated will now reappear, but on the practical level: they do not refer to ontological distinctions, but to the issues confronting the legal subject. Man, in Hobbes, appears to be a split being, for example, he is torn between the "external forum" and the "internal forum", but, above all, he divides himself between the symmetric functions of actor and author, which allow him to act as a "person"' (Balibar 1996: 223-24)

civil – could be 'the whole cause'. Because individual will can always be against the law, we deduce that laws by themselves cannot be considered a 'sufficient and therefore necessitated cause' (LN I.16: 29). The aim of civil science was therefore to establish a mechanism that would complement the 'small power' of the natural law and the still non-sufficient power of civil law *as causes*, with further effective powers. In short, it had to provide as far as possible 'the whole cause', thus making the different natural trajectories of the individual bodies converge into *one* regulated artificial motion, in agreement with the predictive power of reason. For this purpose a civil science was needed, which had not only to provide a perfect scientific knowledge of the body politic, but also to be itself part of the means of its actual production and preservation. The frontispiece of *Leviathan* is a considerable piece of this conjoint epistemological and ideological effort.

Frontispieces: the materiality of ideology

A large amount of ink has been devoted to the suggestive figure represented in Hobbes's *Leviathan*'s frontispiece and, more seriously, to the study of its theoretical meaning, historical sources, and significance within Hobbes's political theory. More recently the discussion has been extended to the whole of Hobbes's frontispieces, particularly attracting new interest as rhetorical tools through which Hobbes intended to implement his political theory. It has been noticed that there is hardly a compatibility between the 'traditional' trope of the body politic to which Hobbes often refers metaphorically, and the allegorical image represented in the frontispiece of *Leviathan*.[107] The traditional body politic entails different functions for the different parts of the body politic, while the image (in particular the one in the original MS drawing) represents indistinct individuals forming one person. Yet it has rarely been noticed and explicitly thematised that the programmatic reference to an automaton Hobbes provides in the introduction – where he describes an artificial man made of spring, wheels, and strings – is clearly inconsistent with the theological and biological *metaphors* Hobbes scattered throughout the whole book and pictured in the famous frontispiece. It is evident that Hobbes was looking for an alternative model to the ancient (and openly Aristotelian) organic one, and it is quite clear that Hobbes's *Leviathan* aims at the mechanical model of a powerful *automaton* he derived

[107] Bredekamp's studies on the sources of Hobbes's 'visual strategies' (far beyond the famous frontispiece of *Leviathan*, Bredekamp 2003) point to display the strategic efficacy of the accurate iconographical work Hobbes carried on. His enquiry on Hobbes's sources collects the influences of the hermetic corpus on the imagination of an automaton endowed with reason, of the royal effigy representing the continuity of sovereignty during the time of the interregnum, and the optical machine producing the actual unity of the image starting from a multiplicity of bodies (Bredekamp 2007: 33-44). According to Malcolm the image on *Leviathan*'s frontispiece allowed Hobbes to represent 'the relationship between sovereign, state and people' when iconography lacked. This relationship would be analogical to the one displayed by Hobbes in the *English Optical Treatise* when explaining perspective: the perceptive shift between the actual shapes on the canvas perceived depending on actual vision and the represented things depicted perceived depending on memory (Malcolm 2002: 224-26). These are both fancies, but one corresponds to an actual body, the second to former fancies and it is in the end illusory.

from the imagery of his epoch, endowed with a consistent and uniform motion capable of defeating the ungovernable multiplicity of the natural bodies of the multitude. In this sense the development of Hobbes's *civil science* also seems to point to the progressive integration of the traditional organic model for the body politic into the new mechanical model. And from this perspective the contradiction between the programmatic assumption of a mechanical *model*, and the constant use of biological *metaphors* can hardly be explained in terms of the rhetorical aims of *Leviathan*; rather, it offers a privileged insight into the paradoxical nature itself of Hobbes's enterprise.

Hobbes's exercise of a rational civil science does not imply a dismissal of metaphors; on the contrary, it needs a constant, adverted, 'double sight'[108] on them, a genuinely Platonic concern of using them as metaphors without concealing they actually *are* metaphors. Hobbes's civil science in fact operates at two different levels. It provides an actual *demystification* of political power, by explaining that sovereign power is a consequence of the rational acts of will of the 'educated' people, and it demonstrates the necessity of a *mystification* of political power: because the passions of men are more powerful than their reason, representation functions only on the condition of power being 'conferred' on the sovereign through 'belief'. Although it is true that 'honour consisteth only in the opinion of power', it is also true that this opinion of power becomes actual power: 'Reputation of power, is power; because it draweth with it the adherence of those that need protection' (Lev X; EW III 80, 74).[109] Malcolm clearly sees how the two sides of the coin are assembled in Hobbes's theory: to 'instruct the people that the sovereign is merely an artificial person' and to 'require them to believe in the "person" as something outside them and greater than any of them'; but he concludes this duality is a 'curious structure of the argument' (Malcolm 2002: 227-28). He does not seem to be aware that he is touching the theoretical core of the modern concept of sovereignty itself.

The very *absence* of God and of right reason, and therefore the structural imperfection of the earthly city, entails, as a consequence, a permanent crisis of politics. This crisis defines the political domain, where civil power represents the only possible substitute for absolute divine truth and justice, which transcends by definition (being *ab-solutus*) the political domain, and yet is relevant precisely because of its absence. In fact the absence of God from history and politics is what authorises the rational acceptance of the sovereign as the paradoxical embodiment of a non-present right reason. In this sense modern sovereignty can be considered dependent on an inherently eschatological

[108] I take this expression from Shapin and Shaffer 1985.

[109] 'Now since men believe that a man is powerful when they see him honoured, i.e. regarded as powerful by others, it comes about that honour is enlarged by worship; and real power accrues from a reputation for power. So in ordering or allowing himself to be worshipped, his *purpose* is to make as many people as possible obedient to him either from love or from fear' (DC XV.13; OL II, 340).

discourse. All problems concerning justice are moved into the mythical future of the Last Judgement, out of the positive boundaries of anthropology and political theory, thus allowing civil science to assume the entirely immanent task of ordering, homogenising, and in fact neutralising the present, by granting the predictability of human actions, once hope and fear for/of the future are neutralised. Yet the formal justification of this power does not imply its actual legitimation: born out of the emergence of a demystifying science of nature, the new civil science would therefore discover that the very existence of its conditions of possibility – that is social order – prescribes a re-mythisation of the roots of sovereignty.

The theological-political structure of modern sovereignty was first theorised by Schmitt precisely through his interpretation of *Leviathan*.[110] According to Schmitt this structure would be theorised in Hobbes's civil science with the purity of a 'crystal', the basis of which is a naturalistic account of human nature, and the structural openness of which to transcendence would be saturated by the collective values established by the decision of the sovereign.[111] This is the ground of the criticism he advances to Hobbes's political theory in *The Leviathan in the State Theory of Thomas Hobbes: Meaning and Failure of a Political Symbol* (1938).[112] According to Schmitt, Hobbes's 'political myth' was a failure because it accepted the discrepancy between the inner and the outer faith of the citizens, a separation that entails a kind of 'neutrality' of the state power in the face of individual values that would seed potential subversion. In short, Hobbes's rational political philosophy would not be able to successfully found the state on the historical and cultural roots of a people, a failure well represented in his eyes by the failure of the liberal-democratic states. According to Schmitt the bureaucratic and technocratic state would not be able to stand if it is not coupled with the myth of the nation-state.

In contrasting Schmitt's interpretation, I assume that Hobbes indeed theorised a project

[110] Schmitt's interpretation of a political-theological foundation of political power in Hobbes is not to be confused with those interpretations of Hobbes that highlight the foundational role for his whole system of religion or, on the contrary, of the critique to religion. Martinich well represents the first line of research, according to which Hobbes's metaphysical attempt in *De corpore* to reconcile Calvinist Protestantism with the new science, is to be understood in the light of Hobbes's belief in God's existence (Martinich 1992). The other line of research is the one of Leo Strauss, who first underlined the strategic function played in Hobbes's political theory by the critique to religion as the only possible ground for political science. Facing religious wars, the *neutralisation* of religion would be the necessary prerequisite of Hobbes's political science, the liberation of a neutral space for the exercise of reason. This preliminary operation would allow for the *rational* justification, instead of a theological foundation, of political power. Leo Strauss' opposition to Hobbes rather concerns the *kind* of abstract rationality Hobbes is dealing with, which is far from the way classical reason was, according to him, connaturated with the very exercise of political praxis (Strauss 1936). For a synthetic view on the different interpretations of the theological-political problem in Hobbes, see Cammellone 2013: 18-41.

[111] See the famous note sketching Hobbes's conceptual 'crystal' in Schmitt 1929-32: 52-53. According to Smith in Hobbes's theory the 'crystal' was closed by the truth that 'Jesus is the Christ', yet, in order to function, the myth needs to be grounded onto the basic friend/enemy contraposition. The myth of the nation-state fulfilled this purpose ever since.

[112] In fact his critique was already sketched in *The State as a Mechanism in Hobbes and Descartes* (1937).

for incorporating the citizens' 'inner faith' into the functioning of the body politic. In this sense, Hobbes's representation of the artificial unity of the body politic must be taken as a programmatic one. We have there the intuition of the materiality of ideology, and of the possibility of planning and producing the effects of a politically planned pedagogy, among the means of which religious imagery is the most effective weapon. As explained, if it is true that the unity of the person is an 'illusory' fancy, yet both fancies and their effects are real. In this sense it can be assumed that all the different scientific and rhetorical issues related to the representation of the body politic, added to the biblical sources of Hobbes's imagination, converged in 'inventing' *Leviathan* as a *materially* effective sign:

> The picture of Leviathan completed the step from mark to sign: in no way only as a device of individual fantasy, it forms the sign of the state, which directions the action from within at any given time. Inasmuch as it has become a sign, the frontispiece possesses a character relevant to the action. (Bredekamp 2007: 50)

The effective signs of power are those that make the parts of the body politic function according to the whole as if there was one person and one aim. In this way, the necessity of the existence of the artificial body politic is precisely what cannot be called into question, the very presupposition of politics that immediately becomes at the same time *the* political goal. In this sense, in *Leviathan* the imagined *persona* is at the same time the overall ideological effect of a well-established commonwealth, and the actual *cause* of its correct functioning. The imagination of the civil person thus embodies right reason in the perfect circularity established through a continuous double motion: from power to collective imagination and from collective imagination to power.

2.5 *Leviathan* as an Ideological Synthesis

The concept of a representative person works in *Leviathan* as a bridge between the ancient and the modern: it allows Hobbes both to refer to the tradition of 'recta ratio' and, once its inexistence *in rerum natura* is assumed, it provides the rational justification of the commitment of individual powers and rights to a sovereign power. Once evoked, right reason needs at the same time to be structurally dislocated, emptied, and unfulfilled in order to allow a passionate belief. And in fact it is still reason that explains that the structural lack of *recta ratio* must be accepted and overcome by means of a faith in the intrinsic rationality of the existing state of things. Hence the concept of person really works in Hobbes's political theory as the immanent substitute of the same function developed by the mystical body of the king in the medieval tradition, translated into the terms of mechanical materialism. By embodying the *recta ratio*, the person of the sovereign – the political actor – shifts it from the pertinence to political theology and divine monarchy to

the artificially existent and effective body politic. The continuity of political power, originally granted by the immortality of the king's mystical body,[113] is thus transferred to the rational and automatic continuity of the mechanical motion of the body politic.[114] This automatic motion was to be safeguarded by the perfect 'impersonality' of the power of the civil person which in fact perfectly mirrors the defensive 'neutrality' of the new civil science:

> I speak not of men, but (in the Abstract) of the Seat of Power, (like to those simple and unpartiall creatures in the Roman Capitol, that with their noise defended those within it, not because they were they, but there). (*Leviathan, Dedicatory Letter*; EW III, not paginated)

This defence of 'just' power was what reason was initially accounted for in civil science. But the new perspective opened by *De cive*, although it had solved the problem of providing civil science with an epistemological foundation on right reason, compelled Hobbes to abandon the hypothesis of a possible actual efficacy of reason, therein conceived as a 'model' rather than as a physical power. In *De cive* the truth of scientific 'models' was intended to be released from the *materiality* of civil power. And on this basis all sciences – civil science included – were definitively assumed to be, in *Leviathan*, 'of small power' (Lev X; EW III, 75).

In effect, what 'new' kind of reality characterised the epistemologically powerful 'right reason' of *De cive*? 'Right reason' was the epistemological model which stood for the *subject* of perfect knowledge, and could be 'personated' through the adoption of a method made of principles, definitions, and deductions. In physics, the figures of geometry – made of perfectly straight lines and curves drawn by an ideal hand following the ideal eye of an ideal subject geometer – were the model which stood for the 'real' natural bodies, and likewise in civil philosophy the 'laws of nature' were the model which stood for the 'real' political bodies. But right reason, the subject of science, needed an objective counterpart which would allow it to become effective. Reality in itself was unachievable to a human knowledge epistemologically limited to pure contemplation, and it resisted as such any human rational deliberation, planning, and action. Taking the rational models of the new geometrical mechanics for reality was the *ideological* trick which allowed Hobbes to connect science to the reality it addressed, and consequently civil science to the body politic. And this is what Hobbes attempted by making of 'ontological determinism' the corresponding 'model' for the *object* of science.

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[113] On the distinction between the physical and the mystical body of the king, which granted the continuity of power, see the classic Kantorowicz 1957.

[114] 'In the end, the constitution of the "body politic" and its physical/legal unity is hardly to be distinguished from a secular transposition of the *corpus mysticum* of the church, in the best theological tradition […]. With its universal, mediating function and its unconditional authority, the legal fabric of the State exactly reproduces the theological properties of the divine/human incarnate Word, a material realization of spiritual power' (Balibar 1996: 225).

The systematic adoption of 'ontological determinism' was a key step towards this ideological synthesis. Taking determinism as an objective correlative to the perfection of right reason, allowed Hobbes to assume that it was possible, on the one hand, to calculate the objective consequences of political intervention, thus grounding the efficacy of right reason when embodied in the agency of the artificial body; and it was possible, on the other hand, to explain and justify political power as the necessary outcome of a whole series of natural causes. In short, ontological determinism grounds both the power and authority of the sovereign. The sovereign *can* produce order because his command, once adequately settled, causes necessary effects. The sovereign is *authorised* to govern because, although there is no God that directly invests him, the fact he is a sovereign is a necessary effect of the whole set of causes we call nature; i.e. if 'right' is 'power' the sovereign deserves his power. The point is not only that *any* government is better than *no* government at all, as maintained by those who claim that Hobbes's is a 'de facto' political theory. Although it is true that for Hobbes there can hardly be a more radical evil than the absence of government, the point is rather that the existing power can draw its authorisation from its very existence, precisely because existence itself *is necessary*. In this sense theological necessity and ontological determinism play a conjoint ideological role. Theological necessity is the investiture of the existing state of things through the divine necessity of nature, and at the same time ontological determinism is the investiture of scientific knowledge by an ordered nature perfectly corresponding to the geometrical-mechanistic model. In this sense the ideological assumption of the deterministic laws of a *nature* conceived as a mechanical whole would play the role of God's agency in the background of Hobbes's civil science, by both empowering and justifying the existing state of things, civil power included, and political science itself.

For these reasons the postulate of ontological determinism might have been considered by Hobbes a part of his political pedagogy: an effective rhetorical tool that would spread the belief in the identification of natural-divine necessity and civil power. But Hobbes never claimed his doctrine of necessity was to be used as such. On the contrary, he explicitly expressed his concern of making it public: 'This doctrine, because my Lord Bishop [Bramhall] says he hates, I doubt had better been suppressed, as it should have been if both your Lordship [Newcastle] and he had not pressed me to answer' (LN II.11: 21). This claim has always been read as a sign of Hobbes's fear of being persecuted for his doctrine. Although this is probably the case, I would not underestimate the importance of a subsequent claim, which appears in surprising agreement with Bramhall's arguments against the moral danger represented by the doctrine of necessity (cf. in particular LN I. 14-17: 4-6). In the passage where he recalls Bramhall's remark, Hobbes implicitly adds a pedagogical-political issue: 'what use soever be made of truth, yet truth is truth, and now

the question is not what is fit to be preached but what is true' (LN II.14: 24). This differentiation between the actual 'truth' of a doctrine and its possible 'preaching', clearly points to one of the main problems Hobbes encountered through developing his political theory, the pedagogical concern on the efficacy of reason towards the multitude. And about the possible misuse of the 'truth' displayed in his *Treatise*, Hobbes finally concedes:

> I must confess, if we consider the greatest part of mankind not as they should be but as they are […] the dispute of this question will rather hurt than help their piety. (LN II.15: 27)

Hobbes's civil science was intended to explain that a purely rational will would correspond to the automatic functioning of the body politic. But, as he had always denounced in his political treatises, even a perfect knowledge of this mechanism would not suffice to capture the actions inspired by a profusely diffused non-rational will. The reason why in *Leviathan* a 'denunciation' of irrationality (of fools, children, and atheists) did not suffice anymore is that at that point of his epistemological development no sufficient power was attributable to science *as a cause*.[115] Yet civil power was not to be considered sufficient either. As Hobbes had claimed in *Liberty and Necessity*, 'to make the law is therefore to make a cause of justice and to necessitate justice' (LN I.14: 25). But, because 'the law regards the will and no other precedent causes of action' (LN I.14: 24), it can only be *a* cause, and not *the whole* cause. In fact the natural law provides a rational 'command' which can always be disobeyed, while civil law perfectly works only as far as the external actions are concerned.[116]

While Hobbes was well aware that in Descartes's framework the metaphysical liberty of *res cogitans* would remain out of reach for political power, his materialistic version of mechanicism apparently offered the means for a more radical solution to this political problem. In effect, Hobbes's materialistic *determinism* granted that once an appropriate geometrical systematisation of the body politic was settled according to the universal (and natural) laws of human nature and of the body politic, a consistent artificial motion would follow, with no 'spiritual' impediments. In other words, the ontological connection of causes established by Hobbes's deterministic ontology would grant the efficacy of right reason once its connection to civil power was achieved, thanks to the integration of civil science into the functioning of the body politic. Civil science was thus directly concerned with its material conditions of possibility, and was ready to endorse them as its central

[115] Weber sketches the evolution from *The Elements of Law* to *Leviathan* as the shift from a *denunciation* of 'de-raison' to a *pedagogy* of 'guerison', corresponding to a shift from a physics to a medicine of the political body (Weber 2000: 43-45, 54).

[116] 'The external actions done in obedience to them [laws], without the inward approbation, are the actions of the sovereign, and not of the subject, which is in that case but as an instrument, without any motion of his own at all' (Lev XLII). This passage is differently analysed, although on the basis of not so different purposes, by Feltham 2013: 154-55.

purpose. The concrete assumption of this goal found its concretisation in Hobbes's rewriting of *The Elements of Law* as *Leviathan*.

Conclusion

It is crucial to stress that Hobbes was determined to import into political theory concepts elaborated by seventeenth-century mechanical science. The complexity of this conceptual transposition made of his *scientia civilis* or 'civil philosophy' a real work in progress. This is an aspect which is often obscured by considering *Leviathan* the monolithic outcome of his political theory. For this reason, I have followed the main orientation of Hobbesian scholarship towards a developmental rather than systematic account of Hobbes's philosophy.[117] But to fulfil this purpose it was necessary to cross Hobbes's *work in progress* in the natural sciences during the 1640s with the development of his civil philosophy, in order to find out how much this was *epistemologically* consistent with its own premises of producing a materialistic science of the body politic. In fact, through this reconstruction of the development of Hobbes's political thought, I aimed to unveil the basic structure of an ideological move, which shows no exhaustive epistemological justification within his materialism.

As his epistemology evolved, Hobbes progressively shifted the relationship between science and political power: he started supposing science could be the solid base for civil power, but more and more he conceived a circular relation in which politics had the primacy. He finally assumed that, on the one hand, civil power provides the *material* conditions of possibility for science (enduring covenants, which establish peace and therefore grant stability both to men's wills and to the principles, definitions, and names on which science is based). On the other hand, he assumed that civil science should contribute (with the support of rhetoric) to provide the *psychological* conditions of possibility of civil power, that is the belief in the actual power of right reason embodied in the person of the commonwealth. The result was perfectly consistent with Hobbes's foundational aim, but this aim was not consistent with his epistemology.

In fact a parallel ideological progression was taking place in his philosophy, which I have treated as two issues: the conjoint adoption of a 'theological-political' perspective on 'right reason' and the endorsement of ontological determinism, that is the key points onto which he could firmly weld a mechanical epistemology with a politics of security. In effect, both assumptions progressively reduced Hobbesian *science* (and not only civil science) to an ideological apology of the sovereign power they relied on, and ultimately committed civil science to providing the means to implement this ideological synthesis with political

[117] A trend which started within the 'Cambridge School', mainly interested in the influence of the *political agenda* on the development of Hobbes's civil philosophy. See my Introduction.

practice. This stance entailed the conjoint epistemological neutralisation of civil science and its absolute commitment to a political-pedagogical project which assumed human nature as the object both of scientific knowledge and of technological action. The achievement of this ideological synthesis pushed Hobbes towards a further reformulation of civil science that took shape as *Leviathan, or The Matter, Forme, & Power of a Common-Wealth Ecclesiasticall and Civill*, 'the *Matter* thereof, and the *Artificer*, both which is *Man*' (Lev *Introduction*; EW III, X).

The book was an operation of re-foundation of civil science on a conception of human nature that would carry all the paradoxical burden of Hobbes's materialistic mechanicism. The naturalisation of civil science entailed the a priori justification of the technologies it had to adopt in order to organise and improve the functioning of the body politic as a collective person. Far from cancelling individual agency, the coupling of the concepts of determinism and of the representative *persona* enforced the connection between the subject of science and the sovereign's agency, making it strongest, and, in effect, 'automatic'. Political power could thus provide a foundation for the actual power of reason, which in turn brought to an epistemological foundation of that power. And the achievement of the perfect knowledge of this circular truth provided by the new civil science was likely to become a self-fulfilling prophecy. All this said, Hobbes's epistemology offered the possibility to follow completely different lines of development. The ideological development of Hobbes's political theory was in fact, as I am going to explain in the next chapter, perfectly consistent with the 'political agenda' settled by Descartes for mechanical philosophy. Not at all with Hobbes's materialistic premises.

Chapter 3

Mechanicism as Ideology

Hobbes tried to solve the problems posed by ancient political philosophy within the secure boundaries of mechanicism. The attempt to provide an anti-Aristotelian, 'geometrical' civil science brought him closer and closer to Plato, whose question concerning the relation between wisdom and government he apparently solved by identifying wisdom with the new mechanical science. This epistemological choice immediately raised the political problem of granting efficacy to the theoretical principles of human nature that grounded civil science: the laws of nature. Through a redefinition of human nature according to the principles of his materialistic mechanicism, Hobbes intended to institutionalise civil science, thus making of politics a neutral, 'administrative' task removed from the domain of political struggle. This process of neutralisation of the conflicting nature of politics entailed the identification of justice and law as the ideal theoretical solution for the indefinite preservation of the artificial motion of the body politic, and the unification of both under sovereign power as the most effective tool for their implementation.

This tension between the professed neutrality and the actual political purposes of science is reflected in Hobbes's theory of human nature. Hobbes was never able to consistently deduce civil science from the principles of his physics without incurring in the problems entailed by Descartes's dualist epistemological agenda. As a matter of fact, although materialism remained the unvaried horizon of Hobbes's political theory, it did not determine its actual shape, which was, on the contrary, a process of redefinition of the ontological and epistemological status of human nature in order to solve the ancient political problem of securing the government of passions by reason. As a result human nature was to be defined by the paradoxical coincidence of a physical and a political body. For the purposes of civil science Hobbes eventually tried to collapse these two opposite features of human nature into a unified image that finally proved its contradictory status by undermining the structure of *De homine* and, in fact, Hobbes's entire system of sciences. For the same reason *Leviathan*, the final achievement of his *scientia civilis*, was born as an *epistemological* monstrosity in which human nature played a contradictory role, being at the same time the subject of scientific knowledge (as a sovereign reason) and the object of political intervention (as a part of the body politic).

Despite the appearance of a neutral description, Hobbes's political theory entailed a theoretical and practical process of definition, control, and even production of human

nature through pedagogical technologies. Thus Hobbes's pedagogical political project displayed a whole set of tools that would allow for its realisation: rhetoric, religion, and even history. It is my aim to demonstrate that this outcome cannot be entirely explained either as a consistent development of Hobbes's theoretical premises or on the basis of historical and/or biographical vicissitudes. Hobbes's ideological development in political theory was, rather, consistent with the metaphysical premises of Cartesian mechanicism and, more generally, with the historical process from which it emerged as a systematic understanding of reality.

On the ground of Hobbes's pedagogical political project my analysis will therefore move to the study of the ideological significance of mechanicism itself. I will discuss the relation between science and ideology starting from the analysis of some Marxist interpretations of the relation between the emergence of modern science, of the bourgeoisie, and of the modern state. I shall particularly focus on the role played by technics in contrast with the ideological theorisation of automatism developed by Descartes and Hobbes in natural and political philosophy according to an abstract conception of the machine. Technics represents the experimental side of the twofold method of science whose implicit relation to matter resists the effort of mathematical and metaphorical symbolisation carried on within mechanicism as both science and ideology. While the neutralising approach of early-modern 'geometrical' mechanicism entails a project of normalisation of political administration according to the principles established by political theory, the normativity of technics confronts political practice with the material emergence of new finalities, thus opening, in accord with a genuinely materialistic agenda, the field of political experimentation.

The chapter demonstrates that Hobbes's civil science did not develop a genuinely materialistic political agenda (whether representing individual or class interests), it rather carried on the epistemological agenda of early-modern mechanical philosophy along with its ideological implications. And, in this sense, Hobbes might be said to have acted as a kind of 'infiltrator' within the materialist tradition, and in particular in mechanical philosophy, in which he imported a dualistic political agenda. Hence the achievement of the thesis is to trace back the origin of the mechanistic ideology in seventeenth-century mechanical philosophy, in order to ground my conclusion that the epistemology of twentieth-century natural sciences allows for both a demystification of the early-modern conception of the world as a deterministic machine, an automaton, and a new materialistic understanding of the relations between science and political power.

3.1 Hobbes with Plato: The Purposes of Civil Science

Classical Greek, Latin, and Christian political philosophy was strictly connected to ethical, moral, and theological issues. A prescriptive science shaped the ideal model of the body politic and the relative duties, functions, and expected behaviour of its members.[1] Political philosophers had always described men 'not as they are, but as they would like them to be', and therefore – in Spinoza's words – they had 'written satire rather than ethics'. The scientific revolution in political philosophy was a shift from political theory as a *prescriptive* science to political theory as a *descriptive* science, which entailed therefore also a shift from a close connection to a sharp differentiation between morality and politics. Yet 'political theory' as a descriptive science does not at all appear to be a neutral issue if, still following Spinoza, we assume that understanding men *as they are* was intended to 'be turned to use' (Spinoza 1670, I.1).[2] These considerations do not entail that political realism was *born* in the seventeenth century as a mechanical physics of the body politic. On the contrary, political science itself was probably born more than a century before with Machiavelli, whose political theory was grounded on *history* as a science. But it was during the seventeenth century that – through Galileo and Descartes and finally Newton – the revolutionary and ground-breaking mechanical science triumphed and completely changed the world picture. And it was along this process that the exigency of a new political science beyond morality, but also completely neutral and objective, emerged: and its model was *geometry*, not history.

In this framework Hobbes intended to build a new civil science. Yet along with the emerging mechanical world picture, plenty of further questions arose: what kind of machines (if any) were human beings? What was a mechanically conceived social system? In which kind of universe were they inscribed? All these questions might have had a quite simple response for the few who wanted to abandon the Aristotelian-Christian framework of a well-ordered cosmos, along with the well-ordered organic image of the body politic it entailed. The straight answer might have been: they are all machines – the universe, the human body, the body politic. But this answer was far from being provided and accepted as a proved, definitive one, and, particularly in political theory, mechanical imagination slowly became a source for metaphors, models, and hopes, rather than a solid epistemological ground for scientific research.

Although Hobbes was probably the first to systematically assume the goal of integrating a project of epistemological foundation of civil science into the mechanical world picture, the

[1] I deliberately say 'members' and 'body', because the classical metaphor of the human body, although supplemented in Christian thought by the reference to the divine persons, dominated political theory throughout the entire medieval period and beyond (see below my Conclusion).

[2] 'Homines namque non ut sunt, sed ut eosdem esse vellent, concipiunt; unde factum est, ut plerumque pro ethica satyram scripserint, et ut nunquam politicam conceperint, quae possit ad usum revocari'.

mechanistic imaginary was hardly compatible with the old questions political philosophy had been asking for centuries. All the questions Hobbes's 'geometrical' *civil science* intended to answer were in fact drawn from ancient political philosophy: What is the relation between the individual and the common good, and between law and justice? What is the political function of science? And what is the political role played by wisdom? Furthermore, mechanicism also posed new problems for political theory. First, the body politic was an artificial machine which did not exist in nature; and therefore there was no naturally prescribed functioning for the body politic: individual human machines did not naturally tend to unite in an artificial collective body. Second, the clear and distinct knowledge of the Wisest was deprived of power, and therefore political practice could hardly be conceived as a domain in which science could prove its predictive and technological efficacy, as was promisingly happening within the domain of nature.

It is the figure of Socrates that, in *De cive*'s preface to the readers – precisely when Hobbes is warning that civil science is the most dangerous and problematic part of philosophy – turns out to be emblematic of the original connection between civil science and wisdom (DC *Praef.*; OL II, 142). This connection is indeed formulated in Socratic terms in *Leviathan* too. Reason is equally distributed in all men, yet this entails some considerable irony:

> Such is the nature of men, that howsoever they may acknowledge many others to be more witty, or more eloquent, or more learned; yet they will hardly believe there be many so wise as themselves […]. This proveth rather that men are in that point equal, than unequal. For there is not ordinarily a greater sign of the equal distribution of any thing, than that every man is contented with his share. (Lev XIII; EW III: 111)

This passage recalls Descartes's opening of the *Discourse on the Method*, where he ironically claims that 'Good sense is, of all things among men, the most equally distributed; for every one thinks himself so abundantly provided with it, that those even who are the most difficult to satisfy in everything else, do not usually desire a larger measure of this quality than they already possess' (AT VI 1-2).[3] In fact Descartes is maintaining here the universal distribution of 'good sense or reason', which is 'by nature equal in all men' although rarely 'applied'. Also for Hobbes human nature has all the potentialities to produce peace, but the lack of diffusion (and the diffused presumption of possession) of what Descartes had called 'good sense or reason' prevents these potentialities from being expressed. In this sense Hobbes openly defends men from the

[3] 'Le bon sens est la chose du monde la mieux partagée: car chacun pense en être si bien pourvu, que ceux même qui sont les plus difficiles à contenter en toute autre chose, n'ont point coutume d'en désirer plus qu'ils en ont'.

accusation of being 'evil by nature'. In fact 'that men are evil by nature, follows not from this principle'; on the contrary 'an evil man is rather like a sturdy boy, or a man of childish mind, and evil is simply want of reason at an age when it normally accrues to men by nature governed by discipline and experience of harm' (DC *Praef.*; OL II, 147-48).[4]

Yet it is precisely because of the presence of ignorant 'evil men' who, although being few, are always in a sufficient number to create a perturbation in the system, that a generalized war might arise (DC *Praef.*; OL II, 147). As a consequence, the general distrust and mutual fear of all men must be taken as a first principle 'by experience known to all men and denied by none', and security is the logical final choice for those who, 'otherwise glad to be at ease within modest bounds' have to defend themselves by pursuing the 'augmentation of dominion over men [being] necessary to a man's conservation' (Lev XIII; EW III, 112). The natural striving for self-preservation is rationally justified and even augmented by the wise awareness of risk. In this framework the state of nature pictures precisely the ever re-emerging impotence to which natural reason and wisdom are irremediably condemned when left to themselves. Despite being the noblest part of a more and more pessimistically conceived human nature, reason is irremediably dominated by passions. The striving for power makes the original equality and community of goods ('what nature had placed in common', DC *Ep.*; OL II, 139)[5] unsustainable, and the fable rationality of human beings prevents any natural instauration of justice. In short, the ancient wisdom reserved to a few privileged men was at the mercy of the blind self-preservation tendency characterising the multitude. On these grounds wisdom did not only authorise violence, but it prescribed it, precisely for the defence of wisdom itself.

On the grounds of Socrates' political interrogation of wisdom, Plato had provided in *The Republic* a science of human nature and of the body politic in order to solve the problem of social organisation and reproduction. His solution prescribed a political pedagogy (*paideia*) based on the selection and education of those men endowed with the best natures, some naturally born *aristoi*, whose ethical status and individual wisdom would ensure the good government of the *polis*. The same political-pedagogical task concerned Hobbes's civil science, but mechanicism completely changed the shape of the problem. In Hobbes's civil science men were all machines equally made of matter in motion (not some of gold, others of silver or bronze): this *ontological* feature, along with the *epistemological* assumption that, as said, civil science was a purely descriptive practice with no ethical

[4] 'Homines natura malos esse, ex hoc principio non sequitur […] Ita ut vir malus idem ferre sit, quod puer robustus, vel vir animo puerili, et malitia idem quod defectus rationis ea aetate, qua per naturam, disciplina atque damnorum experientia gubernatam, accidere hominibus solet'.
[5] 'Quae natura in medium protulit'.

content, and, finally, the *factual evidence* that there were no naturally powerful *aristoi*, deprived civil science of any political efficacy.

In the concluding paragraph of the first half of *Leviathan* concerning the principles of political theory (parts I and II)[6], just before introducing the third and fourth parts concerning the religious foundations of the commonwealth, Hobbes significantly addresses Plato's doctrine to lament the powerlessness of reason and specifically of political theory when not incarnated in the philosopher-king:

> And thus far concerning the constitution, nature, and right of sovereigns, and concerning the duty of subjects, derived from the principles of natural reason. And now, considering how different this doctrine is, from the practice of the greatest part of the world, especially of these western parts, that have received their moral learning from Rome and Athens; and how much depth of moral philosophy is required, in them that have the administration of the sovereign power; I am at the point of believing this my labour, as useless, as the commonwealth of Plato. For he also is of opinion that it is impossible for the disorders of state, and change of governments by civil war, ever to be taken away, till sovereigns be philosophers. (Lev XXXI; EW III, 357)

But the twofold access to civil science first theorised in *De cive*,[7] although situating it in a peculiar domain within the system of sciences, is converted here into its peculiar force. It is precisely because a shortcut from the ideal path of a systematic geometrical deduction is possible in civil science that it does not reserve exclusive access to the philosopher. On the contrary, the object of civil science – as 'the science of natural justice' – becomes directly accessible by the sovereign through his own human nature:

> But when I consider again, that the science of natural justice, is the only science necessary for sovereigns and their principal ministers; and that they need not be charged with the sciences mathematical, as by Plato they are, farther than by good laws to encourage men to the study of them; and that neither Plato, nor any other philosopher hitherto, hath put into order, and sufficiently or probably proved all the theorems of moral doctrine, that men may learn thereby, both how to govern, and how to obey; I recover some hope, that one time or other, this writing of mine may fall into the hands of a sovereign, who will consider it himself, (for it is short, and I think clear,) without the help of any interested, or envious interpreter; and by the

[6] *Leviathan*'s Chapter XXXI, *Of the Kingdom of God by Nature*, matches *De cive*'s Chapter XV, *Of God's government by nature*. Yet the same chapter has a completely different structural function: while in *Leviathan* it concludes the second part, *Of Commonwealth*, in *De cive* it was the introductory chapter of the third part on *Religion*. No reference to Plato appeared there.

[7] See above, Chapter 1.4 on the peculiar epistemological status of civil science as both analytical and synthetical, and below, Chapter 3.2 for a further discussion of the topic.

> exercise of entire sovereignty, in protecting the public teaching of it, convert this truth of speculation, into the utility of practice. (Lev XXXI; EW III, 357-58)

Plato's too-demanding model of rationality and his conception of the eternal truth of ideas is finally replaced by a more 'modest' rationality, which is nevertheless, at least potentially, much more effective. A procedural form of rationality can be implemented *before* the ideal achievement of the mechanistic system by some supreme geometer-kings 'charged with the sciences mathematical'. Hobbes's commonwealth can thus be well established independently of the achievement of perfect knowledge, and not at all by a rear-guard battle, as it appeared to be the case with Descartes's 'provisional moral'. Hobbes's solution was intended to be as definitive as Plato's and yet independent of the too rare eventuality of the intellectual intuition of truth by right reason.

This solution had to be so morally neutral to any determinate content that it could entail no constitutional prescription, in order to be able to be adopted and 'technically' implemented by any form of government. A new kind of 'morally neutral' truth had to impose itself for this purpose, and mechanicism was perfectly suitable for this, as Hobbes's final reduction of reason to calculus proved. In *De cive* Hobbes had already clarified that 'truth is the same with a true Proposition'. Not by chance, he was evoking there Plato's *anamnesis* concerning the classical link between *aletheia* and *mnemosyne*, and, consequently, the knowledge of truth and memory, but warning against the risks carried on by the mutability of significations and the frailty of collective memory, so varying that it could deceive any accurate reasoning:

> And *to know truth* is the same thing as *to remember* that it was made by ourselves by the actual use of the terms. Plato was not far off when he said long ago that *knowledge is memory*. And it sometimes happens that though words have fixed meanings defined by decision, they are so distorted in popular usage from their proper meanings by a particular passion for ornament or even deception, that it is very difficult to recall to memory the concepts for the sake of which they were attached to things, and it needs to a keen judgement and intense labour to overcome the difficulty. (DC XVIII.4; OL II, 419)[8]

Yet it was only in *Leviathan* that Plato's political-pedagogical model finally appears to be the very alternative to the long-fought Aristotelian one.[9] And when he is approaching the

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[8] '*Veritatem scire*, idem quod, esse eam a nobisme ipsis ipsa nominum usurpatione factam, *meminisse*. Neque temere olim a Platone dictum est, *scientiam esse memoriam*. Accidit autem interdum, ut voces, etsi certam et ex constituto definitam habeant significationem, usu tamen vulgari ad ornandum vel etiam fallendum particulari studio a propriis significationibus ita divellantur, ut conceptus, propter quos rebusimpositae fuerunt, revocare in memoraim difficultatem magnam habeat, neque nisi acri judicio et diligentia maxima superandam'.

[9] In *The Elements of Law* Plato is only once individually referenced by Hobbes, in a passage criticising 'platonic love' (EL IX.17); in *De cive* he merely appears generically associated to Aristotle, Cicero, and Seneca, and once again in the quoted passage on memory. Only in *Leviathan* Plato appears in clear shape as

conclusion of *Leviathan*, Hobbes recalls Plato once again for the last time as the philosopher who first posed geometry as a precondition for philosophy *and* founded a school for teaching 'to the youth of the city' (Lev XLVI; EW III, 666).[10] Again, it is by assuming the model of geometry that Hobbes makes his final point on the distinction between philosophy as science (that is wisdom), and prudence as a mere 'memory of successions', by pointing – not to the concept of 'right reason' as a perfect knowledge – but to 'right reasoning', hereby conceived as a purely 'procedural' rationality:

> By PHILOSOPHY is understood *the knowledge acquired by reasoning, from the manner of the generation of any thing, to the properties: or from the properties, to some possible way of generation of the same; to the end to be able to produce, as far as matter, and human force permit, such effects, as human life requireth*. So the geometrician, from the construction of figures, findeth out many properties thereof; and from the properties, new ways of their construction, by reasoning; to the end to be able to measure land, and water; and for infinite other uses […]. By which definition it is evident, that we are not to account as any part thereof, that original knowledge called experience, in which consisteth prudence: because it is not attained by reasoning, but found as well in brute beasts, as in man; and is but a memory of successions of events in times past, wherein the omission of every little circumstance altering the effect, frustrateth the expectation of the most prudent: whereas nothing is produced by reasoning aright, but general, eternal, and immutable truth. (LEV XLVI; EL III, 664)

The natural limitation of 'prudence' depends on its scarce capacity of prevision, to which it is not to be remedied in detail by 'reasoning aright', which only concerns 'general' truth. Reason provides the framework and the method, not the solution to political problems, and thus it opens the space for the efficacy of civil power. The power of reason consists in limiting the *hybris* of prudence, in preventing 'right reasoning' from assuming the imaginary and destructive shape of a supposedly transcendent truth incarnated in right reason, which would make the actual foundation of civil order impossible, or even threaten it. Quite pragmatically, by building the conditions for the *exercise* of 'right reasoning' – rather than for the mystical *access* to 'right reason' – Hobbes prescribed purposes for civil

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'the best philosopher of the Greeks', and a straight epistemological reference; a reference which appears (sometimes implicitly) throughout Hobbes's repeated attacks on Aristotle. Also when in the *Epistola dedicatoria* of *De corpore* Hobbes evokes ancient Greek Sophistry, the 'phantasm' of philosophy, and Aristotle, the 'internal enemy' of Christian faith, he also refers to the less pernicious doctrines of Plato (DC *Ep.*; OL I, not paginated).

[10] 'Every master took some place for that purpose. Plato in certain public walks called *Academia*'; 'Plato, that was the best philosopher of the Greeks, forbad entrance into his school to all that were not already in some measure geometricians' (Lev XLVI; EW III, 666-68). This references introduce Hobbes's discussion on the political significance of the universities that he will later develop in *Behemoth*. See below, Chapter 3.3.

science whose fulfilment required a whole set of new 'preventive' technologies and, as a matter of fact, contradicted its alleged neutrality.[11]

The purposes of a 'neutral' civil science: *between the* Epistola dedicatoria *(1641) and the* Praefatio ad lectores *(1647)*

Hobbes claims in the 1641 *Epistola dedicatoria*[12] that in his *De cive* – when laying the foundations of civil science – he has 'paid careful attention through the whole length of [his] discourse not to say anything of the civil laws of any nation' (DC *Ep.*; OL II, 139).[13] What makes this assumption problematic is not only the obvious consideration that Hobbes's political theory was in fact a political weapon.[14] The assumption is quite problematic also when taken seriously as a scientific claim for the complete 'geometrical' neutrality of civil science. In effect, it carries on an apparent contradiction: the neutral structure of civil science is *explicitly* conceived by Hobbes as actually serving political purposes. As Skinner notes, 'the artificial bodies investigated by civil scientists are such that it remains inescapable to consider in addition the purposes for which they are brought into existence' (Skinner 1996: 5).[15] This problem in fact concerns all artificial bodies, with the difference that political bodies are made of natural bodies endowed with their own purposes and wills, which can be actually influenced by civil science.

In the *Praefatio ad lectores* of 1647 Hobbes himself stresses this peculiarity of civil science in relation to all the other sciences, that either brought to men great benefits or did no harm. On the contrary, since the moment of its birth, civil science has been both the most dangerous and the most useful of sciences, precisely because it could not avoid influencing human behaviour once in place. This process is not reversible, and no return is possible to the golden age in which 'before questions of that kind began to be debated, Princes did not lay claim to sovereign power, they simply exercised it'. Although regretting that 'the simplicity of those times evidently could not understand such sophisticated stupidity', Hobbes is forced to recognise that, once sovereign power has been first questioned by civil science, the latter has become both the most dangerous, *when rhetorically imitated*, and the most useful 'when rightly taught' (DC *Praef.*; OL II, 141-44).

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[11] On Hobbes's conception of 'right reasoning' as distinguished from 'right reason', see above, Chapter 2.2. On the problematic connection of Hobbes's right reason with 'Plato's project', see Johnston 1990: 48-49.

[12] See above, Chapter 1 note 58.

[13] 'Opera etiam diligentem per totum cursum orationis meae dedi, ne quid de legibus cujuscumque nationis civilibus dicerem'.

[14] To this consideration it might be also opposed that this weapon could be used by different parties for opposed purposes from the engagement controversy onwards.

[15] Skinner interestingly suggests that, in fact, also natural sciences can be. After stating that in *De cive*'s preface Hobbes 'also endorses the classical view that such a science must be purposive in character' (Skinner 2002: 42), he adds in a note: 'I am tempted to go even further than Malcolm [1990: 146-47] and add that Hobbes's Baconian conception of *scientia propter potentiam* gives a purposive orientation to his view of the natural sciences as well' (Skinner 2002: 73, n. 42). It is my intention in Chapters 3.4 and 3.5 to extend this hypothesis to the whole of early-modern science and to the ideological assumptions it contributed to injecting into political theory until today.

In this sense from Hobbes's point of view civil science cannot be neutral precisely because if it retired from the political debate, it would leave it to open the spreading of false imitations, politically favouring the dominion of opinion. In Hobbes's world of matter in motion there is no place for immobile neutrality.

From an epistemological point of view, this necessity of being political would not suffice to discharge Hobbes's civil science from the accusation of not being a properly geometrical science, capable of describing men as they are and not as they ought to be. According to Vaughan, *De cive*'s 1647 *Praefatio* would mark the turning point in the development of Hobbes's political philosophy, because it makes the relationship between political theory and practice explicit by connecting moral-political and military matters, and providing the political context of his science, that is the English Civil War (Vaughan 2002: 13-14). This is true, but not in the sense that Hobbes is abandoning there the project of building civil science as an abstract descriptive science. On the contrary, Hobbes appears to be fully endorsing that project precisely while becoming aware of the power of neutrality itself.

McNeilly indicates in *De cive*'s *Praefatio* the threshold from *The Elements of Law* to *Leviathan*, in which the particularity of human motives cannot touch the general structure of the argument. Civil science deals with human nature in general, providing it with an unvarying formalisation of the relationship between man and man, independently of the variations of human motives: 'What is important is not the nature of human motives, whether fair or foul conditioned, but the bearing of the unknown on rational deliberation. It is this passage […] which marks the transition from the earlier version of Hobbes's political science in The Elements to the later formalised version of Leviathan' (McNeilly 1968: 167, referring to OL II, 147). Hobbes's purely abstract science thus clearly anticipates the power of neutrality that will be implemented by the juridical apparatus of the modern state. According to Bobbio, it is precisely the formal structure of the law that most interests Hobbes in *De cive*, where he displays a 'purely formal conception of justice' (Bobbio 1988: 116, n. 1). This connection of rationalisation with formalisation allows for the identification of law and justice. The neutral identification of justice and law represents for Hobbes the ideal theoretical solution for the indefinite preservation of the artificial motion of the body politic, and it is a solid argument for those who interpret Hobbes as a 'de facto theorist', by stressing that the process of neutralisation of politics he is carrying on runs along the lines of the emergence of the juridical system as the mark of the impersonal power typical of the modern state.[16]

[16] The importance of the '*de facto* theorists' contemporary to Hobbes in anticipating his view that the ability to provide protection rather than legitimacy justifies sovereign power has been stressed since Skinner 1966.

What these scholars usually fail to notice is that between *De cive* and *Leviathan* a further step had to be accomplished in order to provide adequate foundation for the neutral structure of knowledge elaborated in *De cive*. As I have explained in Chapter 1.4, Hobbes's philosophy did not claim for reason any privileged, 'external', and steady gaze over (the rest of) matter and therefore over human behaviour. In particular, Hobbes's materialistic approach, in itself, could hardly allow any theorisation of the neutrality of scientific knowledge. Consequently this should be considered an entirely ideological outcome of his research, inconsistent with its materialistic premises. In effect, the ideology of neutrality is grounded on the characterisation of science as the objective description of natural causes that, for their nature, are so complex that their complete account goes beyond the power of human nature. But it also adds that the whole set of causes has to be complete so that a sufficiently detailed knowledge of them would allow not only a complete account of the current state of things, but also a perfect forecasting of the future state of things depending on the present causes. This assumption, that I have named 'ontological determinism', is usually taken as the indisputable *ontological* ground of scientific research itself, which in fact is based on the *methodological* assumption of determinism as a tool for detecting causal chains and making previsions (the 'epistemological determinism' described in Chapter 2.3). Through the ontological assumption of determinism, science silently shifts from classically being the 'knowledge of causes' that allows an objective, neutral (although incomplete) description of reality as it is, to being the 'knowledge of effects' that allows planning and technological implementation of reality as it is believed it ought to be.[17]

This shift is particularly noteworthy from a political point of view, if analysed through the lens of the development of Hobbes's political thought. In fact, Hobbes's materialistic epistemology did not allow a complete reduction of physics to geometry, and therefore it did not allow a complete identification of the actual motion of the body politic to the geometrical theorisation of the laws of nature. But Hobbes's attempt to neutralise science, civil science included, could eventually find in ontological determinism its ground, since ontological determinism allowed the faith in the efficacy of political planning according to the established practical exigencies dictated by the knowledge of the laws of human nature. Hobbes's ontological choice went far beyond what Descartes' philosophy suggested without being allowed to endorse, precisely because of the existence of a spiritual substance independent of the mechanical motion of matter. It was this choice of a radically deterministic version of mechanicism that allowed Hobbes to theorise the efficacy

[17] A vision also shared by many of Hobbes's interpreters, such as Tuck, who thus comments on the latter's deterministic views in his dispute against Bramhall: 'Hobbes's philosophy is closer to the assumptions on which modern science rests than any of the competing philosophies on offer in the seventeenth century' (Tuck 1989: 50)

of civil science which, as a result, could be granted only by the epistemological-political faith in ontological determinism.[18] Yet just a small step was required to discover that this efficacy could be further implemented by the endorsement of an ideology of neutrality. In effect, the assumption of ontological determinism fills the empty space left open by the disappearance of God's providence and government of the world apparently challenged by mechanicism. In short, ontological determinism has religious relevance as far as it perfectly substitutes for God's government of nature. But what is even more important from the political point of view is that the new faith in ontological determinism grounds the assumption of the neutral objectivity and predictive power of science: the rhetoric of reason as an instance *super partes* and as the subject of secure appeal for the solution of political issues.

Far from denoting lack of political commitment, a rhetoric of the neutrality of reason entails a powerful political commitment as a means of delegitimation of any political partisanship, in the name of the overarching neutrality of the sovereign subject of science.[19] And in fact, from Hobbes's point of view, there appears to be no contradiction between the geometrical neutrality of civil science and its political purposes. Not only is civil science neutral as far as it is geometrical, but *also* its political purposes, as far as they deal with human nature in general, are presented as neutral. And in its neutrality resides the specific power of mechanical science. The new civil science is a formal science of general relations among men, and supposedly without content, that can last – in principle – longer than *any* body politic, precisely because it can be equally assumed and sustained by *any* form of political power capable of endorsing the neutrality of science as the ground of its technologies over human nature:

> Finally throughout my discourse it has been my aim, first, not to give decisions on the justice of particular actions, but to leave them to be settled by the laws. Secondly, not to say anything about the laws of any particular commonwealth, i.e. to say what law is rather than what the laws are. Thirdly, not to give the impression that citizens owe less obedience to an Aristocratic commonwealth or to a Democratic commonwealth than they owe to a Monarchical commonwealth. (DC *Praefatio*; OL II, 152)[20]

Thus Hobbes seemed to have finally overcome the Greek contraposition of law and justice. In fact he erased it. The anti-platonic nature of this outcome was noted by Leibniz:

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[18] See above, Chapters 2.3-2.5.

[19] A very interesting clue on Hobbes's 'rhetoric' of objectivity I have found in Jackson 2007: 73, n. 26.

[20] 'Postremo, per totam oratione meam modum talem conservandum mihi proposui, primo ne de justitia singularium actionum quicquam determinarem, sed legibus determinandum relinquerem. Deinde, ne quicquam dissererem de cijuscumque civitatis legibus speciatim, id est, ne quae sint, sed quid sint leges, dicerem. Tertio, ne civitati aristocraticae vel democtraticae minorem a civibus obedientiam deberim quam monarchicae existimare viderer'.

> A celebrated English philosopher named Hobbes, who is noted for his paradoxes, has wished to uphold the same thing as Thrasymachus: for he wants God to have the right to do everything, because he is all powerful. This is a failure to distinguish between right and fact. (Leibniz 1702-03: 47)

Hobbes's mechanistic ideology of neutrality was based on the adoption of a geometrical model for the understanding of reality. As I will explain in Chapter 3.3, assumed within Hobbes's materialistic framework, this model entailed a *political project* of reduction of reality, and an even more radical reduction of human nature – the basic element of civil science and power – to its mechanical representation. In fact, Hobbes's new pedagogical project was still quite classically based on the study of human nature. But the dualistic picture of human nature provided by early-modern mechanicism was hardly compatible with Hobbes's materialistic ontology. In order to fit its mechanical picture Hobbes's vision of human nature and of its epistemological status dramatically changed, more and more incorporating the dualistic nature of early-modern mechanicism. This process went so far as to renew also the exigency of a pedagogy up to date with mechanicism which would move far beyond its alleged neutrality. In this sense Hobbes's mechanicism can be said to have marked the end of the platonic dream of the philosopher becoming a king (or at least his major advisor), and the birth of political science as an objective, neutral science with full theoretical value and possible technological applications. But Hobbes's move was not at all a cancellation of the teleological grounds of Greek philosophy. Wisdom, turned into science, prescribed that all the power should be monopolised by politics, on the one hand, and exerted through a whole set of pedagogical 'technologies' addressing human nature on the other. In this sense, along with the definitive failure of the ancient Platonic project, Hobbes's theory also marked the conjoint emergence of a new project to connect science to civil power, which acquired its fully recognisable shape in *De cive* and could not avoid challenging Plato's original dream, as explained by Johnston (1990).[21] For this purpose a new mechanical epistemology of human nature was needed.

3.2 For a Mechanistic Epistemology of Human Nature

Mechanical models were progressively extended to the whole of the existing bodies, that is to the whole of nature. Yet human nature still represented a noteworthy exception in seventeenth-century mechanicism. Descartes's early *De l'homme* was a systematic

[21] As it should be evident from Chapter 2, I agree with Johnston that 'rather than abandoning Plato's project, Hobbes proposed to transform it' by committing to the sovereign the function of embodying right reason (Johnston 1990: 48-49). Yet my interpretation is inscribed in a completely different framework: rather than rejecting a mechanical (moral and political) 'science of calculation' as inhuman (52-53), I am more interested in distrusting it as *too* human (see below, my Conclusion).

attempt to provide a mechanical explanation of the functioning of the human body taken as 'to be just a statue or a machine made of earth' (AT XI, 120).[22] The unpublished treatise was presented by Descartes as a supposedly fictive account, along the same line of *Le monde*:[23]

> These men will be composed, as we are, of a soul and a body. And I must describe for you first the body on its own; and then the soul, again on its own; and finally I must show you how these two natures would have to be joined and united so as to constitute men resembling us. (AT XI, 119-120)[24]

Yet the fable in this case provided no conclusion, because it was significantly arrested at the threshold of the functions attributed to the soul. It was only a few years later that the mature Descartes went back to the delicate theme of the mechanisation of human body with *Les passions de l'âme* [The Passions of the Soul] (1649). Quite consistently with the supreme medical aim of science formerly stated in the conclusion to his *Discourse* (AT VI, 78), he was giving his key contribution to the process of mechanisation of the image of the human body that would come to considerable success (and some striking mistakes) in anatomical research and more in generally in medicine.[25] Yet the tension between the whole mechanical project and its underlying metaphysical claims cannot escape a close analysis: in the case of the human body a safe place had to be reserved for the soul. The human body appears thus an exception to the functioning of mechanical bodies precisely because the soul is supposed to play a role in it, an in it only, as it is evidenced by the fact that, although passions are entirely mechanical bodily motions, they are in fact passions *of the soul*. This stance was clearly connected to Descartes's conception of body or extension as entirely passive (see above, Chapter 1.2), but it was not at all limited to the boundaries of Cartesian philosophy. On the contrary, the necessity to postulate a soul inhabiting the machine was inscribed in the core of the same Galilean science of nature through which the mechanisation of human body reached it apex.

With Borelli's *De motu animalium* (1680-81) the geometrisation and, subsequently, the mechanisation of the (human) body carried on by Harvey and Malpighi was, at least in principle, achieved. And the metaphor through which Borelli presented it just before dying to the Queen Christina of Sweden – the 'open book constituted by the heavens, the earth and all the visible creatures and, in the first place, in the anatomy of animals and man' – was a clear reference to its Galilean roots:

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[22] 'Une statue ou machine de Terre'.
[23] On Descartes's *Le monde* as a 'fable', see above, Chapter 1.1.
[24] 'Ces hommes seront composés comme nous, d'une Ame et d'un Corps ; et il faut que je vous décrive premièrement le corps à part, puis après l'âme aussi à part: et enfin, que je vous montre comment ces deux Natures doivent être jointes et unies, pour composer des hommes qui nous ressemblent'.
[25] 'Between the seventeenth and the eighteenth centuries a gradual and complex shift took place in European medicine: man the microcosm gradually transformed into man the machine' (Hanafi 2000: 121).

> Animals are bodies and their vital operations are either movements or actions which require movements. But bodies and movements are the subject of Mathematics. Such a scientific approach is exactly Geometry. Similarly, the operations of animals are carried out using instruments and mechanical means such as scales, levers, pulleys, winding-drums, nails, spirals, etc. The scientific knowledge of these means is the province of geometry. Thus it is true that, in building the organs of animals, God exerts geometry. To understand them we need geometry, which is the unique and appropriate science to enable one to read and understand the divine book written on animals. (Borelli 1680-81: 2)

And yet this radical mechanisation of the body did not automatically entail the adoption of a materialistic metaphysics. On the contrary, 'iatromechanics', the application of (Galilean) physics to physiology, neither arrived to cancel the existence of a 'soul', nor excluded it from the functioning of all natural bodies. Corpuscolarism and experimentalism did not imply a radical materialism in physiology and, consequently, did not completely overcome the 'ontological' difference between living and artificial bodies. Although Borelli rejected the Cartesian (and Aristotelian) preeminence of the heart, pointing to the central role played by the brain, he never reduced natural bodies to automata. Automata are useful instruments for the knowledge of regular discrete and recursive natural motions (Borelli 1680-81, LXXIX: 282-84); it is true that the animal is in fact 'an automaton of Nature' endowed with 'a regulating machine' similar to 'the regulating pendulum of a clock' which 'regulates by its oscillatory force the movement of blood and spirits to prevent these from flowing frantically and foolishly' (Borelli 1680-81, CXVI: 319-20).[26] But natural bodies are furthermore dependent on 'the principle and the effective cause of movement of animals': the soul (Borelli 1680-81, I: 7). Thus they are subject to 'fear and belief, which are the cognitive faculties of the soul' commanding voluntary motions through the motive faculty residing in the animal spirits. The 'animal cognitive faculty' modifies the automatically regulated motions by transmitting 'spirits to certain parts of the brain to shake the roots of well-determined nerves which go to a certain muscle rather than to another' (Borelli 1680-81, LXXX: 285-86). [27] Borelli was resolutely anti-Cartesian because radically experimentalist and diffident towards the deductive approach. Yet in the light of this original distinction between natural-automatic motions on the one hand, and will-determined ones on the other, one might argue that, even though iatromechanicism

[26] In this sense air respiration is the origin and constant support of the regular motion of blood, namely of life itself (and it is important to notice how close – also epistemologically – respiration was to being a function of the *psyche*).

[27] See Hanafi 2000: 129-34; but the author does not clarify whether animal motion is guided by the soul or not, and smoothly passes from the animal/automaton analogy to a human/automaton difference which is not so evident in Borelli's text (Hanafi 2000: 132).

extended Galileo's geometrisation to the functioning of the human body, it could not get rid of Descartes' dualistic metaphysics.

According to my hypothesis, explanations that only point to a precautionary use of the concept of soul by these authors do not suffice to clarify the topic. I am rather focusing on the simplified vision of the machine offered by early-modern mechanics in order to achieve the project of mechanisation of nature. For this purpose machines themselves had to be reduced to geometrical representation. The irregular, unpredictable functioning of actual machines had to be transformed into the well ordered, perfectly structured and articulated motion of the 'theoretical machines' used by 'geometers' in their researches. Only through the imagination of these perfect machines endowed with a perfectly organised (artificial) motion could matter in (natural) motion itself be conceived as a machine, and could the laws of motion be both grasped in their geometrical essence and extended to the whole of nature. Thus the purely imaginary functioning of geometrical machines was made perfectly suitable for an abstract representation of nature.[28]

The assumption of such geometrical models had relevant consequences also at the ideological level. The complex phenomena characterising life, and in particular the emergent phenomena characterising human life, could not be easily explained in such simplistic mechanical terms. This required an alternative explanation, which could be easily intended as a metaphysical alternative to the material reference to bodily motions. This ontological necessity joined the epistemological necessity of founding the new science of motion on reason, with the consequent attribution to it of a status of exception compared to all moving bodies. As explained in Chapter 1, reason as the subject of the method of the new mechanical science needed to be grounded on an immaterial instance accessing some eternal and divine principles of motion, themselves immune from motion. It is quite easy to see how these ontological and epistemological exigencies – on the one hand to explain the peculiar motion of living bodies (and of the human body in particular) and, on the other hand, to provide a stable ground to human reason – could converge, making of the soul the keystone of the entire edifice of mechanics. In this sense materialism was a dangerous exception in the process of systematisation of the mechanical world view. And for this reason human nature was also the topic on which Hobbes's materialistic mechanicism found its major impasse. This is particularly noticeable in his treatises concerning civil science, on which the knowledge of human nature was to be based.

[28] On the way the 'intellectual manipulation of objects and geometric diagrams', as much as actual practice of mechanics with technical objects, influenced early-modern mechanics, before algebra took possess of it by the end of the seventeenth century, see Bartoloni Meli 2006.

Hobbes's evolving conception of human nature

The simplified image of human nature provided by mechanicism did not allow Hobbes to solve the classical problem of the relation between passions and reason, which was nevertheless crucial for his political theory. As I am going to explain, the *metaphysical* postulate on human nature that grounded Cartesian mechanics – and was in principle excluded from Hobbes's materialistic philosophy – can be said to have re-emerged within the development of Hobbes's civil science as a *methodological* dualism. On these grounds, I am going to take as a serious epistemological assumption Hobbes's claim in *Leviathan* that the first thing to be considered in order to describe the Commonwealth is 'the *Matter* thereof, and the *Artificer*, both which is *Man*' (Lev *Introduction*; EW III, X). In effect, the metaphor appears here to carry a quite ponderous methodological significance if referred to the crucial role played by human nature in Hobbes's research. In Hobbes's three political treatises the same quite 'classical' picture of human nature as divided between reason on the one hand, and passion, desire, or will on the other, is differently presented. But the different configurations of this opposition, which of course cannot be taken as an ontological one, have a clear methodological meaning. A sequential consideration of the dedicatory epistles, prefaces, and/or introductions to the three political treatises and to *De homine* helps to stress some discontinuities in a progression that may be quite revealing of Hobbes's conjoint treatment of human nature as both an epistemological and a political issue. This development displays the progressive transcription of a classical problem of political theory – the government of passions by reason – in terms compatible with the implicit dualism of early-modern mechanicism.

In the *Dedicatory epistle* of *The Elements of Law* Hobbes is concerned with the study of the complexity of human nature as it actually is, and this actual complexity is synthesised by the duality of reason and passion. The opposition between reason and passion is not at all ontological, because, as we know, human nature as a whole is rather characterised by the complexity of the motions that inhabit the human 'body and mind'. But it entails a double kind of 'learning', 'mathematical' and 'dogmatical': the first is based on 'figure and motion', while the second depends on 'right and profit'. While through 'mathematical' learning reason always leads to agreement, through 'dogmatical' learning passion invariably leads to 'dispute and contradiction'. The aim of the book is therefore to build a *mathematical* science of 'justice and policy' that, relying on the knowledge of *all* the elements composing human nature, would grant peace (EL *Ded. Letter* XV-XVI).

In the *Epistola dedicatoria* of *De cive* the opposition inhabiting human nature is strongly accentuated at the ontological level, while at the epistemological level a fundamental unity is preserved. At the ontological level human nature is clearly split into two opposite and

hardly compatible tendencies, one of which is clearly natural, while the other appears to be rather artificial. The commonly stressed wolf-like tendency ('*homo homini lupus*') is in fact applied by Hobbes to the relations between commonwealths, where the 'natural' bestial state cannot be definitely overcome. The Godlike tendency ('*homo homini deus*') is assumed as typical of the relations among citizens within the commonwealth, that is in the artificial body politic, where 'Man is a God to man' (DC *Ep.*; OL II, 135-36). On the contrary, at the epistemological level the two opposite tendencies are assumed as the 'two certain postulates of human nature' – on the one hand natural desire [*cupiditatis naturalis*], and on the other natural reason [*rationis naturalis*] – which should serve to ground and extend geometrical knowledge to the whole of moral philosophy, thus providing the basis for the only possible *a priori* science of natural justice [*justitia naturalis*] the book is intended to be founding (DC *Ep.*; OL II, 138).

In short, while in *The Elements of Law* human nature is considered the unitary object of two possible kinds of knowledge, one of which is science, in *De cive* human nature is itself split into two opposite tendencies, that a unitary geometrical science of natural justice is supposed to deal with. This sequence well represents the shift from an original project of deduction of the body politic from the *ontological* 'elements' featuring human nature (human faculties and powers), to the assumption of human nature as the *epistemological* starting point of a science of principles. The first part of *The Elements of Law* concerning human natural motions (Chapters I-XIII) could thus disappear from *De cive*, in order to be placed in *De homine*, the second part of Hobbes's system of sciences, where the ontological nature of man was supposed to be investigated outside the boundaries of civil science.

But this was not Hobbes's conclusive word. In the later *Praefatio ad lectores* for the 1647 edition of *De cive* he openly stated the possibility of a twofold method. In the *Praefatio*, it is through the image of the body politic as a watch that human nature is definitely considered an internal mechanism of it, and the objective 'matter' of civil science. Yet once man has been isolated as a peculiar object of science at the threshold between nature and artifice, its dualism immediately reappears in the twofold methodology admitted for civil science. As explained in Chapter 1.4, Hobbes explicitly theorises there a double path for civil science, by opposing a quite elitist 'synthetical' geometrical science based on deductive demonstration, and a more popular 'analytical' one based on the internal experience of directly evident first principles. In effect Hobbes claims that the early publication of the third part of his system had been undertaken under the assumption that 'it did not need the preceding parts, since it rests upon its own principles known by reason'

(DC *Praef.*; OL II, 151).[29] A twofold method for civil science thus embodies at the epistemological level a dualism that Hobbes had banished from the ontological horizon. Apparently, Hobbes's conclusive solution was that a twofold method for civil science was possible:

> They also that have not learned the first part of philosophy, namely *geometry* and *physics*, may, notwithstanding, attain the principles of civil philosophy, by the *analytical method*. (DeCo VI.7; EW I, 74)

But Hobbes's conclusive word in political theory had been completely different, as was evident from the first pages of *Leviathan*. The methodology of a direct access to the science of human nature through internal experience first provided in *De cive* as an alternative path for science, was eventually demonstrated in *Leviathan* to be the definitive and, in fact, the *only* possible method for civil science. More precisely, the method concerning man as a 'part' of the political body appeared there to be an autonomous section of the science of the human being: still a geometrical science, but characterised by a peculiar method that, as I am going to explain, irremediably undermined the same 'scientific' picture it was supposed to provide. In effect, when he finally accomplished his philosophical system, Hobbes was forced to openly admit that the only evidence for the 'geometrical' account of the body politic provided by civil science was given by internal *introspection*. Thus in the introduction to *Leviathan* he explicitly addressed the sovereign to 'read in himself' the universal features of human nature:

> He that is to govern a whole nation, must read in himself, not this or that particular man; but mankind: which though it be hard to do, harder than to learn any language or science; yet when I shall have set down my own reading orderly, and perspicuously, the pains left another, will be only to consider, if he also find not the same in himself. For this kind of doctrine admitteth no other demonstration. (Lev *Introduction*; EW III, XII)

In effect human nature was precisely what allowed Hobbes to collapse in *Leviathan* the subject and the object of civil science, reason and the natural body, in the same way in which ontological determinism had allowed him to make geometry and natural motion coincide. In this sense *Leviathan* can be said to have transferred into civil science the collapse of the geometrical epistemology of mechanicism and the ontology of motion that characterised Descartes's natural philosophy, as explained in Chapter 1.4.

Leviathan, *Chapter IX: 'Of the Several Subjects of Knowledge'*

In Chapter IX of *Leviathan* Hobbes felt the necessity to provide a scheme of the sciences which he possibly built by renovating the tree structure he had adopted for establishing

[29] 'Cum eam principiis propriis experientia cognitis innixam, praecedentibus indigere non viderem'.

the table of contents of *The Elements of Law*, which in the manuscript copies he had entitled 'The Order' (Malcolm 2012: 142). This time, after the full immersion in the *Elementa* project during the 1640s, the scheme had to cover the whole spectrum of philosophy, including all possible sciences. Thus the table presents the different kinds of scientific 'knowledge of consequences' ('which is also called philosophy') sorted 'according to the diversity of Matter' (Lev IX; EW III, 71-73). The main division between 'natural philosophy' and 'civil philosophy' is related to the kind of bodies they refer to, either 'natural' or 'politics'. Yet as far as the former include '*Mechanics*' and the latter 'ETHICS', 'POETRY', 'RHETORIC', 'LOGIC', it is clear that this classification of the bodies does not match the distinction between natural and artificial bodies that would be more consistent with the reference to human nature as a producer or not of the bodily motion concerned. And what is more striking, 'The Science of JUST and UNJUST' is classified as a part of natural philosophy, as if it was not an integral part of, or even the same as, civil philosophy. This patent contradiction clearly makes of *Leviathan* Chapter IX an open question, rather than an answer, concerning the epistemological status of civil science.

In an article devoted to *Hobbes's Scheme of the Sciences*, Sorell deepens his previous analysis of Chapter VI of *De corpore* (Sorell 1988a), highlighting its strong continuity with the Preface to the 1947 edition of *De cive*. He notes that, as in *De corpore* Hobbes problematically collocated 'civil philosophy' out of the methodological domain of 'philosophia prima', similarly, *De cive*'s analytic method 'bypasses the sciences', thus making of civil philosophy a *specific* form of knowledge, in striking contrast with the general scheme of sciences provided in *Leviathan* IX (Sorell 1996: 50, 55-56). In short, what Sorell aims at is to demonstrate that Hobbes was not actually willing to (or able to) treat civil philosophy as a science of matter in motion, and its 'philosophically informed rhetoric' was safely far from a 'Realist philosophy of science' pretending that 'social studies significantly resemble physics' (Sorell 1988a: 80). I certainly agree with Sorell when he says that 'there is more continuity between Chapter VI of *De corpore* and the Epistle to the Reader [sic] of *De cive* published nearly a decade earlier' than with the (*English* version of) *Leviathan* (Sorell 1996: 50), and I also agree with the fact that the method of *De cive* – the most properly 'scientific' political work of Hobbes's – is not directly related to a physics of motion.[30] But I refuse his hypothesis that the different accounts for the epistemological status of civil philosophy (and first philosophy) Hobbes gives in *De cive*, *De corpore* and in the English *Leviathan* are due to the fact that they are 'apparent exceptions' (Sorell 1996: 49) to Hobbes's materialism. In particular, in order to make his point and to 'save' Hobbes's civil science from the accusation of mechanistic

[30] Sorell concludes by attacking the general idea of a 'politics of motion' (Sorell 1996: 56-57) as it was presented by Spragens 1973.

reductionism, Sorell proposes a differentiation between 'science' and 'knowledge' that results in denying to civil philosophy the status of 'genuine *science*', rather limiting it within the boundaries of historical (or prudential) *knowledge*. Not only this is something Hobbes struggled all his lifetime to reject, it is not even based on textual evidence, and in fact it clearly contrasts what Hobbes himself claims in the corresponding Chapter IX of the *Latin* version of *Leviathan*, which Sorell omits mentioning.

In the Latin version of *Leviathan*[31] Hobbes replaces the scheme of the English version with a couple of pages where he gives a brief textual account of his scheme of the sciences: he explains there the difference between 'two kinds of knowledge' and their consequent register [*conscriptio*], represented by history and philosophy. It must be stressed that *both* fields are concerned at the same time with 'natural' and 'civil' subjects, but, while history registers a knowledge of facts relying on 'witnesses', philosophy registers a proper science 'of consequences' both of natural and civil bodies (cf. Lev Lat IX; OL III 66).[32] This *epistemological* divide between two methods of knowledge allows Hobbes here to maintain the distinctiveness of science independently of any *ontological* characterisation of the kind of bodies it is concerned with, and hence to clearly reassert that his civil philosophy pertains to the system of sciences.[33]

What I am trying to suggest is that civil science entails no exception in Hobbes's materialism, and that in the table of sciences presented in the English *Leviathan* there was a contradiction due to the quasi-ontological opposition between natural and artificial bodies that Hobbes tried to resolve with the new Chapter IX of the Latin version. In general, from the epistemological perspective assumed in *Leviathan* the classification of civil philosophy among the other sciences depends on the different relationship between the political body and 'human nature' as a subject (and in this case also an object) of science, rather than on the characterising features of the object studied. And in effect in the Latin version the classification of sciences is still based on the distinction between different kinds of bodies,[34] yet the opposition between natural and artificial bodies is replaced there by the distinction between bodies the 'internal motions' of which are either invisible or visible, which is a distinction more openly relative to the way human nature, as a subject of science, has access to such bodies.

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[31] According to Tricaud 1971 the first version was the Latin one. Skinners (1996: 3, n. 15) definitely rejected the hypothesis.

[32] 'Cognitionis duae sunt species. Altera facti; et est cognitio propria testium, cujus conscriptio est *historia*. Dividitur autem in *naturalem* et *civilem*, quarum neutra pertinet ad institutum nostrum. Altera est consequentiarum, vocaturque scientia; conscriptio autem ejus appellari solet *philosophia'*.

[33] As had always been clear throughout the whole of the *Elementa* project (and therefore both in *De corpore* and in *De cive*), where first philosophy had its proper place as a *methodological* precondition of *all* kind of sciences.

[34] 'Quoniam autem subjecta scientiarum sunt corpora, [philosophia, i.e. scientia] distribuenda est in species, eodem modo quo distribuuntur in suas species corpora ipsa, id est, ita ut universaliora minus universalibus antecedant' (LEV IX; OL III, 66).

Now, this shift from the natural/artificial to the invisible/visible opposition might shed some light on the epistemological meaning of *Leviathan* itself. As explained, in *Leviathan* it is not anymore the quasi-ontological distinction between natural/artificial objects of science (bodies) but rather the epistemological relation to human nature *as a subject* to mark the threshold between different kinds of bodies and, therefore, between different methods of knowledge. This is the long-term result of the epistemological stance earlier assumed in *De cive*, following which civil philosophy becomes, from an epistemological point of view (and not from an alleged 'ontological' point of view), much nearer to sciences such as mechanics, ethics, and geometry, in which *internal* motions are 'directly' knowable by man, being dependent on the subject's will rather than on physics.[35] On the other hand, and at the same time, the ontological reference to 'human nature' *as an object* still serves the purpose of assigning to civil philosophy a place in the system of sciences among the other sciences concerned with human bodily motions: 'Finally, from the observation of man and its faculties, sciences as ethics, logic, rhetoric arise, and also politics or civil philosophy' (Lev Lat IX; OL III, 66).[36] In this sense the unity of the method was achieved only in principle, as de facto the different sciences had to follow different paths depending on the respective relation between their objects, but the overall unity of their object was never called into question. The object of all Hobbesian sciences is the body in motion, for the quite simple and straight reason that other objects do not exist.

It is true that natural bodies, whose internal motions are invisible, can only imperfectly be known from the 'outside', starting from the 'signs' we collect, while the artificial bodies of civil philosophy offer to our knowledge an alternative shortcut due to the fact that we are part of their internal motions. And nevertheless I don't think the conclusion that Hobbes's civil science 'does not depend on knowledge of physics and geometry' (Sorell 1996: 56)[37] can be indistinctively applied to the whole of Hobbes's political production. If this view can be applied to many and probably most of Hobbes's actual political writings, it is clearly not true if referred to the *Elementa* project as a whole, which is on the contrary grounded on a postulate of methodological unity based on the primacy of first philosophy, and the dependence of civil science. Yet Sorell's lesson has to be considered: we must in fact acknowledge that Hobbes's science did not achieve the actual deductive aim it had

[35] As explained, geometry is the 'only Science that it hath pleased God hitherto to bestow on mankind' (Lev IV: 105), because it is the only kind of science which man produces the principles of, and therefore it is built on an *a priori* knowledge of the right definitions of names (cf. also DH X.4). Outside the field of geometry, individual reason has no power to 'produce' names, since its operations concern only addition and subtraction. On the analogy between civil science, mechanics and ethics, see above, Chapter 1.4.

[36] 'Ex contemplatione denique hominis et facultatum ejus oriuntur scientiae *ethica, logica, rhetorica,* et tandem *politica* sive *philosophia civilis*'.

[37] 'While the truths of civil philosophy may depend on truths that are explained by physics and geometry, knowledge of the truths of civil philosophy does not depend on knowledge of physics and geometry, and can indeed be acquired on the basis of a certain self-knowledge, or acquaintance, with human passions in oneself' (Sorell 1996: 56).

carried on in the ontology of *The Elements of Law* and promised when first sketching the epistemology of the *Elementa* project in *De cive*. But my thesis is that this failure of Hobbes's project was not due to a kind of ontological peculiarity of human nature, as Sorell seems to assume (which makes no sense in Hobbes's materialistic perspective),[38] but to the structural limitation of early-modern mechanicism, as I will explain in my conclusion.

From this perspective, in *Leviathan* we witness the failure of the *Elementa* project, and the collapse of the epistemological gap between model and reality opened by *De cive*. The patent contradiction between the methodology explicitly adopted in *Leviathan* and the one Hobbes was at the same time theorising in *De corpore* could not leave his systematic project untouched. In the *Epistola dedicatoria* to *De homine* Hobbes eventually acknowledged that the twofold methodology of his treatise depended on the twofold characterisation of its object. He stressed that *De homine* had been a quite difficult achievement precisely because it had to connect the final part of physics (*De corpore*) with the principles of politics (*De cive*), that is 'the most difficult with the easiest one'. And, since 'man is not only a *natural body*, but also part of a state [*civitatis*], i.e. (so to say) a *political body*', the very intermediate section of Hobbes's system had necessarily to be split into two 'very different' parts, developed according to two different methods, relying respectively 'on demontrations' and 'on experience', and accessible to two quite different audiences (DH *Ep.*; OL II, not paginated).[39] While in *De cive* the analytical method was supposed to be an equivalent alternative to the rigorous synthetical one, in *De homine* the two methods were to be combined, because neither of them could provide by itself a complete account of human nature: 'This was necessary as it was required by the method of the whole work' (DH *Ep.*; OL II, not paginated).[40]

Where the ontological unity of human nature as the object of science was postulated, the peculiarity of human nature as both the object and the subject of mechanical science made Hobbes's civil science the turning point of the failure of his system. As explained in Chapter 2, the epistemological gap first opened by *De cive* had far-reaching consequences for the development of Hobbes's political theory, as far as it strongly questioned the political efficacy of reason. More generally, the twofold nature of the method of science itself became more and more evident to Hobbes and contaminated the

[38] Sorell's 'solution' appears to be a typically 'Straussian' assumption of the epistemological incompatibility between Hobbes's natural and political philosophies. Malcolm poses the hermeneutic problem represented by Hobbes's scheme of sciences by considering the variations between the two versions, yet his explanation appears to be driven by the assumption that the hope for an epistemological composition of 'the puzzle' is far from being at hand (Malcolm 2012: 145).

[39] 'Contigit autem sectioni huic, ut duae partes ex quibus constat sint inter se dissimillimae. Est enim altera difficillima, altera facillima; altera demonstrationibus, altera experientia constans; altera a paucis, altera ab omnibus intelligi potest'.

[40] 'Necessarium erat, ita scilicet postulante totius operis methodo'.

whole of his systematic project. As Pacchi noted, the 'ideal of the unity of science' – in the form of a 'methodological unity' alternative to the Aristotelian one – remained untouched throughout the whole of Hobbes's production, but its 'internal' duality progressively brought his enterprise to a failure of which *De homine* marked the final step.[41]

But this *epistemological* failure was in fact turned into a striking success by the *ideological* move through which, in *Leviathan*, Hobbes made of the twofold nature of men – natural and artificial – both the starting point and the result of the perfect automatic functioning of the body politic. In fact, as I explained in chapter 2.5, the ideological solution to the epistemological impasse of civil science Hobbes provided in *Leviathan* was ultimately inconsistent and non-scientific. He postulated on the one hand a deterministic ontology of human nature and on the other hand the possibility of a privileged and neutral scientific insight on its mechanical functioning. This impossible coincidence was what finally defined the paradoxical nature of Hobbes's epistemology of civil science. In this sense we can say that the epistemological gap opened by *De cive* was 'saturated' in *Leviathan* by human nature and supported by both the deterministic ontology Hobbes had in the meantime developed and consolidated in his natural philosophy, and the epistemological function he attributed to the sovereign. And in effect, Hobbes's treatment of 'human nature' in *Leviathan* displays this postulated identification of the epistemological and ontological functions of 'human nature', that is the very collapse of 'man' as a subject and as an object of science, within a body politic 'the *Matter* thereof, and the *Artificer*, both which is *Man*' (Lev *Introduction*; EW III, X).

The epistemological function of human nature

Hobbes's conception of human nature completely changed once it had entered the transcendental shift of early-modern epistemology and metaphysics enacted by Descartes, in which human nature was split in order to become both the natural object (body) and the metaphysical subject (reason) of mechanical science. Although no doubt about Hobbes's genuine materialism can be admitted, evidently his concern with framing human nature as a 'natural' but stable starting point for civil science disclosed the necessity of finding a way to cut the edge between man's reason and nature also within materialism. In Hobbes's materialistic framework this split had to be reformulated in different terms, which affected at the same time his conception of human nature and the

[41] According to Pacchi Hobbes pursued his project of a 'deduction' of civil science from geometry only during the period 1645-1649 (Pacchi 1965: 169-170), which would mean that such project concerned the *Preface* to *De cive* but not yet the *text* of *De cive* itself. However, in *De homine*, while physics still remained hypothetical, civil and moral philosophy had been definitely assumed to be 'a priori deducible as geometry, *but starting from principles internal to themselves*; in complete autonomy, and not from general principles anymore'. According to Pacchi this methodological unification of all the fields of science, was carried on by Hobbes on the basis of the unity of their object: the phenomenon (Pacchi 1965: 216-17; see also Pacchi 1971: 112 ff.). In this sense he claims that Hobbes's system was as a complex attempt to conciliate 'epistemological phenomenalism' and 'materialistic realism'.

epistemology of civil science. And this is what he tried to do in *Leviathan*. In order not to abandon the postulate of the unity of science, Hobbes eventually made human nature the key methodological issue and the impossible point of convergence of his entire research, characterised by a kind of 'double bind'. Because of its paradoxical 'internal' universality, civil science should have been able to stand on the stable ground of human nature both as its object and subject. But the human nature that grounded civil science was irreversibly marked by its 'natural' absence of reason. As an object (stable) of science it might even be entirely known according to the most rigorous principles of mechanics, but as a subject (in motion), it undermined any possible stabilisation of such a knowledge. This irreversibly made of the science of human nature itself a crucially political issue, despite Hobbes's pretended *neutral* description of human nature as it was and not as it ought to be.[42]

In fact, human nature marks in *Leviathan* the collapse of the object and the subject of civil science within a conceptual framework that does not allow it. It injects a de facto idealistic anthropological difference into the heart of Hobbes's materialism, where 'man' plays the role of the 'privileged' part of nature in which the latter produces a *rational* knowledge of its own functioning. Apparently, the procedural reason displayed in *Leviathan* is not inscribed in human natural motion as such. It is clearly not 'as sense and memory, born with us; nor gotten by experience only', but it 'is attained by industry' through the activity of 'imposing' names and getting a method (Lev V; EW III, 35): an attained capacity of doing abstract operations on names (Lev V; EW III, 30).[43] Reason is, in this sense, a normative concept, a feature characterising 'adult' human nature. That is why 'speech' constitutes for every individual man both a heritage and a mark of the attained capacity of using 'Reason':

> Children therefore are not endued with Reason at all, till they have attained the use of Speech: but are called Reasonable Creatures, for the possibility apparent of having the use of Reason in time to come. (Lev V; EW III, 35-36)

And nevertheless, when other typical human passions such as 'curiosity' and 'admiration' are concerned (Lev VI; EW III, 44, 45), reason reveals to be profoundly rooted in the properly human conatus, a desire that, in order to secure its continuation, has to gain exponential increase:

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[42] Johnston frames the problem in terms of the opposition between the abstract theory of human nature characterising Hobbes's former political treatises and the 'historical dimension' he would add to human nature in *Leviathan*, while basically maintaining the same abstract theory of the commonwealth. Hence the new political purposes of civil science: 'Hobbes's theory would not achieve practical realization until men became the rational actors they had always had the potential to be' (Johnston 1986: 128-29).

[43] The procedural neutrality of reason is allowed to cover any possible object of science: 'In what matter soever there is place for addition and subtraction, there also is place for reason; and where these have no place, there reason has nothing at all to do' (Lev V; EW III, 30).

> So that in the first place I put for a general inclination of all mankind, a perpetual and restless desire of Power after power, that ceaseth only in Death. And the cause of this, is not always that a man hopes for a more intensive delight, than he has already attained to; or that he cannot be content with a moderate power: but because he cannot assure the power and means to live well, which he hath present, without the acquisition of more. (Lev XI; EW III, 85-86)

Although concealed under the more physical cloth of 'speech' or some peculiar 'desire of knowledge', reason, like any other typically human feature, is profoundly rooted in a potentially infinite desire characterising human motion that simultaneously both nourishes and threatens the body politic. As a result, the procedural neutrality of reason has not only to account for, but also to take in charge, the continuation of the bodily motion it is assumed to arise from and depend on. Reason is bound to protect and regulate human desire because reason itself *is* desire, and its endless continuation becomes the founding value to be protected at all costs. It is in order to regulate and maintain human motion that the body politic – as a 'second Nature' – assumes the monstrous shape of a deterministic machine that would repeat at the human scale the 'divine' mechanical order of nature, and it is for this purpose that human nature has to be accurately shaped to fit the particular kind of motion which corresponds to the geometrical model of its perfect functioning: men 'as they are' *must* be reduced to men 'as they ought to be'. This exigency of defining, controlling and even producing the 'nature' of man is what finally made – precisely through Hobbes's materialistic determinism – the idealistic nature of the political agenda of mechanicism explicit.

3.3 Educating the Educators: *Behemoth*'s Political Pedagogy

Laws of nature, right reason, power, right, sovereignty, will, liberty, and – in particular with *Leviathan* – also representation, these and all the other concepts that provide the scaffolding of Hobbes's political theory were evidently born outside of the domain of mechanicism and their genealogy is often completely indifferent to the field of natural philosophy. Yet Hobbes had to implicitly or explicitly translate them, in order to allow them make sense *also* in the terms of a physics of motion. In effect, in all the domains of his research Hobbes never abandoned the key assumption of his materialistic version of mechanical philosophy, the basic postulate that all is 'but' matter in motion. This is the postulate of his whole epistemology of sciences and the implicit postulate of his political doctrine, which entails that all the concepts Hobbes adopts to elaborate his civil science also have to comply with this basic principle. More precisely, the 'train of thought' representing science and the whole set of its principles are always implicitly assumed to

be physical motions themselves. Therefore it is evident that, since the principles of science must be understood also from the point of view of the physical motion that generates them, they should be also considered motions of mind which, as such, can always be changed by further motions, as entailed by Hobbes himself when he argues against the Cartesian 'ideas' of God, of the infinite, of eternity etc. (AT VII, 179-80).[44] And, although my former analysis prevents any straight identification of Hobbes's 'law of nature' with the objective laws of natural motion as they were first established by Descartes and later accepted after Newton's enterprise, it has nevertheless also stressed that a deeper connection between the laws of nature and the laws of physical motion can be seen running through all of Hobbes's writings and constantly influencing his civil science as a necessary background.

Of course, this does not mean that Hobbes simply 'analogically' transposed the Galilean concept of motion onto the psychological and political domains. Rather he postulated that the explanation of causes in any possible domain was to be in principle compatible with a physical account of motion, whether this explanation was directly accessible by human enquiry or not. In fact Hobbes did not provide a *systematic* redefinition in the jargon of mechanicism of any of the psychological and political concepts he used.[45] Nevertheless he assumed this was, at least in principle, possible: in his works – political or not – he also repeatedly returned to these issues, trying to perfect the definitions and explanations of the terms, principles, and concepts he was using, as long as his philosophical system evolved.

There is no doubt that, from the beginning of his scientific career, Hobbes was trying to found his theory of knowledge on the Galilean principle of local motion, on the basic assumption that nothing else than matter in motion existed, as his own account of the journey with Cavendish clearly shows (OL I, LXXXIX, vv. 105-130).[46] As usual, the systematic evaluation of the ontological and/or epistemological relevance of Galileo's hypothesis was committed to mechanical philosophers. Like all the authors gravitating around Mersenne's circle, Hobbes soon became concerned with the epistemological need to ground the new mechanical science of matter. As a matter of fact, both Hobbes's and Descartes's enterprises were looking for a philosophical solution to the problem posed by Galilean relativity. But Hobbes's radical opposition to Descartes's dualist conception of substance and physical conception of matter resulted in a completely different strategy to

[44] It is worth recalling that Hobbes had just argued that 'the mind will be nothing more than motion occurring in various parts of an organic body. (AT VII, 178). See above, Chapter 1.2 on Hobbes's *Objections* to Descartes's meditations.

[45] Macpherson interestingly pointed out that the epistemological 'gap' between Hobbes's physiology of the individual body and his sociology of the collective body had an ideological source (Macpherson 1962: 40 ff).

[46] Hobbes, *Vita Carmine Expressa*. According to Paganini, along his research Hobbes was not even so far from developing a kind of 'anti-Platonic' tendency also present in Galileo (Paganini 2010: 66-67).

solve the epistemological problem of the foundation of mechanical science. In Descartes, as explained in Chapter 1, this was achieved through a) the postulate of a metaphysical substance, immune from motion, capable of intuitive knowledge; b) the mechanisation of nature through reduction of matter to an extended body submitted to the laws of nature. In Hobbes the same purpose was pursued through two converging strategies: the 'physicalisation' of geometry and the 'geometrisation' of physics. But Hobbes's path was the one which required the utmost ideological effort, because it was carried on within the framework of a materialistic metaphysics, traditionally empiricist and relativist, and, quite often, non-deterministic.

The basic inconsistency between the integral assumption of the mechanistic project and the framework of materialism required Hobbes to fight his war on different front lines: against the Aristotelian tradition and against the new mechanical philosophy both in its Cartesian deductive form and in the experimental form which was soon thereafter triumphing through the Royal Society. This aporetical stance compelled him to oscillate for a long time between some themes of the materialist tradition: the hypothesis of void, which dangerously opened the space for an aleatory form of materialism, and the question of ontological determinism, which soon proved to be a decisive battle for the holding of the whole system. Along this path he finally committed to the (purely ideological) solution of the epistemological-political problem of connecting the foundation of the names, definitions, and principles of science to the effective artificial order of the political body, with the purpose of granting the continual motion (and infinite reproduction) of the latter. This was Hobbes's way of *abandoning* the Galilean principle of the relativity of physical motion and making of 'matter in motion' a safely circumscribed object for science. As I am now going to explain, this political outcome is at the very core of the mechanistic project. It corresponded to the political agenda of mechanical philosophy, which Descartes had settled on apparently opposed metaphysical grounds. In fact early-modern mechanicism – the philosophical foundation of Galilean mechanics – was born essentially dualist, deductivist, and determinist. And, despite – or rather precisely because of – its apparent neutrality, it was implicitly committed to developing a pedagogical agenda. Along this path, Hobbes's pedagogical project drives straight back to its mechanical sources.

Defining, controlling, and producing human nature

When in *Leviathan* civil science identified human nature as an object of scientific knowledge and pedagogical technology, this was the result of Hobbes's epistemological-political enterprise. But the agenda of this project was set as early as in *De cive*, and it was the transposition into civil science of the Cartesian agenda which prescribed the

identification of geometry and the physics of motion. As stones 'of rough and irregular shape' have to be shaped to fit the structure, while others, too hard 'to be compressed or cut', must be 'thrown away as unsuitable',[47] the same is for men who, when 'inconsiderate' to others, are not to be esteemed human anymore: 'Cicero regards *inhuman* as the opposite of *considerate*, as if he had this law in mind' (DC III.9; OL II, 187).[48] This exigency of order, along with the exigency of 'squaring' human actions through laws, was not at all a novelty in Hobbes's political views:

> The true end of all Laws is to ordain, and settle an order, and government amongst us, the Jurisdiction whereof we are rather bound to obey, than dispute; Laws being […] the very rules, by which all the actions of our life be *squared* and disposed. (HS 105, italics added)[49]

Yet the actual endorsement of the 'collapse' of geometry and civil science by means of mechanics was not clearly stated by Hobbes before the *Preface to the Readers*, where there appears for the first time in his writings the model of the clock. Emblematic of Hobbes's definitive adoption of ontological determinism, the model of the clock allowed him to postulate, despite the epistemological limitations of knowledge, the ontological presupposition of a perfect mechanical functioning of the body politic:

> As in an automatic Clock or other fairly complex device, one cannot get to know the function of each part and wheel unless one takes it apart, and examines separately the material, shape, and motion of the parts, so in investigating the right of the commonwealth and the duties of the citizens, there is a need, not indeed to take the commonwealth apart, but to view it as taken apart, i.e. to understand correctly what human nature is like, and in what features it is suitable and in what unsuitable to construct a commonwealth, and how men who want to grow together must be connected. (DC *Praef.*; OL II, 145-46)

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[47] 'Lapis, qui prae figura apsera et angulosa plus loci caeteris aufert quam ipse implet, neque prae materiae duritie comprimi vel secari facile potest, nec compaginari aedificium sinit, tanquam *incommodus* abjicitur'.

[48] 'Cicero tamen *commodo* opponit *inhumanum*, tanquam ad hanc ipsam legem adspectans'.

[49] *A Discourse of Laws* is part of a twelve-essay volume entitled *Horae Subsecivae* [Leisure Hours]*: Observations and Discourses*, published anonymously in London in 1620 (cf. Reynolds and Saxonhouse 1995, pp. 3-19). Strauss relied on *Horae Subsecivae* as Hobbes's early work. A recent study based on a computerised 'Wordprint Analysis Procedure' has apparently 'proved' Hobbes's authorship for three of the twelve essays. Skinner casts doubts on such analyses, although he provisionally accepts the hypothesis on the young humanist Hobbes, which is highly compatible with his portrait of the development of the latter's philosophy: 'Nevertheless, it seems very probable that Hobbes at least had a considerable hand in these texts […]. There are, in short, some independent reasons for thinking it likely that the computer analysis is correct. Given these reasons, it seems appropriate to assume, at least provisionally, that the three Discourses singled out by the computer are indeed by Hobbes. The implications with respect to the place of the studia humanitatis in his intellectual development are of great interest' (Skinner 2002: 46). More recently Skinner 2008: 1, n. 3, seems to have rejected the hypothesis. However, these problems of attribution do not affect my argument, because quotations from *Horae Subsecivae* are here rather used as rhetorical device than as arguments.

This assumption definitively integrated Hobbes's civil science into a systemic perspective where the main purpose of philosophy was the preservation of the body politic at all costs. For this purpose an epistemological and political decision was needed to both define and dominate the political monstrosity of human nature, by re-inscribing it within the established geometrical order:

> Suppose a woman gives birth to a deformed figure, and the law forbids killing a human being, the question arises whether the new-born is a human being. The question then is, what is a human being? No one doubts that the commonwealth will decide – and without taking account of the Aristotelian definition that Man is a rational Animal. […] In all disputes on these topics [i.e. '*ius*, *politia*, et *scientiae naturales*'] individual citizens should obey the laws and decisions of their commonwealth. (DC XVII.12; OL II, 389)

The political efficacy and the risk of all politics of human rights substantiated by a science of human nature is evident here.[50] Through different pedagogical technologies human nature can be reduced to fit *any* 'artificial' order grounded on (if not established by) political power.[51] And, in effect, the definition, control, and production of human nature was in Hobbes a strategic epistemological and political task.

Although *Leviathan* was not at all about mechanics, mechanics was postulated as the ultimate justification of the argument presented therein: human natural individual bodies are not fit for collective life, their growth is disorderly, and therefore the collective body has to be an artificial one, whose mechanical motion would function, on the contrary, according to the ideal laws of (human) nature. Hobbes's horror of *organic* growth is quite evident when he invests Leviathan, the biblical monster he draws from the book of Job, with the epic task of fighting the multiple-headed monster representing the *hybris* of 'the children of pride':[52]

> To what disease in the natural body of man, I may exactly compare this irregularity of a commonwealth, I know not. But I have seen a man, that had another man growing out of his side, with a head, arms, breast, and stomach, of his own: if he had had another man growing out of his other side, the comparison might then have been exact. [...] It is a contention with ambition, like that of Hercules with the monster Hydra, which having many heads, for every one that was vanquished, there grew up three. (Lev XXIX; EW III, 318-19, 338)

[50] See for instance Badiou 2001. See also Agamben 1998.

[51] It is worth noting that Hobbes always conceived the sovereign as an 'arbiter', not the 'creator', of truth. It is through this conceptual distinction that Popkin maintains that – although Hobbes was not a sceptic – by 'making the sovereign the political arbiter of truth' he laid 'the groundwork for a much more dangerous scepticism', the one characterising 'the new Orwellian state', based on technologies capable of shifting state power from the possibility of 'deciding' on truth to the capacity of 'creating' it (Popkin 1982: 145).

[52] Leviathan 'is king over all the children of pride' in the book of Job 41:34.

New heads of the hydra continuously sprout and grow within the body politic because of the natural passions of men, from the dangerous imitation of the exempla of some great men, who should be opposed by the sovereign at the outset (when they still are of little danger).[53] This 'organic' re-emergence of the natural irrational tendencies characterising human nature was in fact pictured by Hobbes in the earlier *Elements of Law*, where he denounced all internally growing bodies as inherently cancerous, capable of becoming 'one body of rebellion' (EL XXVII.11).[54] In *De cive*'s dedicatory letter he stressed that a 'geometrically organised' commonwealth could perfectly secure peace, exception made for the eventuality of conflicts 'over space, due to the growth of the multitude [*crescente hominum multitudine*]' (DC *Ep.*; OL II, 137-38). In short, any growth preventing the artificial functioning-as-one of the body politic becomes a kind of 'internal enemy', a risk for the overarching aim of the collective automaton: its continuation at all costs, in order to grant 'peace and leisure' (and, last but not least, a stable ground for scientific research).[55]

Hobbes's problem was to control the genesis of the artificial body politic from the natural bodies of men, that is from human nature. To this problem – a problem of motion again – Hobbes's subsequent solutions changed along with his epistemology. In the case of a 'natural' body politic the narration of *The Elements of Law* poses the problem of the passage from the natural commonwealth (by acquisition) to the artificial commonwealth (by institution), to which corresponds a certain genealogical analysis of the passage from democracy to aristocracy and monarchy in Chapter XXI devoted to the forms of government, and finally the distinction between the pact *unionis* and the pact *subjectionis*.[56] From *De cive* onwards everything changes. The pact is unified and neutralised, and we have in fact a quite a-temporal description of the model of the pact, while the description of the three forms of government is largely topological and its genealogical progression still appears as a background narration. In short, Hobbes moves from an ontological genealogy of the pact producing the commonwealth in *The Elements of Law* to the uniformation and neutralisation of the model of the pact in *De cive* (union *and* submission), and the consequent disappearance of the problem of the relation between what is natural and artificial in the political sphere.

The next step is the ideological achievement of the representation of the logical form of the pact in *Leviathan*, where the birth of a rhetoric of neutralisation is finally accomplished.

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[53] On the crucial role played by the ambivalence of 'ambition' in Hobbes's 'political philosophy of glory', see Slomp 2000: 58-73. According to the author the assumption of this structural ambivalence would progressively open Hobbes's political theory to a political pedagogy of civil obedience.

[54] In *De cive* and *Leviathan* Hobbes does not even mention a 'body of rebellion'. More radically, he explicitly states that sedition cannot generate new 'civitates' (DC XII.8; OL II, 291-92) or 'commonwealths' (Lev XXIX, 308-9, 313, 318-19), it just menaces to dissolve existing ones.

[55] '*Leisure* is the mother of *philosophy*; and *Commonwealth*, the mother of *peace* and *leisure*. Where first were great and flourishing cities, there was first the study of *philosophy*' (Lev XLVI; EW III, 666).

[56] This sequence is synthesised by Piccinini 2007: 73, 76-77.

While in both *De cive* and *Leviathan* the pact *unionis* and the pact *subiectionis* are in fact a single step, the great novelty of the latter is the reappearance of the problem of the relation between human nature and the artificial body politic. The problem of the transition is solved by the ritualisation of the sovereign's investiture: the actor/author scheme puts on the stage the imaginary result of the pact *as if* it were a pact of each one with everyone. The material democratic genealogy of sovereignty described in the ontology of *The Elements of Law* is here revived as a democratic ritual and therefore *neutralised* (Piccinini 2007: 82).[57] Therefore in *Leviathan* we do not have only the investiture of the sovereign with the power of controlling human nature but, more significantly, with the power to produce a representation of it that would guide the mechanisms of its selection and preservation, according to an ordered, secure, artificial pattern.

In fact, even in *The Elements of Law* we are never concerned with an actually 'natural' body politic. Human 'wills' continuously provide their 'natural' part of causality contributing to the building of artificial bodies, but without ever granting their unity and persistence. Thus, even if a body politic might 'naturally' result from the convergence of men's natural wills, it should also have to be 'artificially' kept in motion, otherwise it would soon cease to *be* (since, as Hobbes clearly explains in *Leviathan*, 'life is but a motion of limbs', Lev *Intro*, EW III, IX). That is why Hobbes can at the same time state that *consent* is a natural (that is mechanical) convergence of wills producing one single action (EL XII.7), and still claim the necessity of a further 'artificial' common power in order to compel men to 'direct their actions to one and same end' (EL XIX.4).[58] But Hobbes's achievement in *Leviathan* is marked by the complete awareness of the necessity of regulating – that is dominating *and* preserving – human natural motion. Individuals are properly *defined* 'human' only by some particular kind of motions which constitute the model of their 'functioning', in particular, as explained in Chapter 3.2, curiosity and admiration (Lev VI; EW III, 44, 45), and last but not least speech, the mark of the attained capacity of acquiring the use of 'Reason' (Lev V; EW III, 116). Humans are a peculiar part of matter that must be organised in order to be kept in motion on the basis of its internal causes, the laws of human nature. Any artificial tools (also and mainly ideological) have to be employed to help human natural bodies develop their inner human motions by coping with external causes, utilising or resisting them according to the case:

> The use of laws is not to bind the people from voluntary actions, but to direct and *keep them in such a motion* as not to hurt themselves by their own impetuous

[57] The author convincingly pictures *Leviathan* as a 'huge disciplinary dispositif' strongly contributing to the generation of the very concept of 'public opinion' as the basis of a public space of disciplination and compatibilisaton of individual opinions (Piccinini 2007: 84-85; see also Piccinini 1999: 136).
[58] Cf. also EL XIX.6 to see how 'natural' consent needs an artificial reinforcement.

> desires […] not to stop travellers, but to keep them in the way. (Lev XXX; EW III, 335, italics added)

It was still alluding to the book of Job that Hobbes tried to picture this distinction between the natural and artificial motion of human matter. The Leviathan/Behemoth antithesis mythically represents in the political domain this struggle between the ordered motion of the machine and the disorderly growing matter of the multitude.[59] In effect in *Behemoth* Hobbes conceives the multitude as characterised by a kind of motion which tends – so to say – to oppose the artificial motion of the body politic. Independently of its composition, the multitude tends to *forget* all that has been learned:

> The common people have been, and always will be, ignorant of their duty to the public […]. If you think the late miseries have made them wiser, that will quickly be forgot, and then *we* shall be no wiser than *we* were. (Beh; EW VI, 212, italics added)[60]

This feature characterises the 'natural' motion of the multitude towards the ignorance, notably, of the 'rules of just and unjust' despite their simplicity (Beh; EW VI, 212). And this natural tendency of the multitude is precisely what exposes it to all kinds of propaganda from which intermediate bodies (that is 'the unjust') can emerge and grow.[61] Hobbes's remedy for this cancerous disease was a true *pharmakon*, a Leviathan contrasting Behemoth: an artificial counter-monster endowed with mechanically regulated motion, capable of preventing the risk of a disordered organic growth due to the intrinsic lack of memory and ignorance of the multitude.

Also *Behemoth*'s science is ultimately based on one single fundamental law of nature – that prescribes the preservation of life – which is double sided: on the one hand it prescribes for the people the obedience to the sovereign; on the other it prescribes for the king the preservation of the *salus populi* (Beh; EW VI, 248-49). And it is Hobbes's conviction that, on the basis of this single clear and evident law of nature, all disputes could be settled thanks to a commitment to the 'wisdom of the state' (Beh; EW VI, 244). But in *Behemoth* it is more clear than ever that, for this purpose, an *active* endorsement by civil power of the pedagogical power of both science and ideology is required. Although the practice of natural philosophy must not mingle with religion and remain the privilege of an elite (Beh; EW VI, 236-37), its discoveries have to be at the service of the state that conversely grants the 'leisure' for the development of research. Thus a fundamental

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[59] This antithesis was explicitly stated by Hobbes when he ironically suggested to Bramhall, for those who would prepare a refutation of his *Leviathan,* 'a fit Title for their Book, *Behemoth against Leviathan*' (EW V, 27).
[60] Hobbes's use of the 'we' here might suggest that the multitude represents a feature inscribed in the nature of every human being, the learned included.
[61] It is quite easy to imagine 'what kind of men such a multitude of ignorant people were like to elect for their burgesses and knights of shires' (Beh; EW VI, 212).

feature of the state becomes the development of philosophy, because it is the actual basis of the system of knowledge that, on the law of (human) nature, can project the foundations of public education through what we might call a deliberately ideological use of science. This development has the aim of overcoming the divide between science and ideology in order to make of rhetoric, Hobbes's greater enemy (Beh; EW VI, 249), a tool of state power. In fact, Hobbes is well aware of the limitations of state power and the risk entailed by coercion, as far as opinions are concerned:

> A state can constrain obedience, but convince no error, nor alter the mind of them that believe they have the better reason. Suppression of doctrines does but unite and exasperate, that is, increase both the malice and power of them that have already believed them. (Beh; EW VI, 249)

As a consequence, through science civil power has not only to *control* public opinion, but must also *produce* it. And around this issue the problem of universities comes to be crucial. First, because 'the *Universities* have been to this nation, as the wooden horse was to the Trojans' (Beh; EW VI, 213).[62] And second because they can be transformed into the most powerful tool for state power. For these reasons, universities 'are not to be cast away, but to be disciplined' (Beh; EW VI, 236). In short, only an institutional reform of the university, sustained by the powers of science and religion through rhetoric, can fully serve this purpose, and make 'solid reason' prevail (Beh; EW VI, 233). On this ground Hobbes sketched his project of reformation of the universities by the formation of an intellectual army educated to the new science against 'all those preachers that taught the contrary' (Beh; EW VI, 213): an army of 'well-principled preachers' (Beh; EW VI, 237) who would bring men to love obedience and true liberty, namely the absence of 'the constraint and insolence of their neighbours' (Beh; EW VI, 237).[63] In effect, at that point Hobbes's main political problem was no longer the Platonic one of 'controlling the controllers' – it was not a problem of 'sovereignty' – but rather of 'educating the educators'. It was a problem of discipline. And in this project also the discipline of history had a crucial role to play.

From this perspective *Behemoth* can be read as a book in which, against any epistemological claim ever provided by Hobbes, history is treated from the perspective of a 'science' of human nature, and therefore subject to similar limitations: 'I cannot enter into other men's thoughts, farther than I am led by the consideration of human nature in general' (Beh; EW VI, 200). But in this case the simplicity of science *must* confront the

[62] Here Hobbes is particular challenging the Presbyterians and the Catholic Church. In effect, the (counter)model of Hobbes's project was the Catholic Church, who occupied the universities, forming scholars who spread Christian-Aristotelianism.
[63] On Hobbes's definition of liberty as 'absence of external impediments', see above, Chapter 2.3.

complexity of ideology, because Hobbes's history of the Civil War is intended to shed some light on the effects of the *opposition* between the clarity of science and those who made use of 'the obscurity' of their doctrine (Beh; EW VI, 215). As a result *Behemoth* appears to be a study of human actions through the scientific lens of human nature, but also what one might name a militant *science of ideology*, namely of the disputable contents that cause and drive human actions, independently of scientific truth. In *Behemoth* history appears to be first of all the description of the human actions that led to the Civil War. But it is, at the same time, the science of the 'causes, pretensions, justice, order, artifice, and event' of human actions (Beh; EW VI, 165). It is therefore based on the *science* of human nature as a cause, but it is also, and more precisely, a science *of ideology* as a cause of sedition and war:

> The history, not so much of those actions that passed in the time of the late troubles, as of their causes, and of the councils and artifice by which they were brought to pass. (Beh; EW VI, 220)[64]

In this sense it is evident that Hobbes's practice of history in Behemoth is part of the disciplinary technologies required by a politics of science in order to provide an artificial functioning for the natural motion of human matter. Such technologies are not included in Hobbes's system of sciences – in fact they were never considered sciences by him – and yet they function as political means at the service of the main scientific aim: consolidating the social order allows peace and therefore scientific research to take place.[65] For this purposes the educators in the universities should have been educated not only in the new science, but also in the good use of the pedagogical technique *par excellence*, that is Religion, which in turn will allow them to educate the multitude:

> The rules of *just* and *unjust* sufficiently demonstrated, and from principles evident to the meanest capacity, have not been wanting; and notwithstanding the obscurity of their author, have shined, not only in this, but also in foreign countries, to men of good education. But they are *few*, in respect of the rest of the men, whereof many cannot read: many, though they can, have no leisure; and of them that have leisure, the greatest part have their minds wholly employed and taken up by their private

[64] Hobbes himself does not fail to clarify that Behemoth is not at all a piece of (military) history: 'I intended only the story of their injustice, impudence, and hypocrisy; therefore, for the proceeding of the war, I refer you to the history thereof written at large in English' (Beh; EW VI, 313).

[65] As explained by Skinner, in *The Elements of Law*, *De cive*, and *Behemoth* Hobbes consistently considered history as only a source of prudence (in which also beasts participate), and therefore not a science (Skinner 1996: 260 ff). But according to Skinner Hobbes's argument was simply Aristotelian: history has no universality nor necessity since it narrates individual events (Skinner 1996: 262). I am suggesting that in fact Hobbes, precisely in *Behemoth*, was prospecting the possibility of changing the Aristotelian view on history.

> businesses or pleasures. So that it is impossible that the multitude should ever learn their duty, but from the pulpit and upon holidays. (Beh; EW VI, 213)[66]

Hobbes's ontological assumption concerning the nature of the multitude grounded and justified a conjoint epistemological and political action on human nature through which the latter could be reduced to the laws of nature prescribed by the established 'artificial' order. And here comes Hobbes's main argument concerning the special kind of rhetoric of neutrality that science can effectively endorse. Precisely because science is not a question of contents but of procedures of reasoning based on the correct establishing of meanings, it can be used in disputes against those (here 'this Parliament') who, on the contrary, 'in the use of their words, when they accused any man, never regarded the signification of them, but the weight they had to aggravate their accusation to the ignorant multitude' (Beh; EW VI, 249). More precisely, the rhetoric of science can be properly used not *in* disputes, but rather *against* them, by preventing the useless quarrels in the universities from becoming dangerous struggles within the state that would threaten the unity of the body politic (Beh; EW VI, 242). For this purpose any means would fit, apart from the ones that excluded what had to be necessarily presupposed and produced: the disposition to understand and/or to believe in the theoretical power of reason, capable of providing a neutral account of facts *and* effective advice for political action.

3.4 Science *and* Ideology? The Political Agenda of Mechanicism

My research has shown so far that Hobbes's civil science was not only the outcome of a political agenda, it also carried on an epistemological agenda that was hardly compatible with its materialistic premises. Hence I am going to move a step further in order to claim that this contradiction casts doubt on the consistency of the mechanistic enterprise as a whole as the attempt to define the secure boundaries of science from the moving perimeters of opinion, which modern science simply labels as ignorance or ideology. As explained in the introduction, I have crossed three different approaches in order to analyse the role played by ideology in Hobbes's mechanicism: constructivism, intellectual history, and Marxism.[67] Each of these approaches entails, more or less explicitly, a theory of the emergence of modern science and of its political stakes, on the one hand, and a

[66] According to Vaughan, a rhetorical use of history was carried on by Hobbes in *Behemoth*, where he displayed a process of pedagogical education – between A and B – through historical examples (Vaughan 2002: 98-100). Although clearly seeing the centrality of political pedagogy in Hobbes's project, Vaughan seems to overlook the pedagogical function of religion, which is also crucial in *Behemoth*. Religion was not at all 'a private concern' for Hobbes (Vaughan 2002: 80): on the contrary, it had to be monopolised by the public sphere, in order to avoid any 'private' use of it. In fact, it is in this direction that he spent more and more ink and time dealing with this topic in his political treatises, and not only.

[67] In my Introduction I have mainly dealt with intellectual history and constructivism by taking as emblematic of these approaches Jesseph 1999, Shapin and Shaffer 1988, respectively. In this section I will extensively deal with Marxist interpretations.

theory of the relation between scientific truth and ideology, on the other. For intellectual history, the term 'ideology' usually explains inconsistent deviations of the individual's thought from reason and a meaningless opposition to facts: in short, ideology equals objective description *minus* natural facts as they appear to a neutral observer in his historical context. For the constructivist approach ideology is a relational concept born within Western science in order to identify antagonist truths by stressing their distance from the dominant scientific one. For Marxism ideologies are the superstructural expression of modes of productions and class conflicts, and they must therefore be interpreted in terms of their strategic opposition to a scientific truth which is rarely questioned.[68] According to Sohn-Rethel most Marxist accounts on science inherited this biased view from an original lack in Marx's own work:

> In fact Marx did not focus his attention on a historical-materialist understanding of natural science […] natural science was not given a place as either belonging to the ideological superstructure or the social base. The references to science in *Capital* appear to take its intrinsic methodological possibility for granted. (Sohn-Rethel 1978: 2)

As a matter of fact, also when presented within Marxism, such an approach is idealistic insofar it takes as its undisputed object a natural 'reality' which is in fact the result of collective processes of imagination, transformation, *and* manipulation of matter, in a word of praxis. It is evident that any account of philosophical thought which undisputedly assumes *science* (of facts) as the ultimate horizon of knowledge can only find its own epistemological foundation in the present achievements of science, and refuse any philosophical questioning of the emergence of science itself. These achievements are nevertheless the results of a 'tradition' the emergence of which is usually explained through a plain reference to some primordial evidence, implicitly based – willing or not – on the undue hypostatisation of 'human being', 'human nature', or 'human rationality', whether in the form of a biologically determined feature or of a metaphysical soul. In my view this hypostatisation is precisely the persisting counterpart of an implicit idealistic reduction of nature to mechanical functioning as it was *imagined* in the seventeenth century by those who invented mechanical philosophy. By imagining nature as an abstract machine, modern mechanicism provided a powerful image of it which was perfectly reflected in the perfection *in principle* attributed to human reason. From such a perspective, in Descartes's *res extensa* and in his mechanistic image of nature we find an

[68] Of course, as I have explained in my Introduction, in Marxist thought the relation between science and ideology has always been quite far from being a plain assumption. And, as a matter of fact, modern science was in Marxism the subject of deep and prolonged debates that, by questioning science, arrived at questioning the epistemological status of Marxism as a science itself.

ideology both so near and so far from us, which implicitly avoids questioning the historicity of science and the 'a-theoretical facts' through which it allegedly represents reality as it is.

But Descartes's systematic foundation of what will be later called mechanical philosophy was not a direct and necessary outcome of the *method* of the new science. In fact, it was rather the result of a metaphysical choice the roots of which fall far beyond the boundaries of the realm of philosophical writings and scientific research. And the world picture it contributed to generating has for a long time been a winning and pervasive one. Yet it is not clear how much this outcome depended on the method of the new mechanical science or/and on its metaphysical systematisation by mechanical philosophers. In short, it is still to be enquired how far the method of modern science itself, although defined and supported by the apparently ahistorical evidence of its technological applications, was rooted in early-modern society. This detour will allow me to get back to my interpretation of the significance of Hobbes's materialism as a case study perfectly embodying the ideological stakes of early-modern mechanical philosophy.

Science as ideology and the technical basis: A Marxist debate

Edgar Zisel was one of the first to analyse the social roots of early-modern science by focusing on the twofold characterisation of the scientific method itself:

> The two components of scientific method were separated by a social barrier: logical training was reserved for upper-class scholars; experimentation, causal interest, and quantitative method were left to more or less plebeian artisans. Science was born when, with the progress of technology, the experimental method eventually overcame the social prejudice against manual labor and was adopted by rationally trained scholars. This was accomplished about 1600 (Gilbert, Galileo, Bacon) […]. Eventually the social barrier between the two components of the scientific method broke down, and the methods of the superior craftsmen were adopted by academically trained scholars: real science was born. (Zilsel 1942a: 935, 942)

Quite emblematic of the problem concerning the social roots and ideological status of modern science within the Marxist tradition was the debate between Borkenau and Grossmann, a brief summary of which will allow me to pose the problem of the relation between the two sides of the method of modern science outside of any simplistic opposition between classes. This will display all the difficulty of treating modern science under the label of bourgeois ideology. In fact, in my work, I have assumed that the problem of the objective value of modern science must be addressed *within* its ideological function, through the peculiar role played by technics in shaping the method of modern science.

At the beginning of the 1930s, Franz Borkenau crossed the boundaries of the Frankfurt School's conceptual framework in order to provide one of the most interesting Marxist narrations about the emergence of modernity.[69] According to Borkenau the bourgeois mechanistic world-picture ultimately derived from the development of manufacture. Mechanised manufacturing processes of production constituted the model for a new way of understanding natural phenomena (Borkenau 1932: 109). The emergence of 'abstract work' gave an impulse to quantitative methods exclusively concerned with the abstract properties of matter deprived of all non-controlled unproductive qualities, thus developing the theoretical basis for modern Galilean mechanics: 'For the first time it [manufacture] created abstract work and abstract matter' (Borkenau 1934: 22).[70] Galilean mechanics, the prerequisite of the mechanistic world-picture, was hence differently framed according to the exigencies of the different social forces. Cartesian philosophy was the ideological construction of an 'optimistic' and idealistic *Weltanschauung* by the French *noblesse de robe*, while Hobbesian civil science was the ideological construction of a 'pessimistic' and materialistic *Weltanschauung* by the English *landed gentry* (Borkenau 1932: 120-125). The mechanistic *Weltanschauung* eventually imposed itself, not mainly in regard to 'the requirements of the technical production process', but where the social classes which were carrying it on prevailed (Borkenau 1932: 110): not in Italy then, but in France, Holland, and England (Borkenau 1932: 117).

Borkenau's train of thought is: 1) men's social self-intuition is the basis for the understanding of nature; 2) in the seventeenth century a new mode of production (manufacture) produced a new framework for collective self-intuition,[71] and therefore determined the emergence of a new image of nature (mechanicism), which assumed different forms depending on the different social forces carrying it on; 3) when the social transformation of productive-social relations had widely transformed men's self-intuition, the new bourgeois world-picture was culturally 'established' and mechanicism became the dominant ideology. As a consequence, when nature was eventually conceived as an ordered mechanism governed by abstract mathematical laws, and society revealed inner

[69] Although basically Marxist, his analysis is indebted both to Weber and Dilthey. For the Dilthey-Weber heritage in Borkenau, see Szakolczai 2011, who notes that Weber himself claimed that beside his work on the Protestant Ethic, a parallel one could be devoted to the 'mechanisation of technology', 'the creation and diffusion of the rationalist and antitraditionalist spirit' (Weber 1978: 1128-29; quoted in Szakolczai 2011: 110, n. 12).

[70] The mechanistic 'revolution' had taken place in a quite short period, but the same model encountered, in fact, different ethical-political perspectives depending on the different positions endorsed by different actors within the framework of class struggle: 'The rejection of qualitative philosophy, the creation of the mechanistic world-picture is a radical change that started around 1615 and had its culmination in Descartes's *Discours* (1637), Galileo's *Discorsi* (1638), and Hobbes's *Elements* (1640)' (Borkenau 1934: 22-23).

[71] In short, modern anthropology was the result of a circular epistemological process conceiving man as a part of nature, by completely removing the fact that the latter actually was a social construct (Borkenau 1934: 299 ff.). In partial consonance with Borkenau's view, one of my aims shall be to explain, through the analysis of the concept of machine, why, despite the appearances, mechanicism still was anthropomorphic.

contradictions and irreducibility to the rational laws of nature, a reversal was accomplished of the medieval hierarchy in which, on the contrary, the cosmos of human society was opposed to a qualitatively impenetrable and 'diabolic' nature.

But then on what was the entire process of mechanization of the bourgeois world-picture based, in the last instance? To a certain extent, Borkenau seems to look for the foundation of men's social self-intuition in the categories of thought and praxis dependent on the historical determination of the technical experience of the 'working process'. According to Borkenau the source of mechanicism as bourgeois ideology was not manufacture as a technique of production, but rather the mathematical reduction of reality in which the productive 'model' of manufacture found its adequate and powerful representation. The mechanistic epistemological 'turn' was, in short, the ideological systematisation of a new – socially produced – *Weltanschauung*:

> The theory of knowledge, apparently a presupposition, proves to be an outcome of the socially conditioned view of the world order. (Borkenau 1932: 114)

These topics, both epistemological and political, touched a deeper problem in Marxist thought, concerning the link between modern science and capitalism and therefore the ideological status of modern science as integrant part of bourgeois ideology. Indeed, the reaction was not long in coming. One year after Borkenau had published his book, Grossmann (1935a) harshly criticised him for providing an 'over-simplified' narration of the emergence of modern mechanical science, by presenting the origins of capitalism, that is primitive accumulation, as an 'idyll' (Grossmann 1935a: 120).[72] This heresy, partially inherited from Weber, would entail a double mistake – theoretical and historiographical – concerning both the super-structural determinacy and the dating of the emergence of capitalism.[73] Borkenau would in fact be projecting Smith's eighteenth-century account of manufacture onto seventeenth century, thus failing to provide a correct account of the earlier emergence of mechanised processes of production under the shield of monetary capitalism (Grossmann 1935a: 120), and consequently disregarding the initial historical development of capitalism in the pre-manufacturing period pointed out by Marx himself in Capital XII.[74] The category of 'monetary capitalism' would this way cease to be a valid Marxist tool for explaining the Renaissance and the dissolution of the feudal world. On the

[72] Against this ill-tolerated heresy Horkheimer commissioned an attack on Henryk Grossmann, after Benjamin had failed to provide the requested article for the *Süddeutsche Zeitung* (Freudenthal – McLaughlin 2009: 247). The result was an important quarrel concerning Marxist interpretations of modernity, touching some points of the relationship among ideology, science, and technics, which are vital for my research. On Borkenau's heretical position within the *Frankfurt School* and Horkheimer's reaction, see Schiera 1978.

[73] One year before, Borkenau was similarly criticized by Grossmann for his Weberian stances, in that case related to the way he dealt with the role played by Calvinism in the emergence of capitalism: 'In short, he follows directly in the footsteps of the petit bourgeois ideology of Max Weber, in which the history of emergent capitalism is an idyll' (Grossmann 1934: 205). See Kuhn 2006.

[74] Chapter XIV of the English version.

contrary, for Grossmann 'the bearers of the emerging capitalism did not originate from artisans', since money governed this process far *before* the appearance of manufacture (Grossmann 1935a: 114). In conclusion – states Grossmann – the model for the 'abstract work' conception which links capitalism to mechanics was not originated in manufactural production, but rather developed in the sphere of trade (Grossmann 1935a: 129).

Besides this whole set of important historiographical questions, what is more interesting for my purpose is the central role played by technics in Grossman's argument. This is, as Grossmann clearly states, the 'essential point' of divergence with Borkenau, well evidenced by the centrality given to Leonardo's texts in Grossmann's essay (Grossmann 1935a: 110 ff.). According to his argument, well covered in the original English summary of *The Social Foundations of the Mechanistic Philosophy of Manufacture*, the straight impact of the study of machines on the new world-view was not necessarily linked to a fully developed capitalistic framework:

> The development of machinery, not the calculation with abstract hours of labour, is the immediate source of modern scientific mechanics. This goes back to the Renaissance and has relatively little to do with the original factory system that was finally superseded by the Industrial Revolution. (Grossmann 1935a: 156)

Grossmann contrasts here a widely shared view on technology as the goal of seventeenth-century science, which would result from a struggle between relations and forces of production. To this narration, which 'expresses the position usually attributed to Marxist historiography of science – and emphatically rejected by Koyré, Hall and other traditional internalists in the history of science' (Freudenthal – McLaughlin 2009: 4-5), Grossmann opposes that modern science is rather the genuine expression of a collective power of invention through 'technical' models. As far as it is linked to technics, science *is not in itself* ideological: it just *becomes* ideological within the development of capitalism. Hence Grossmann interrogates the bourgeois project of colonisation of collective imagery which originated during the Renaissance.[75] For Grossmann, early-modern science had a revolutionary potential which it directly inherited from (Leonardo's) mechanics, and Borkenau's basic historiographical mistake was precisely to underestimate the importance of earlier mechanics for the shaping of the new world-picture. In short, according to Grossmann, Borkenau's analysis not only tended to reduce mathematics to the

[75] The way he conceives this as a revolutionary potential still present in seventeenth-century science is particularly evident in his essay on *Descartes and the Social Origins of the Mechanistic Concept of World* (1946), where he examines the sociological aspects of Descartes's 'Science Universelle': 'Not Descartes and Hobbes but Leonardo da Vinci was the initiator of modern thought. Leonardo's theories, evolved from a study of machines, were the source of the *mechanistic categories* that culminated in modern thought […]. In Descartes, science thus reveals a truly new character, popular in the profoundest sense of the term, and universally human; a character alien to antiquity, as well as to the Middle Ages and the Renaissance' (Grossmann 1946: 225, italics added; see also 161-62).

expression of a historical conjuncture, it also deliberately left out the theme of the ontological status of technics.[76]

On the contrary, for Grossmann technics and science as collective tasks share the same 'ontological' link with the collective power of invention: 'There is no fundamental difference between inventing a technical and an intellectual construction. In the last analysis, every technical construction is also an intellectual one' (Grossmann 1946: 221). Although he does not explicitly assign to technics a specific role in the social processes of constitution of the world picture, Grossmann repeatedly stresses the role of the observation of machines in shaping men's (and philosophers') thought. And, quite significantly, to Leonardo's reflection on mechanics he sometimes seems to attribute a sort of progressive infrastructural autonomy due to the fact that 'mechanics was only slowly created by the struggle of human reason with the empirical material' (Grossmann 1935a: 141). Hence Grossmann provides plenty of examples of his faith in the historically progressive force of technics, which seems to find its epiphany in a letter of 1935, where he openly contrasts Marx's answer 'to the question, why no scientific mechanics could rise in antiquity'. It was not because antique society was based on slavery – he claims – but because of the encounter of a new social need for 'saving *human labor*' with some determinate inventions that both accomplished this *practical task* and provided the *theoretical models* for mechanics (Grossmann 1935b: 231-233).[77]

The Borkenau-Grossmann debate not only directly challenges the understanding of early-modern mechanicism as a science *and* an ideology, it also indirectly touches the assumptions of constructivism and intellectual history. What is more crucial, this debate allows us to draw some provisional conclusions, because it suggests that the social and ontological status of technics poses the problem of the link between science as a symbolic construction and matter as an instance that brings into modern science, and hence into culture, its own independent normativity. Grossmann's concern is to show how the emergence of modern science is related to specific technological problems and solutions, rather than to attribute to technics in itself a particular inventive function, which could be more than the expression of the socioeconomic infrastructure. Therefore he does not actually provide a dedicated reflection to the ideological status of science, ultimately relying on productive forces and relations to set the framework for the structural explanation of 'the totality of the social situation' (Grossmann 1935a: 155). Although he

[76] This reduced his enquiry to a purely 'idealistic' history of the concept of 'natural law' as the supposed pinpoint for modern science (Grossmann 1935a: 107), and excluded the possibility of any epistemological or factual evidence capable of *imposing* by its own force.

[77] Here Grossmann adds catapults, levers, and pumps to firearms and, in particular, clock mechanisms, which he had already mentioned and analysed in his essay on *The Social Foundations*. There he also underlined that 'in our context Th. Hobbes is of special importance, since he first applied the mechanical conceptions to the social sphere, whereas previously they referred to natural phenomena only' (Grossmann 1935a: 141 ff.).

reproaches Borkenau's method as confused (literally 'protean', Grossmann 1935a: 147), Grossmann does not seem here to grasp the central active role he sometimes seems to assign to technics, and therefore he misses the way the ontological force of technical invention can be transposed in theoretical science too, thus partially preserving it from its ideological usage. In conclusion, despite the strength of Grossmann's own method, that is the implementation of his genuinely Marxist historical analysis in the study of technics, his approach does not clearly prevent mechanical science from being reduced to the ideological expression of determinate forces and relations of production.

For this reason I will rather follow Sohn-Rethel when – despite confirming the 'primacy of society on technics' – he clearly assumes that the basis is as much economical as technological, and its twofold nature explains both scientific and ideological development:

> Two parallel causal series contribute to the formation of consciousness, which I marked as economical and technological lines of development. Their effects are actualized in different ways and consequently have different ideological or scientific value. In European intellectual history, the ideological-philosophical series is clearly represented by Descartes, Hobbes, Gassendi, etc., the series of scientific thought by Galileo, Huygens, Newton, etc. Although the two series are surprisingly often conceptually intertwined, nevertheless I understand them as two separate trunks born from the same roots. (Sohn-Rethel 1970: 109)[78]

It is worth considering, of course, all the risks connected to this conception of technics (and, as far as it is concerned with experiments, of science) as an independent line of development. But if we assume this approach, we can appreciate how, much more sharply than Grossmann's, it allows us to differentiate modern sciences and ideology. If science were just intended to *follow* actual techniques it could be read as their ideological implementation within class interests, while if science is intended to *borrow* from techniques its theoretical instruments, it can be considered itself an alternative field of invention: 'exact sciences are the preliminary conditions, while ideology is only an effect of the capitalistic class domain' (Sohn-Rethel 1970: 116). According to this approach, sciences can be considered in themselves non-ideological only insofar as they depend on the technological 'line of development',[79] and therefore, as Sohn-Rethel points out, the

[78] The manuscript of *Intellectual and Manual Labour, Critique of Idealistic Epistemology* was ready in 1951 (Sohn-Rethel 1970: 22), but it was first published in German (1970) and then translated into Italian. Only in 1978 it appeared also in English, but with so many variations (mainly cuts in the text and additions in quotations) that it is not always possible to refer to the English edition of *Intellectual and Manual Labour: A Critique of Epistemology* (1978).

[79] 'Unlike the economical line of development, technological development does not allow consideration of its ideological effect abstracted from the nature of things' (Sohn-Rethel 1970: 114). However, technological development is still understood by Sohn-Rethel through the dialectical scheme (Sohn-Rethel 1970: 114, n. 13). My approach is rather indebted to the way Leroi-Gourhan 1964, 1965, and Simondon 2012 highlight the

ideological significance of mechanicism does not discredit it *tout court*, but only its capitalistic 'postulate of automatism':

> Needless to say, however, the self-acting property of the labour process presents itself from the point of view of the capitalist; from that of the workers it looks different indeed! It is thus not science but ideology in the sense of one-sided class consciousness when, in the seventeenth century, philosophers like Descartes and Hobbes looked upon the outer world as a whole and in all its parts, organic no less than inorganic, as self-operating mechanisms. (Sohn-Rethel 1978: 123)

And in effect the myth of a universal automatism became the basis of the mechanistic model of the modern state presented by Hobbes in *Leviathan* as a political project rather than as an object of scientific description. As explained in Chapter 3.3, the struggle against the 'organic' body politic was programmatic in *Leviathan*, where Hobbes explicitly aimed at the mechanical model of a powerful *automaton* that would build a consistent artificial body out of the natural bodies of the multitude. But when he displayed the political power of the anthropomorphic image of the geometrical machine, contrasting the irreducibility of human matter, he was still facing Descartes's epistemological project of reducing the real emerging from technical experimentation to its mechanical-geometrical account. What seemed there to be a reduction of man to matter was in fact a reduction of matter to man: to the perfect, pure automatism *imagined* as both the accomplishment of the capitalist mode of production and the final solution to the political problem.

Mechanicism as (bourgeois) ideology?

From this perspective Hobbes's theory of political power can be interpreted as part of the same ideological struggle Descartes was taking part in: a struggle in the field of epistemology between the exigencies of aristocracy and of the emerging bourgeoisie. But this was not a struggle in which the two philosophers can be taken as the representatives of one or the other field: rather, the struggle took place within each of their two philosophical enterprises. Probably for this reason Hobbes has been

> differently defined as the ideologue of absolutism, of despotism, of a declining feudal aristocracy, of an emerging or winning bourgeoisie, of the totalitarian State, of a society that had reached the generalisation of market economy, Hobbes escapes any of these definitions. (Biral 1999: 134)

Engels addressed Hobbes's political theory as an 'aristocratic, esoteric doctrine' (Engels MEW 19: 536), as such committed to absolutism and opposed to the political expression of merchants and landed gentry, that is the provisional political forms through which the

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role played by technics as a trigger of symbolic and social invention. See also Mumford 1934, and Stiegler 1994.

capitalist mode of production would later lead to the emergence of the bourgeoisie. Yet Marxist historiography has traditionally shared a bourgeois characterisation of Hobbes's political thought (e.g. Macpherson 1945 and 1962) with both liberal and conservative scholars – such as Tönnies (1925), Leo Strauss (1936), Arendt (1958).[80] Of course one can assume that the twofold nature of Hobbes's social position was, in such an age of revolutionary transition, 'equivocal, open onto two sides' (Hill 1971: 355-57).[81] Indeed the ambiguous socio-political collocation of Hobbes's texts, early detected by his contemporary opponents, pushes to consider the seventeenth century *itself* as double-sided. In Marxist terms, it might be said that the century prepared the shift to a capitalist economy while displaying the feudal reaction to the capitalistic issues that were already appearing on the political field.[82]

Most of the thinkers this thesis has been dealing with were part of this historical process. And in particular, although playing a different role, Hobbes acted and thought in the same historical conjuncture as Descartes's, thus representing another 'individual facet' of a collective drama taking place during the seventeenth century (Negri 2007: 113), following the libertine/sceptical denunciation of the end of the revolutionary project of the Renaissance.[83] The twofold method of science, dangerously open to technics as experimentation, was thus neutralised by Descartes's metaphysics, which postulated the modern ideology of the objective neutrality of science and technology. Through Descartes's ideological 'choice' for a mechanistic ontology of *res extensa* and for *res cogitans* as its metaphysical counterpart, mechanicism became provisionally *consistent* both with the bourgeois long-term project of domination of the world-machine and with the aristocratic need to equip the existing state of things with the power of scientific knowledge and technical invention. This framework steadily opened to the free development of an economy of techno-scientific progress within the secure boundaries of state power.

From this perspective Hobbes's integration of Descartes's perspective can be said to reflect the fact that the modern sphere of 'the political' arose, and Europe entered the conjuncture in which 'the field of politics was enlarged to sectors which it could previously overlook' (De Giovanni 1981: 33-35). More precisely, Hobbes contributed to the replication of the secure boundaries established by Cartesian metaphysics out of the spiritual domain: on a political domain where human beings would be able to actually build

[80] Thomas (1965) is a useful source of information on the variegated range of interpretations concerning the social origins of Hobbes's political thought.
[81] Yet Hill finally maintains that Hobbes's overall attitude towards politics, his mentality, his presuppositions 'are bourgeois' (Hill 1971: 355-57).
[82] This perspective is explicitly assumed for instance by Haydn 1950 and Tronti 1977.
[83] On Hobbes's conceptually problematic relation to the 'constructive or mitigated scepticism' characterising Mersenne's circle, see Popkin 1982.

– through the state – a secured space for what would later be called civil society. In this sense 'we are witnessing the historical phase in which "the political" is becoming "state"' (De Giovanni 1981: 46). In this transition the main scope of political science became the conservation, administration, and even production of the form of life peculiar to these new artificial bodies. Through Hobbes's implementation of mechanicism in the political domain, Descartes's project for a reconstruction of the world-picture could definitely accept absolute authority as the only alternative granting – through a renunciation of direct political participation – 'a limited but safe social space' for freedom and research (Negri 2007: 121).

In this sense Negri has been able to recognise the spectre of Leviathan flowing from the same source as Cartesian ideology: 'Absolutism was born on the lack of pursuable alternatives for men who had set their sights on revolution' (Negri 2007: 128).[84] In an only apparently similar way Koselleck claims that '[Hobbes's] absolutist theory of the State already contains the nucleus of the bourgeois notion of a government of laws' (Koselleck 1988: 22). In fact, Koselleck detects in Hobbes the origins of the 'pathogenesis of modern society', that leads to the 'neutralisation of conscience by politics' (Koselleck 1988: 38-39): situated precisely at the seventeenth-century 'juncture' of Absolutism and Rationalist philosophy, Hobbes's political theory would still presuppose the necessity of a sovereign defence of reason, thus preventing seventeenth-century philosophy from understanding that 'the spirit of Enlightenment enables reason to emancipate itself' (Koselleck 1988: 34). In this sense Negri's Marxist thesis that Absolutism was the strategic 'choice' of a bourgeoisie which had abandoned its Renaissance utopian dream of conquest, rather reverses Koselleck's – quite dialectical, indeed – thesis that 'the bourgeoisie utopia was the "natural child" of Absolutist sovereignty' (Koselleck 1988: 183).

Both agree on the crucial role played in this process by early-modern rationalist philosophy through Descartes and Hobbes. And nevertheless, despite the metaphysical 'perfection' of the rationalist solution, in mechanicism there was also something exceeding the historical circumstances of the absolutist and/or bourgeois project: something concerning the collective praxis of science, in which technical activity and experimentation showed the *resistance* of matter to geometrical *models*. In fact, in mechanistic philosophy a particular kind of praxis can be found, which *experiments* with the actual limits of its

[84] Negri explains Descartes's 'reasonable ideology' of separation as the separation of the long-term project of the bourgeoisie from the time of its accomplishment after the provisional defeat of its Renaissance emancipatory dream (Negri 2007, Chapter 3). Cacciari thus sketches 'the political theory' to be drawn from the Cartesian subject of science: 'foundation of modern science as global rationalisation of the world and as general political domain […] bourgeois property of science […] rationalisation of "nature" in order to use it, and rationalisation of the "world" in order to make of it a private property. The Cogito which "functionalises" being, reduces it to technics, namely to a system of relations – the subject separates itself from being in order to *have* it technically, as a rationalised world' (Cacciari 1970: 388-89). In short 'separation and *political* domination (through scientific ratio) of the world are no longer in contradiction' (Cacciari 1970: 377).

theoretical models, by challenging a reality which – as technics repeatedly testify – is outside of the predictability typical of geometrical mechanisms and required by the long-term project of the bourgeoisie. But from a materialistic point of view, mechanical philosophy must be considered – as exemplarily testified by Hobbes's case-study – an *ideological* attempt to reduce technics to a human measure, detaching it from the realm of nature, thus entirely submitting it, and through it nature itself, to the control of political power (and possibly by a determinate class). It was the bourgeoisie that eventually won the game, successfully reducing *material techniques* to the *idea of technology*, that is to its own image of the abstract machine of market, where the resistance of matter – and of human matter too – was relegated to a disturbance of the automatic and supposed 'natural' functioning of the machine itself. I this sense, Hobbes's rationalisation of the method of political science through reduction of politics to the laws of human nature was probably counterrevolutionary in its aims, and certainly Hobbes's political epistemology was not originated within the bourgeoisie. But it finally became consistent with its long-term development, driven by the necessity of producing a stable point of view consistent with (if not sustaining) the neutral horizon of 'laws' and 'facts', on which the technological administration of the existing state of things could be secured. To the epistemological struggle between the 'bourgeois' Descartes and the philo-aristocratic Hobbes, *Leviathan* provided an apparently neutral solution, which alternatively appeared to be fit – not by chance – for both the monarchy and the parliament, or for neither of them.

The complexity of Hobbes's biographical and intellectual relation with the different theological, metaphysical and political aspects of mechanical philosophy prevents any individual work from picturing it without previously drawing the boundaries of such an effort. What I have tried to do in this thesis has been to particularly focus on one aspect – materialism – from which a wider picture of the problematic development of Hobbes's philosophy could be drawn, in order to question the basic assumption of the mechanistic project itself: the political neutrality of science. The analysis of the contradictions entailed by this assumption leads to the understanding of mechanicism as 'a materialistic inversion of theological schemes' (Balibar 1996: 221).[85] Hence it is through the prism of Hobbes's materialism that I have tried to analyse the hesitations, impasses, and shortcomings characterising the development of his political thought. Materialism was for Hobbes the fundamental philosophical postulate around which his epistemology, along with the methodology of his civil science, evolved. But in this process his materialist mechanicism itself evolved, and as far as it assumed its peculiar shape, it incorporated some essential

[85] Balibar is referring here to Hobbes's doctrine, whose equivocal interpretation would possibly arise 'from the fact that Hobbes uses physical concepts to build an anthropological doctrine which is officially free from any theological allegiance but ultimately grants the "body politic" a mystical kind of unity, which might very well prove to be a materialistic inversion of theological schemes' (Balibar 1996: 221).

features inherited from the dualistic metaphysics of his declared enemy, the dualistic metaphysics of Cartesian mechanicism.

Hobbes's materialism as a case study of the political agenda of mechanicism

As a background of my research I have assumed that the new *Galilean physics* was not only the epicentre of the scientific revolution, but was also an ideological battlefield for establishing the metaphysics which would found the new world picture. Hence Descartes's and Hobbes's philosophical choices have been taken as both *epistemological* and *ideological* outcomes consistent with the agenda of early-modern mechanics. This means that their metaphysical assumptions have been taken as both theoretically *required* by the aim of founding a mechanistic epistemology and historically *confirmed* in their ideological function of justifying an emerging world picture. The concept of an automatic functioning of nature and the body politic, had political, economic, and social stakes because it allowed for the extension of the allegedly neutral power of technology over all these spheres. And to this historical process mechanical philosophy provided its ideological support.

Hobbes's epistemological development in civil science was, in fact, an ideological one, in which he might be said to have actually endorsed Descartes's completely inadvertent suggestion of a possible extension of the mechanistic approach to the political domain. This suggestion we can recollect by returning to the above quoted letter to Mersenne, where, just after stating that 'it is God who has laid down these laws [mathematical truths] in nature just as a King lays down laws in his Kingdom', Descartes appears to convey the implicit desire of the whole mechanistic enterprise:

> These laws ['mathematical truths'] are all inborn in our minds [*mentibus nostris ingenitae*] just as a king would imprint his laws on the hearts of all his subjects if he had enough power to do so. (AT I, 145)

In this light, along with other disciplinary technologies, civil law itself appears to be for Hobbes's sovereign a tool apt at making uneducated citizens behave according to the laws of nature, despite the general want of wisdom that commonly prevents human nature from perfectly complying with the dictates of right reason. This 'disciplinary'[86] production of subjects was not only Hobbes's political project, it was in fact the very dualistic

[86] Hobbes is pictured by Foucault mainly as the theorist of territorial sovereignty. I concede that Hobbes's concern with movement opens to a more dynamic interpretation of his conception of the relationship between society and the state, yet I assume that his mechanistic opposition to growth prevents going so far as to detect a properly 'biopolitical' issue in the '(re)productive movement' he deals with in political theory, as interestingly argued by De Vries and Spieker 2009: 470-74. Rather – by assuming the tripartite framework provided in Foucault 2004: 10-11, 22 – Hobbes might be said to have developed a theory of *disciplinary* power. On this topic see also Chignola 2006.

epistemology of mechanicism that entailed, as such, an entire political pedagogy, ultimately relying on a conception of nature as the potential enemy:

> Whether men will or not, God is king of the whole earth; and he is not shaken from his throne if a few men deny his *Existence* or his *Providence*. God so rules all men through power that no man can do anything which He does not want done; yet this is not Reigning in the precise and proper sense. A ruler is said to reign if he rules through *speech* rather than *action*, i.e. if he rules by *precepts* and *threats*. In the kingdom of God therefore we do not count inanimate bodies or things without reason as subjects (though they are subject to divine power), because they *do not understand* God's *precepts* and *threats.* (DC XV.2; OL II, 332)[87]

Along with 'atheists' and 'those who believe in God's existence but not in his governance here below', 'inanimate bodies' and things 'without reason' are also included in Hobbes's list of what cannot be counted as a 'subject' in God's kingdom (DC XV.2; OL II, 332-33). All natural bodies are in fact, from this perspective, a danger in themselves as far as they resist scientific and politically-established rationality. This epistemological attack on nature was in fact an ideological one, in which Hobbes was endorsing the political agenda of mechanicism. The political agenda of mechanicism prescribed the ontological neutrality of Reason as an *apolitical* subject, and therefore a *political* project of neutralisation of knowledge *and* of its objects. It is in this sense that the objectivist approach of *mechanical philosophy*, when transferred into the political domain, entailed a project of normalisation of political practice according to the principles established by political theory.

In my view, the challenge represented by Descartes's metaphysics led Hobbes to tackle the topic of civil science three times in about a decade, from *The Elements of Law Natural and Politic* (1640), through two editions of *De Cive* (1642 and 1647), to the English *Leviathan* (1651). On this basis I have tracked in Chapter 2 the progressive politicization of epistemology and of scientific discourse in Hobbes's philosophy, focusing particularly on the connections between his epistemology and the civil science he built during the 1640s in close contact with Descartes's natural philosophy. Along the lines of this epistemological struggle, Hobbes's research eventually generated a subject of science that was entirely dependent on the power that could preserve its existence from the ungovernable contingency of matter in motion and of human matter in particular. This path led to a 'conclusion' which appears strikingly far from Hobbes's possible point of departure

[87] 'Scilicet velint nolint homies, Deus est rex universae terrae; neque si sint qui *existentiam* ejus vel *providentiam* negaverint, ideo solio suo excutitur. Quamquam autem Deus homines universos ita per potentiam regat, ut nemo possit quidquam facere quod ille factum nolit, non est tamen hoc, proprie et accurate loquendo, regnare. Regnare enim dicitur, non qui *agendo*, sed qui *loquendo*, id est, *praeceptis* et *minis* regit. In regno igitur Dei, pro subditis habemus, non corpora inanimata, neque irrationalia, licet potentiae divinae subjiciantur; quia *precepta* et *minas* Dei *non intelligunt*.' Hobbes is here commenting on the Psalms 96:1, 98:1 (Vulgate numbering, in the Molesworth edition; 97:1 and 99:1 in King James Version numbering).

in *Horae Subsecivae* (1620) when – writing *A Discourse upon the Beginning of Tacitus* – he seemed to maintain a certain primacy of liberty: 'the Fable is also applied of the Horse, who suffering a rider and the bit, for his assurance against the Hart that fed with him in the same pasture, could never after recover his former liberty' (HS 238).[88] In fact, in order to maintain peace at all costs, in *Leviathan* Hobbes often expected the sovereign to use any means, going so far as to implicitly desire something similar to what Tacitus himself had once described as a fake peace grounded on false names:

> To plunder, to slaughter, to steal, they falsely name government; and where they make a desert, they call it peace. (Tacitus, Agricola, XXX)[89]

My choice of Hobbes as a case study has been precisely aimed at displaying how materialism *is inconsistent* with the epistemological-political project entailed by the deterministic – and inherently dualistic – version of mechanicism founded by Descartes's metaphysics, and how this inconsistency required an ideological commitment of science to political power. In this light the development of an ontological determinism, incompatible with Hobbes's epistemology, was rather the consequent result of an *ideological* enterprise he shared with Descartes: the effort to exclude with a single move both the experimental unpredictability and the epistemological relativity the Galilean approach had introduced in the new mechanical science. In fact, in Hobbes's quarrel with Descartes the metaphysical or theological fight between idealism and materialism proved to be less important than Hobbes's primary concern with the relations between science and politics. Descartes had provided a theological metaphysics ratifying the eternity of scientific knowledge and freeing *soul* and *reason* from the constraint of the mechanical world. From his materialistic point of view Hobbes could clearly see the inconsistency of Descartes's metaphysical solution, in which man's *res cogitans* still remained out of the control of political power. In this sense Hobbes's stance appears to have been even more radical than Descartes's. Not only did he maintain his materialism despite all the epistemological difficulties it entailed, but he maintained it against all the experimental evidence provided by the most advanced physiological research of his time, according to which the existence of a soul could hardly be excluded.[90] Thus he helped make materialism more and more radically

[88] Hobbes quotes here Aesop 'against' Augustus, under which 'Rome utterly lost her liberty' (HS 237). As Martinich emphasizes, this passage highlights the difference between Hobbes's *Leviathan* and his *Tacitus*, where Hobbes 'praises liberty' (Martinich 1999: 49). In fact, I would be quite careful in extending the differences between *Tacitus* and *Leviathan* to the whole of the *Horae Subsecivae*. Although it is clear that '*some* of the essays contain opinions diametrically opposed to those later expressed by Hobbes on the same subjects' (Skinner 1996: 237, italics added), yet this does not appear to be the case with many of them, such as the very Hobbesian incipit of *A Discourse of Laws* quoted above, Chapter 3.3.

[89] 'Auferre, trucidare, rapere, falsis nominibus imperium; atque, ubi solitudinem faciunt, pacem appellant'. Tacitus is reporting a speech he attributes to Calgacus, a Briton leader.

[90] See above, Chapter 3.2.

mechanistic and deterministic, according to one of the two sides of the twofold methodology of mechanical science, the one hypostatised by Descartes as *res extensa*.

In conclusion, despite following completely different metaphysical paths, Cartesian and Hobbesian metaphysics came to the same end: the foundation of a techno-scientific theory of securisation of bodily motion – individual and collective – deterministically conceived. During the 1640s Hobbes progressively incorporated the epistemology of his declared enemy, finally reducing – if not in principle, at least de facto – matter in motion to a mechanical expression of the pure geometrical, 'divine' laws of nature. But following his monistic premises Hobbes had to commit the inscription of the laws of (human) nature to the only power capable of actually making them effective: political power. Thus the integration of the mechanistic project in materialism entailed an entire political pedagogy that Hobbes injected into civil science. As he clearly explains in *De corpore*, if the 'universal principles' of motion are principles and not postulates, although by definition they cannot be demonstrated, yet they can be taught, since 'teaching is nothing but leading the mind of him we teach, to the knowledge of our inventions, in that track by which we attained the same with our mind' (DeCo VI.12; EW I, 80; OL I, 71). This was Hobbes's final version of the maieutic method.

What Hobbes had to erase from his materialism was the very epistemological question that dualistic mechanicism had raised and progressively cancelled: Is the geometrical image of nature fit to describe natural motion? In principle, the identification of natural and artificial motions could have resulted in conceiving the experienced complexity and partial indeterminacy of physical motion as a model for the understanding of mechanical motion (and of geometry itself). On the contrary, the identification went the other way round, and the geometrical account of artificial motion was extended to natural motion itself. This correspondence between geometrical motions and natural motions was granted by God's geometrical legislation, and all that did not fit that picture was to be considered either the effect of imperfect knowledge or the effect of non-mechanical causes. To this purpose, Cartesian dualism fixed the problematisation of this imagined regularity by suturing within *res cogitans* any possible doubt concerning the completeness of the geometrical accounts of nature. That nature would not ultimately be grounded in some eternally fixed regularities was consistently denied by the whole Aristotelian tradition, by Christian faith, and by the new dualistic mechanical philosophy. Although the image of the cosmos could change, in fact the postulate of a basic subordination of nature to some superior legislation was far from being abandoned. But early-modern deterministic materialism went even further in this ideological enterprise: through Hobbes's effort it colonised the

very field of resistance to this idealistic representation of reality, namely materialist philosophy.

This operation required a strong reduction of complexity. A reduction of knowledge to geometry, of matter in motion to its primary qualities, of actual techniques to an abstract conception of technology, of scientific research to Science, and a coherent reduction of the social machine to the abstract machine of the state through which Hobbes ideologically joined political theology with technocracy. The consequence was both a new sacralisation of collectivity as *the state* and a depoliticization of society the automatic functioning of which was the ideal to be implemented through technology. In this perspective, addressing Hobbes's peculiar materialism has meant challenging the very philosophical system in which mechanicism explicitly and radically confronted the epistemological limitations and the ideological opportunities of expanding the automatic machine theorised by early-modern mechanicism in the field of political theory. Thus my research has aimed at demonstrating that the development of Hobbes's civil science not only was the outcome of a political agenda (whether representing individual or class interests), but also carried on the epistemological agenda of early-modern mechanical philosophy along with its ideological implications. My hypothesis is that this agenda cannot be abandoned without the elaboration of a new epistemological agenda that takes into account the development of the twentieth century's natural sciences. It is my conviction that this very framework allows for both the demystification of the early-modern conception of the automatic and deterministic machine, and a new materialistic understanding of the relations between science and political power. And it is with some of these suggestions that I will briefly deal in my conclusions.

Conclusion

> Human species seizes that much reality in order to become master of it, to take it into service. The mechanistic concept of motion is itself a translation of the original occurrence into the sign-language of eye and fingertip.
>
> Friedrich Nietzsche

Although the *machina mundi* had remained until the seventeenth century rather a metaphor than a scientific model (Roux 2009: 166, 171), by the end of the following century the mechanistic picture of nature had acquired an ontological primacy which, in natural philosophy, completely overcame the limits of the metaphor. On the contrary, political thought resisted the integral mechanisation of man and of his political milieu. Since the late Renaissance, mechanical metaphors had begun to appear alongside the ancient organic metaphor of the body politic, the origin of which was both biological and mystical.[1] Clocks, levers, and balances had became the accepted tools for both rhetorical and scientific representations of the body politic (Mayr 1986: 102).[2] And yet, with few exceptions – such as Hobbes and some of the 'court philosophers' of Frederick the Great – the question of the 'political machine' displayed in political thought a metaphorical and mythical rather than a scientific function, while the organic model maintained an undisputed scientific primacy.

Indeed, when Romanticism adopted organicism as a sort of anti-mechanistic antidote, the simplistic image of the automatic clock had long since been dismissed in political thought, and in the end it was the idea of the organism as a 'developing totality' that became widespread throughout the nineteenth century as a kind of a priori in the field of the social sciences, both as a scientific model and as a metaphor (Schlanger 1995: 48, 173). As a scientific model, it proved to be much more suitable to the description of the 'physiological' processes of economic distribution of the money-blood and thus the development of a theory of the social-medical intervention of the state, precisely at the time when economy was pushing towards a 'mechanisation' of social life (Harvey 2007: 60 ff.). As a metaphor, it served perfectly the celebration of the totalising form of life of the organic nation-state.

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[1] On the organism as a metaphor *also* in political theory, see Schlanger 1995. On the theological nature of the political body of the king, see the classical Kantorowicz 1957; on the theological-political nature of the body politic and its functioning, see Agamben 2011.

[2] Schlanger stresses the importance of the 'theology of the clock' (Schlanger 1995: 52). In effect clocks hide – and glorify – the mechanism under the uniform time pictured by the resulting movement of clock hands, while balances show the interplay of weights and counterweights. And nevertheless clock and balances share the same deterministic perspective on the functioning of the machine.

Nevertheless, the automatic machine theorised by early-modern natural philosophy indirectly colonised all the fields of the philosophical imagery, if not as an accepted model then as a threatening one. Spreading from the nature-machine to the animal-machine and to the state-machine, the metaphor of the machine was intended to be a warning against any ethical and political reduction of the human being to the supposed automatic, 'inhuman' functioning of nature. At the same time, it was also leading political thought to a new understanding of the body politic in view of its technological administration. For these reasons the metaphor of the machine is far from being a mere rhetorical device. It has to be taken seriously as a model that played a major role in shaping modern political theory.

We witness today the long term effects of the early-modern adoption of mechanical *metaphors* and *models* in the natural sciences and in political theory. Despite the attacks by the natural sciences, the mechanistic imagery forged in early-modern philosophy still inhabits the conceptual framework we adopt in order to understand reality, along with the ideological alternatives it entails. The very ontological opposition between the *natural* and the *artificial* always played a peculiar role in political theory, providing it with a false alternative entailing some form of metaphysical commitment, and compelling people to take some kind of stand for or against the mechanisation of human beings and society. The choice between either a closed community characterised by a strong *natural* identity, or a depersonalised *artificial* individualistic society, has for a long time dictated the agenda of political theory. In going back to the early-modern origin of this apparent opposition we can detect the implications and the political power of mechanicism as ideology and the way it has also affected the materialist tradition.

My research was precisely concerned with the possible discovery, beyond Hobbes's professed materialism, of a theoretical structure which would prove an implicit adhesion to a dualistic metaphysics, namely an anthropocentric stance that de facto preserves for human beings a privileged place *out of* or, in the case of Hobbes, *in* nature. This was a completely ideological move within the materialistic tradition. To this move Hobbes contributed by politically encompassing the intrinsic epistemological limitations of a materialistic philosophy. In fact, as I have explained in Chapter 1.4 dealing with Hobbes's 'political epistemology', in a consistently materialistic perspective it is always impossible to *found* the ontological gap between reason and the rest of the universe that grounded early-modern mechanicism. Although defining the domain of human nature is not incompatible with materialism, yet it is incompatible to take it as the ultimate foundation of science and, furthermore, of political practice. Nevertheless, Hobbes's ideological solution in civil science was to build a totalising deductive methodology postulating a privileged scientific insight in human nature. This attempt of neutralising science, civil science

included, only could find in ontological determinism its ground, since it was precisely ontological determinism that allowed the faith in the efficacy of political planning according to the established science of human nature. And on this path, although it contributed to the destruction of the ancient faith in a natural teleology, mechanicism made a new kind of teleology emerge in both the fields of natural and political philosophy.

The implicit teleology characterising a *deterministic* mechanicism can be detected only through an analysis of its theoretical structure. As I have argued, determinism is grounded on the characterisation of science as the objective description of natural causes that, given their nature, are so complex that a complete account of them goes beyond the power of human reason. But it also adds that the whole set of causes has to be complete so that a sufficiently detailed knowledge of them would in principle allow not only a complete account of the current state of things, but also a perfect forecasting of the future state of things depending on the present 'causes'. This assumption, that I have named 'ontological determinism', is usually taken as the indisputable *ontological* ground of scientific research itself, which in fact is based on the *methodological* assumption of determinism as a tool for detecting causal chains and making previsions, which I have named 'epistemological determinism' (see above, Chapter 2.3). Through the ontological assumption of determinism, science silently shifts from classically being the 'knowledge of causes' that allows an objective *and* incomplete description of reality as it is, to being the 'knowledge of effects' that allows planning and the technological implementation of reality as it will be and *therefore* ought to be.[3]

In short, although finality appeared to disappear from the horizon of the new science of motion, where a causal explanation concerned only efficient causes, it was surreptitiously reintroduced both in the natural and in the political domain through ontological determinism and in the form of natural necessity. The geometrical laws of nature set at the moment of creation were intended to prescribe the automatic functioning of God's clockwork with no exception, just as in the political domain the laws of human nature provided the founding normativity that justified any technological intervention over the abnormal functioning of human matter in order to contribute to the 'normal' development of the whole process. The respect of the first principles of human mechanical motion was thus turned into its final cause.

[3] Kelsen framed the problem as follows: 'The norm determines what is to happen in the future. Natural law, on the contrary, explains reality by seeking in the past the cause of the present event'. Yet in science 'the law of causality', that is a probabilistic statement about reality, has been taken as a 'a norm', that is a theological and juridical claim to inviolability. Hence modern technology is to be intended as a secularised form of prophecy: 'The application of the laws of causality to future events, an application which originated from practical necessity, is a secondary function resulting from the fact that cognition, though independent of volition and action, is placed at their service. Prophecy is no longer pure cognition but knowledge applied to technique' (Kelsen 1941: 554-55).

On the background of the theoretical structure of deterministic mechanicism, in this thesis I have interpreted dualistic metaphysics, born out of the reflection on the principles of modern science by some of those who invented and practised it, as the attempt to *stabilise* the shift between knowledge and reality characterising the productive method of science by making of the mathematisable reality of primary qualities a reality in itself. Thus the models, principles, and laws adopted by early-modern mechanicism do not describe reality as it is: they describe it as an automatic machine whose motion can in principle be perfectly understood and, if well planned at the outset, be maintained through minor interventions of regulation and with no substantial changes. In fact the emergence of *nature* as a deterministically conceived object within the modern dualistic framework went far beyond the exigency of scientific research, and rather appears to have been pictured as the counterpart of the hypostatisation of a sovereign 'subject of science': the automatic machine. To this imagination of nature, in the emblematic enterprise of Descartes a deterministic *res extensa* provided adequate ontological repair while, on the other hand, to its scientific knowledge *res cogitans* offered – in all its metamorphoses – a metaphysical hook which preserved the subject of science from the collective vicissitudes of human and natural history, in which it is nevertheless embodied.

In this sense ontological determinism displays a problem which is both epistemological and political. On the one hand, the mechanistic model of the automaton misses the actual motion of human nature, of organisms, and in fact of matter, which is understood as the passive subject of a superior legislation.[4] On the other hand, automatism is also ideological: it presents itself as a neutral, descriptive form of knowledge, and in fact it is prescriptive, because it presents the normal functioning of the automaton as the most performing and simple, and in the last instance as 'natural'. Thus both at the epistemological and political level, automatism downplays experimentation and privileges deduction and discipline on the basis of the ideological justification it draws from picturing the objective, non-teleological, in a word neutral, 'power of science': in Greek, 'technocracy'. Thus not only did mechanicism mark the birth of the ideology of science as a *neutral form of knowledge*: as the case of Hobbes exemplarily demonstrates (see above, Chapter 3.3), the mechanistic ideology of neutrality entails the identification of model and reality and its implementation in politics through pedagogical technologies. In this sense Hobbes's extension of mechanical determinism to the field of political theory can be said to have also marked the birth of the ideology of technocracy as a *neutral form of government*.

[4] For a critique of the mechanistic imagination of organisms from Positivism to cybernetics, and its extension to social systems, see Canguilhem (1955, 1966).

From this perspective I have analysed the theoretical structure of Hobbes's inaugural move as the transposition of mechanicism *as ideology* into the field of political thought. Hobbes's move was the common source of two apparently opposed *ideologies* concerning the body politic: the theological faith in its ontological unity, and the technical organisation of its planned automatism. In this light, *Leviathan* appears to have been the *ideological* synthesis of two scientific models, the state-machine and the state-organism. The Leviathan-automaton – this artificial body endowed with the same automatic unity of functioning supposedly existing in natural bodies – has been regarded in this thesis as the result of a tormented epistemological development, at the end of which Hobbes finally made the two metaphors (the classical biological and the mechanical one) ideologically coincide. In this sense I have pointed out in Chapter 2.5 that the contradiction between Hobbes's programmatic assumption of a mechanical *model*, and his constant use of biological *metaphors* in *Leviathan*, reflects the paradoxical nature of his solution. As I have tried to demonstrate, the compatibility of the two models was purely *ideological* precisely because it was *aporetical* at the theoretical level *and effective* at the practical level: the two opposite ideologies of 'organic teleology' and 'mechanical determinism' converged into an original synthesis of technocratic liberalism and voluntaristic conservatism.

This synthesis still appears to be guiding most political practices by *converging*, on the one hand, the often unconfessed belief in a *natural* finality of the political body to be respected, and, on the other, the commitment to a *technical* finality imposed by the indeferrable exigencies of political administration. Although the technocratic model of the state-machine has been, and still can be, considered a successful *alternative* to the re-emergent imagination of the state as an organic body, the two apparently opposed models – the mechanical and the organic – have also proved to be *compatible* with the myth of the nation-state and *complementary* to the development of capitalism. Indeed, the two apparent alternatives concur to effect the same *neutralisation* of political invention. In the era of the end of ideologies, tempered by *artificially* planned procedures, the mechanisms of democracy would maintain the body politic open, preventing the social system from *naturally* collapsing in a closing tendency inscribed in the very nature of human social groups.[5] Indeed, what has always been a false alternative at the theoretical level, has eventually proved to be a quite performative oscillation at the political level, where technocratic practices function and can be tolerated precisely thanks to the teleological horizon they implicitly assume, by combining a rhetoric of 'natural' collective

[5] See for instance how Fukuyama grounds his 'natural history' of social order on the assumption of the adaptive function of institutions coupled with their overall rigidity and inner tendency to 'political decay' (Fukuyama 2011: 26-48, 437-57; Fukuyama 2014: 524-48).

identity with the technological organisation of social relationship. In fact the interplay between the two models excludes the actual *emergence of finality* from within the social system. In short, it cancels the field of political invention, namely the process of experimentation in which finality would actually emerge *within* the body politic as the result of political struggles. These struggles are precisely what Hobbes's work sought to remove from the political sphere, situating them in an a-political *outside* of the ideological alternative framed by modern political theory:

> The actions of men, which singly are inconsiderable, after many conjunctures, grow at last either into one great protecting power, or into two destroying factions. (PrG 50, 200-203)

According to my hypothesis the theoretical grounds for this ideological-political synthesis were provided by seventeenth-century epistemology. The organism/machine corresponds perfectly to Descartes's metaphysical opposition between an ontological *liberty* that entirely frees *res cogitans* from its ties to reality and an ontological *determinism* that allows us to plan the effects of any intervention on the *res extensa*. On the one hand organicism institutes the unconditioned domain of a natural political will and of its goals. On the other hand mechanicism, pictured as automatism, allows for a technocracy that entirely reduces political intervention to the initially established exigencies of its functioning. This synthesis is granted by an ideology that, although apparently depriving teleology of any possible significance, in fact restrains any political project to the calculable conditions of possibility that underlie it and *therefore* to the a-problematic assumption of predetermined goals. In short, this kind of normativity is inherently conservative and, furthermore, concerned as it is with keeping at distance the spectre of revolution, results in an exponential growth of the exigency for security entirely determined by the organisation of the system initially adopted. Through the inscription of *civil science* into the Cartesian deductive epistemology of mechanics, Thomas Hobbes not only conferred on political theory its objective, neutral, scientific method, but also provided its basic ideological configuration. It is in order to suggest a move beyond this synthesis provided by modern political thought that I have undertaken my research on the epistemological foundations of Hobbes's materialistic political theory.

The model of the automatic machine offered by early-modern mechanicism and the reference to an absolute subject implicit in its dualistic epistemology still inhabits our understanding of nature and entails considerable ethical and political effects. First of all it pushes an ethical choice: either we integrally embrace mechanicism and conceive the universe as deprived of any sense, or we refuse it and consider the human being a different kind of being, capable of knowledge of truth and freedom of choice. The

undisputed ground of this alternative is the ontological opposition between liberty and necessity, the key institution of a supposed 'ontological difference' between the human being and nature (or better – to use a Spinozian rather than an Heideggerian expression – the presupposition of an 'imperium in imperio'). In this sense the criticism of ontological determinism and its implicit automatism allows for a 'genealogical' explanation of the meaning attributed to the apparent 'distance' between human being and nature, and of the early-modern epistemological divide between knowledge and reality. All this history is in fact dominated by a postulate of dichotomy between the (in principle) perfect order of knowledge and the chaos of opinions also in the political field. The unaccountability of something makes of it a monstrous menace to the power of knowledge. 'Matter' was for a long time the name of this unaccountability, which mechanicism contributed to exorcise, by forcing the perfect regularity of the laws of nature both in the natural bodies of physics and in the artificial bodies of politics.

Yet at the beginning of the last century in the eyes of many scientists and philosophers quantum physics seemed to present unprecedented evidence: matter was hardly reducible to imagination, not even to a possible mathematical kind, and certainly not the one which classical mechanics had dreamt up. It is in the light of that *thaumaston* that it might be possible to overcome the very horizon that grounded both the determinism and the substantialism of modern philosophical mechanicism: metaphysical dualism.[6] My research is intended to contribute to the dismantling of both the modern image of nature as a deterministic machine and its complementary onto-theological postulate: the transcendence of reason. It is from this very perspective that determinism shows its original connection with substantialism. The two concepts originally derived from the same ideological matrix, which postulated an ontological gap between the order of reality and the order of knowledge, and therefore a kind of isolation: man's thought as an exception within the realm of nature. This operation had been condemned by Spinoza, who intended to use determinism as a conceptual lever in order to dismantle Aristotelian and Scholastic teleology. Nevertheless, as it emerged from Cartesian mechanicism, determinism assumed the paradigmatic function of isolating the human species from its milieu, by reclaiming the straight metaphysical substantialisation of free will.

[6] According to Prigogine and Stengers it was not quantum mechanics, but rather thermodynamics, that marked the beginning of a possible 'new alliance' between human beings and nature, long after the early-modern breakthrough. The study of dissipative structures and of processes far from equilibrium might possibly end the faith in the modern myth of a science 'capable of discovering *global* truths about nature' that culminated in a metaphysical dualism that overlooked precisely the *technical* characterisation of the physical-mathematical notions it was relying on (Prigogine-Stengers 1984: 44, 51, 75-77). Rightly or wrongly inspired by the paradigmatic power of quantum physics, Simondon considered instead the conception of singularity he derived from quantum mechanics incompatible with the Cartesian conception of *res extensa*: 'A particle which can be represented as the singularity of a field cannot be conceived within Cartesian geometry, because one cannot introduce singularities in the space of *Res extensa*, extended substance, without modifying Cartesian geometry and mechanics' (Simondon 2005: 144).

But in Hobbes's world, exclusively made of matter in motion, not even free will could differentiate humans and animals in the cosmos of mechanics, where 'beasts also deliberate […] And beasts that have deliberation must necessarily also have will' (Lev VI; EW III, 48). Yet Hobbes was so well aware of the epistemological inconsistency and political risk entailed by the very presence of a metaphysical will that he made of the techno-political exigency of forecasting one of the main features characterising human nature. Given the universality of determinism, in *Leviathan* the human/animal divide is marked by a specific human passion, a 'curiosity' that derives from the human imaginative *and* rational capacity of projecting and programming the future:

> The train of regulated thoughts is of two kinds; one, when of an effect imagined we seek the causes, or means that produce it: and this is common to man and beast. The other is, when imagining any thing whatsoever, we seek all the possible effects, that can by it be produced; that is to say, we imagine what we can do with it, when we have it. Of which I have not at any time seen any sign, but in man only; for this is a curiosity hardly incident to the nature of any living creature that has no other passion but sensual. (Lev III; EW III, 13-14)

In this framework determinism fulfils first of all a 'techno-biological' task, which one could define as strategic due to its perceptive efficacy in foreseeing and thus orienting action. Organisms, in general, through the deterministic perceptual filter, reduce complexity and shape their own milieu in view of possible actions. Piaget individuated the evolution of this pattern in the changing relation between the child and its milieu, which entails the progressive elimination of chance from 'nature' (Piaget 1927: 310).[7] As the quantum physicist De Broglie stated, by referring to Bergson, at the 'macroscopic' level of perception 'reigns the apparent determinism that makes […] action on things possible' (De Broglie 1947: 210-11).[8] The possibility of questioning determinism can emerge only when scientific knowledge is conceived, as happens in quantum physics, as the result of the experimental interaction between subject and object. This conception of science as 'techno-science', that is as a technical intervention that produces the object of description itself, demonstrates any 'neutral' description of the existing state of things impossible, thus allowing doubt to be cast also on accounts of any alleged deterministic 'laws'.[9] On the contrary, early-modern mechanics was inescapably bound up with what I have called 'ontological' determinism; that is, with an integrally deterministic understanding of natural

[7] For Piaget, 'the evolution of the notion of cause presents for children a characterisation very close to the one we examined in the notion of real' (Piaget 1927: 291). See also Piaget 1926.
[8] The note to which De Broglie refers can be found in Bergson 1934: 61.
[9] On the basis of this conception of techno-science Bachelard could schedule an entire epistemological agenda: 'It is necessary to dissolve the huge block of metaphysical determinism that burdens scientific thought' (Bachelard 1934: 112).

mechanisms which did not understand that the immediate identification of nature with the 'imagined' machines of Euclidean geometry was not a scientific result but an ideological outcome.

But these biological and psychological explanations do not dismiss the problem, because they all presuppose the invariance of 'perception', as if it were not strongly influenced by culture, and, in the case of Western culture, even shaped by the historical emergence of deterministic mechanicism itself. Precisely for that reason, this cannot be considered a merely psychological issue. Beyond the basic explanations of determinism depending on an organic, or more specifically anthropomorphic, process of reduction of complexity, an ideological explanation is needed which again returns to the particular structure and history of early-modern science, where deterministic causality progressively became the very postulate for a kind of knowledge which has gained undisputed worldwide supremacy and shapes the 'spontaneous philosophy' of scientism. This topic raises a wide range of issues which cannot be challenged without referring to the epistemological structure and to the historical conditions of the emergence of early-modern science. From this perspective, the emergence of determinism calls not only for biological but also for epistemological and historico-sociological explanation, which, as I have explained in Chapter 3.4, should also refer to the acceleration of the process of mechanisation and mathematisation of the world picture which took place along with the emergence of capitalism.

As a matter of fact, the epistemological models built by science in order to explain, control, and foresee physical processes are both rooted in our biological constitution and strongly affected by the way modern science has been absorbed in culture thanks to technological achievements, and therefore the myth of automatism is as hard to question as the one of progress. Yet in the natural sciences the encounters with matter actually contributed to shape the first principles of natural sciences. The Cartesian deductive model initially gave way to the Royal Society's experimentalist strategy, and then to Newton's scientist prefiguration of the moral imperative: 'hypotheses non fingo'. But the two trends later resolved into a productive conflict between experimentalism and the deductive approach that proved its force in pushing the development of the sciences of matter. On the contrary, modern political theory encountered at its very beginning an important impasse when dealing with modern science, because its twofold method could not adequately fulfil the striving for security it was intended to satisfy. Therefore its experimental side tended to be ignored in political theory, where the deductive path made of the experimental questioning of the first principles a purely discursive and fictional matter. As a result, the same dualism that in natural sciences has proved productive, in the field of political

thought has become an irreconcilable dualism between philosophical theory and political practice: the first reduced to ineffectual speculation, the second following collective imagery (that is ideology) rather than actual science. And if a practice out of the horizon of science is usually a conservative one, which reproduces prejudices rather than producing experimentation, a practice inside the horizon of a fictive science (purely deductive and technocratic) is necessarily a false practice, and just a means for maintaining the existing state of things.

Indeed, it was and is hard to maintain determinism in its technical, inventive, and epistemological dimension, irrespective of the metaphysical assumption of ontological determinism and the implicit anthropomorphic teleology it entails. Through Hobbes's philosophical case study, my analysis pointed to another possible mechanicism, neither anthropomorphic nor deterministic. Hence I aimed to show that a genuine materialistic conception of being and knowledge – and therefore of politics – requires an epistemology compatible with a *mechanical* conception of physics, *but* not essentially deterministic. A deterministic conception of motion must be understood as ideological and anthropomorphic, since it is not at all consistent with the *epistemological* premises of materialistic mechanicism, and it projects on nature the too-human construction of Euclidean geometry. It is only with the understanding of the complex nature and partial indeterminacy of *any* motion that determinism (and mathematics itself) is confined in the realm of the conceptual tools, where it serves the purposes of scientific knowledge and political practice. Thus science – and therefore political theory – can be built on the methodological assumption of determinism without pretending it to be the ontological postulate that grounds a secure, ordered image of reality governed by divine laws, consequentially rising the complementary spectres of the perfect artificial political automaton and of the pure natural body politic, and their ideological, technocratic synthesis.

If we assume that political theory still follows the agenda set by early-modern mechanicism, privileging the deductive conception of science and social reproduction against social experimentation, we cannot overlook the historical process through which sovereignty, science, and technocracy converged in framing a theory that postulates the automatisation of the artificial body politic as the only possible solution to the political problem. On the contrary, questioning the simplistic image of nature provided by early-modern mechanicism means assuming the political relevance of the actual inscription of human nature in it. On this ground, sciences such as genetics, cognitive sciences, sociology, and natural history itself have direct political relevance as far as they challenge precisely the concept through which modern political theory aimed at defining and

governing social processes: ‘human nature’. After Darwin we know that human nature is not fixed, and, from natural history, that the human/animal divide is just the provisional result of a serious competition between species. In this ecological perspective political problems cannot concern only humanity, because the order of magnitude of politics is crossed by many different processes that take place between the long-term history of our ecosystem and the *hic et nunc* of political decisions. At this order of magnitude politics appears to be a quite short-term process in which human nature is no more entitled to occupy an exclusive and privileged place. An ideological battlefield is opened in which a materialist political philosophy can challenge the early-modern model of nature which still – implicitly or explicitly – resonates through most political theory.

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