Rationality and Spatial Structure: Physics, Metaphysics and Space in Seventeenth Century Thought

by

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Abstract

The structuring of knowledge is related in complex ways to the political, social and economic geography of the period. The seventeenth century was a period of great social, political and economic turmoil in England and Western Europe, throughout which intellectuals proposed various alternative models of social, no less than scientific, certainty and stability. Of these disputes, the debate between Thomas Hobbes and Robert Boyle during the 1650s and 1660s over the interpretation of Boyle’s air pump trials is a prime example of the complex, multiply imbricated, terrain traversed in pursuit of "right method" and social order. By the century’s end, a broadly syncretic philosophical position which largely favoured Newtonian modalities was conjoined with a political settlement in a way which clearly set Western intellectual development onto a new developmental trajectory.

Of particular importance to this thesis are the geographical correlates of these ostensibly universal scientific transformations. This general restructuring of theories of science and society also necessarily entailed aspatial restructuring at the abstract philosophical level. The ontological dispute between spatial absolutists and spatial relativists drew on rival conceptions of substance and subjectivity which were in turn employed to underwrite divergent ideas about the spatial structure of knowledge production. Ultimately these spatialities were mapped into divergent conceptions of social and political order.

These debates and social transformations resulted in the undermining of sophisticated visions of a geographical discipline, such as that forwarded by Bernhardus Varenius in his Geographia Generalis. Instead, geography was established as the study of the relations between objects and their environments in a way which elided critical questions regarding the spatiality of many ontological and epistemological problems.

In this thesis I will attempt to integrate an analysis of the spatial content of seventeenth century ontological and epistemological theories with an analysis of the historico-geographical context within which they were elaborated and diffused. One implication of this thesis is that the "project of modernity",...
initiated during the "Scientific Revolution" also contained a corollary spatial
discourse which must be recovered if modernity itself is to be more fully
understood. Suggestions about an "end" to the "project of modernity", and the
dawn of a "postmodern" era, must consequently establish that modernity's
constitutive spatial and geographical modalities have either been superceded or
significantly transformed.
# Table of Contents

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abstract</td>
<td>ii</td>
</tr>
<tr>
<td>Table of Contents</td>
<td>iv</td>
</tr>
<tr>
<td>List of Figures</td>
<td>vi</td>
</tr>
<tr>
<td>Acknowledgement</td>
<td>vii</td>
</tr>
</tbody>
</table>

## Chapter 1  Modernity, Space and Human Geography

1.1 Geography and Modernity                                           2
1.2 Historicism and Geographical Thought                               8
1.3 Phenomenology and Human Geography                                   17
1.4 Philosophies of Space in the Seventeenth Century                   26

**Plan of the Work**

## Chapter 2  Into Modernity's Basement: An Historical Geography

of Seventeenth Century Philosophy

2.1 Introduction                                                       37
2.2 The Seventeenth Century Crisis of Confidence                        40
2.3 Political Economic Aspects of Cartesianism and Baconianism          46
2.4 Concluding Comments                                                 58

## Chapter 3  Ontology and the Spatiality of Subjectivity:

the interpenetration of physical and metaphysical spaces

3.1 Ontologies of Self and Substance                                    61
3.2 Hobbes' and Descartes' Plenist Ontology                             66
   Theories of Substance                                                66
   Theories of Causality and Motion                                     71
3.3 The Plenist Construction of Subjectivity                            76
   Varieties of Seventeenth Century Dualism                            76
   Hobbes' 'Limited' Dualism                                           81
3.4 Human and Physical Ontologies and their Spatiality                  85

## Chapter 4  The Human Geographies of Seventeenth Century Philosophy:

the interpenetration of physical and metaphysical spaces

4.1 Self/Substance Ontologies and Political Geography                   90
4.2 The Frontispiece to *Leviathan*: Hobbes' Political Geography        91
**Table of Contents** (cont'd)

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.3 Hobbes, Boyle and the Air Pump Trials</td>
<td>99</td>
</tr>
<tr>
<td>Technological Space</td>
<td>103</td>
</tr>
<tr>
<td>Social Space</td>
<td>109</td>
</tr>
<tr>
<td>The Spatiality of Hobbes’ Objections to Boyle</td>
<td>114</td>
</tr>
<tr>
<td>4.4 Spatiality and the Partition Between Physics and Metaphysics</td>
<td>118</td>
</tr>
<tr>
<td>Chapter 5 Theories of Absolute versus Relational Space: the interpenetration of physical and metaphysical spaces</td>
<td>3</td>
</tr>
<tr>
<td>5.1 The Latent Spatiality of Scientific Discourse</td>
<td>121</td>
</tr>
<tr>
<td>5.2 The Logic of Relational Space</td>
<td>125</td>
</tr>
<tr>
<td>5.3 The Triumph of Absolute Space</td>
<td>131</td>
</tr>
<tr>
<td>5.4 Theories of Space and Seventeenth Century</td>
<td>136</td>
</tr>
<tr>
<td>Chapter 6 The Historical Geography of Modernity and the Prospects for a Postmodern Human Geography</td>
<td></td>
</tr>
<tr>
<td>6.1 On the Historical Geography of Early Modern Thought</td>
<td>145</td>
</tr>
<tr>
<td>6.2 On the Spatiality of Early Modern Thought</td>
<td>148</td>
</tr>
<tr>
<td>6.3 Modernity, Postmodernity and Critical Human Geography</td>
<td>149</td>
</tr>
<tr>
<td>Bibliography</td>
<td>152</td>
</tr>
</tbody>
</table>
List of Figures

<table>
<thead>
<tr>
<th>Figure</th>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Figure 1</td>
<td>Integrated Historico-Geography of Spatial Thought</td>
<td>32</td>
</tr>
<tr>
<td>Figure 2</td>
<td>Enclosures of Common Fields 1700-1800</td>
<td>42</td>
</tr>
<tr>
<td>Figure 3</td>
<td>Frontispiece to Sprat's <em>History of the Royal Society</em></td>
<td>47</td>
</tr>
<tr>
<td>Figure 4</td>
<td>Social Composition of the Royal Society</td>
<td>50</td>
</tr>
<tr>
<td>Figure 5</td>
<td>Hobbes' Classification of the Sciences</td>
<td>54</td>
</tr>
<tr>
<td>Figure 6</td>
<td>The Ptolemaic Universe According to Robert Fludd (1619)</td>
<td>62</td>
</tr>
<tr>
<td>Figure 7</td>
<td>Frontispiece to Hobbes' <em>Leviathan</em></td>
<td>94</td>
</tr>
<tr>
<td>Figure 8</td>
<td>Hollar's Engraved Portrait of Charles II (1650)</td>
<td>97</td>
</tr>
<tr>
<td>Figure 9</td>
<td>Hooke's Diagram of a Flea</td>
<td>104</td>
</tr>
<tr>
<td>Figure 10</td>
<td>Diagram of Boyle's Air Pump</td>
<td>106</td>
</tr>
<tr>
<td>Figure 11</td>
<td>Sketch of Royal Society Proceedings Based on Magalotti and Shapin</td>
<td>112</td>
</tr>
<tr>
<td>Figure 12</td>
<td>Frontispiece to Roberts' <em>The Merchant's Map of Commerce</em></td>
<td>140</td>
</tr>
<tr>
<td>Figure 13</td>
<td>Varenius' Plan for a Special Geography</td>
<td>143</td>
</tr>
</tbody>
</table>
Acknowledgement

This thesis is, I believe, a reflection of trends which are currently emerging in human geography and social theory. After decades of concern about space as an object of theoretical concern, geographers are discovering that not only are the objects of research spatially constituted, but so too are the research programmes themselves. Moreover, there is a complex, but critically important, interplay between the objects and programmes of social research. One implication of such insights is that broad intellectual trajectories, such as the "project of modenity", suddenly take on new importance in the history of geography. Such understandings have helped usher in a period of remarkably rich and sophisticated research.

I thank my teachers, colleagues and friends for helping me to explore some of the possibilities presented by such a complex and subtle viewpoint. The Dept. of Geography at the University of British Columbia provided me with a remarkably rich and sympathetic environment in which to struggle with the issues examined in this work.

Special thanks are due to Derek Gregory for his gentle prodding (to get it done), his excellent humour (as chapter deadlines were repeatedly missed) and for his faith in the ideas upon which this work is based (especially at those times when that same faith eluded me).
Chapter 1

"Modernity, Space and Human Geography"

1.1 Geography and Modernity
1.2 Historicism and Geographical Thought
1.3 Phenomenology and Human Geography
1.4 Philosophies of Space in the Seventeenth Century

Plan of the Work
1.1 Geography and Modernity

This thesis is an inquiry into the intersections between philosophical conceptions of space, historico-geographical processes (events occurring within space and through time) and that cultural and intellectual complex we commonly refer to as the "project of modernity". In particular I will argue that questions revolving around how conceptions of space have been implicated in current intellectual histories, at least those rooted in the European tradition, have been largely neglected. Rarely in the canon of western philosophy does one come across a treatment of "the difference that space makes" to intellectual history. Even now the intersections between analyses of rationality and analyses of spatial structure are considered to be novel, at least within the purview of the historiography of science.¹ And where space is explicitly raised as a philosophical issue, it is generally "solved" and subsequently tucked away from further view. It is well known, for example, that Newton placed great importance upon the careful conceptualisation of space in his natural philosophy. Yet, he clearly considered his most explicit and thorough treatment of space as a "scholium", or prologue, to his more central theorisations of physical dynamics.² Conversely, theories of time and temporal relations have not been so readily dismissed, submerged or otherwise effaced. Indeed, philosophical problems of temporality have been much closer to the core of modernity's agenda since at least the late eighteenth-century. There is then an abiding asymmetry between space and time within the project of modernity not just in terms of their respective conscious theorisations, but, and perhaps more significantly, in terms of their respective positions as relevant items on modernity's agenda. Yet, following Harvey, it seems plausible to suggest that this apparent "annihilation of space through time" can only exist as a paradox, because we 'moderns' have become inured to it by louder or more audible, claims.³ In this thesis I try to recover some of the complexity and critical edge of

² See Milic Capek 1976: The Concepts of Space and Time: Their Structure and Development (Boston:D.Reidel Co.), Note also that Kant too seems to have dealt with space in a similar fashion as Newton, though it is important to remember that this is not totally equivalent to his understanding of geography.
³ David Harvey 1989: The Condition of Postmodernity: An Enquiry into the Origins of Cultural Change (London: Basil Blackwell) p.258. Harvey also says that "this leads us back to the most
human and physical spatiality as it was discussed and conceived at the outset of
the so called 'Scientific Revolution'.

It has become standard in much academic research to trace the origins of
our present intellectual trajectory back to the turn of the eighteenth-century and
especially the philosophical thought of David Hume (1711-1776), Immanuel Kant
(1724-1804) and Georg Wilhelm Friedrich Hegel (1770-1831). Hume and Kant
had recognised as the central problematic of Enlightenment was to effect the
emancipation of the independent rational human subject from the
transcendental theology in which Descartes and his contemporaries had left it
mired. Descartes, who had first postulated the cogito ergo sum, had,
unfortunately in Hume's view, been content to render transcendental the
subjectivity of the cogito by identifying it ultimately with the Christian God. The
invocation of the Christian God, or, more precisely some historico-
geographically specific conception of the Christian God, as the foundation of all
rational thought unavoidably begged the question of the western intellectual
tradition's relationship to its past. If Descartes dealt with the cogito's origin by
relating it to God as a transcendental principle, then the whole problematic is
merely shifted onto the grounds of the historico-geography of Christian theology.
Paradoxically, Descartes' epistemologically modern rationalism seemed to Hume
and Kant to be founded upon a decidedly premodern ontology. At one and the
same time therefore, Descartes, and with him perhaps all of the champions of

4 The common claim is that the 'project of modernity' within which we are today immersed was
initiated in the philosophical works of Hegel and Nietzsche and the literary works of Goethe,
Flaubert and Baudelaire at the beginning of the nineteenth century. See, for example, Jurgen
Habermas 1987: The Philosophical Discourse of Modernity Translated by Frederick Laurence and
wth an Introduction by Thomas McCarthy (Cambridge, Mass: MIT Press); Marshall Berman 1982:
All That is Solid Melts into Air (New York: Penguin); Peter Gay 1969: The Enlightenment: An
Interpretation (London: Weidenfeld and Nicholson); Ernst Cassirer 1951 (1932): Philosophy of
the Enlightenment (Princeton:Princeton Univ. Press); and also Harvey 1989. As an aside I note
that geographers who have examined the history of geography itself also tend to adopt a
roughly convergent timeframe. See David Stoddart 1986: On Geography: and its History
(London: Basil Blackwell); and Derek Gregory 1989: "The Crisis of Modernity?" draft paper Dept
of Geography, Univ. of British Columbia, Spring 1989.

5 The novelty was that human subjectivity was defined in terms of the activity of rational directed
thought.

the seventeenth-century "Age of Reason", were simultaneously profoundly modern and anti-modern! In their view what was required was a rectification of those areas where Descartes had 'gone wrong', betraying his rationalism with metaphysical speculation. Hume and Kant set about freeing the Cartesian subject from its backward looking historical shackles, largely through attempts at its objectification through reflective self consciousness.7

Yet, it would appear as though there was still another important transformation to be negotiated prior to the dawning of a fully 'modern' intellectual era. As Habermas points out, Hegel was probably the first continental philosopher to perceive that the resolution of this Cartesian paradox takes us well beyond Kant's reflections upon rationalism in and of itself:

As modernity awakens to consciousness of itself, a need for self-reassurance arises, which Hegel understands as a need for philosophy. He sees philosophy as confronted with the task of grasping its own time - and for him that means the modern age - in thought. Hegel was convinced that he could not possibly obtain philosophy's concept of itself independently of the philosophical concept of modernity.8

Kant and Hume had failed, on Hegel's view, by not seeing that their appropriation of rationalism remained mired in much the same "positivity"9 of doctrine, of "objective rationalism", as the "orthodoxy" they were trying to rehabilitate. By emphasising the replacement of the Cartesian 'God of faith' with one of reason they had failed to see that the two could amount to pretty much the same thing: the continued submission of the present to the past via the complete rationalisation of an absolute subjectivity. For a solution to this difficulty Hegel returned to the classical distinction between self consciousness as an historical problem, and self knowledge as a philosophical one.10 That the

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7 Kant's formulation of the problem as one of "aufklärung" (enlightenment) is clearly explicated in Michel Foucault 1984: "What is Enlightenment?" in The Foucault Reader. Edited by Paul Rabinow (New York: Pantheon) pp.32-50. For Hume much the same sentiment is encapsulated in his well known comment "Reason is, and only to be, the slave of the passions and can never pretend to any other office but to serve and obey them" quoted in Gay 1969, p. 188
8 Habermas 1987, p.16
9 By "positivity", at least in this context, Hegel appears to imply the creation of intellectual modalities which subsequently influence, perhaps through the constraining of alternatives, the possibilities for self knowledge.
two had not developed in tandem through the Enlightenment provided Hegel
with a new entré into both the Enlightenment's achievements as well as its
aporias. For Hegel the unmasking of the historical "positivity" of Kantian
idealism was a profoundly philosophical issue, rooted in the dialectical
relationship between "time consciousness" and "self consciousness".

Immediately as it was posed in this fashion, however, Hegel felt
compelled to consider the implications of the aporia between historical and
philosophical self understanding for social and political order. This much would
appear to follow since the corollary of the (dialectical) union of self knowledge and
self consciousness at the individual subjective level at the level of the
externalised "Spirit" was at that time commonly taken to be the union of citizen
and state. Both Rosen and Habermas have commented on this connection,
especially in terms of its putative status as a dialectical corollary, rather than
merely an analogy to his analysis of subjectivity. In any event, Hegel's own
tendency was to perceive that "the only source of [civil] normativity which
presents itself is the principle of subjectivity from which the very time
consciousness of modernity arose." This of course is similar, but the not
identical, to the problem of "Aufklärung" posed by Kant. Rather than seeking
the redemption of the Enlightenment promise in the historical tradition of
rationalism per se, Hegel argued that only "the philosophy of reflection, which
issues from the basic fact of self consciousness, adequately conceptualises this
principle". Though Hegel did not articulate it in these terms, it would seem
that, for Hegel, the only connection between microcosm and macrocosm, citizen
and state, which typifies modernity would be the one which reunited knowledge
of the self as a conscious, knowing being, with its objectification as externalised
Being. From this platform the movement into the more thoroughly
productionist metaphysics of Marx in the nineteenth century and Heidegger in
the twentieth was comparatively straightforward

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11 Habermas 1987, p.37ff analyses this Hegelianism in terms of the further aporia between civil
order and the order of productive practices. Rosen, by contrast, rejects outright this synthesis,
insofar as he appears to think that it requires that "...the subjective dimension of the state (the
satisfied, ethical citizen) initiated a unification of subjective and objective Spirit in Art,
Religion and Philosophy" 1989, p.113.

12 Habermas 1987, p.41
But where does space fit into all of this? The development of modernity from Descartes, through Hume and Kant to Hegel has thus far been sketched solely in terms of the interpenetrations of time consciousness and western subjectivity. And yet it should be patently clear that concepts of what it means to be "modern" cannot possibly avoid an engagement with spatial problematics. The relationship of time consciousness to self consciousness which preoccupied Enlightenment thinking up to Kant and which was problematised as a philosophical problem by Hegel necessarily carries with it important and largely unexplored spatial baggage. The spatialisations of the self/other, micro-macro, private/public and other centrally important dichotomies, are de-emphasised in pursuit of the reconciliation within a post-Hegelian model of modernity of historical and philosophical understandings. One especially ironic result has been that the tradition of academic geography, though it has worked hard to further our understanding of human and physical relations in space, it has been structurally disinclined to interrogate its own concepts of what spatiality is believed to consist of, and what this means for the conduct of geographical research. On this basis an argument will be made for the further development of modernity's project through the inclusion of both historico-geographical and historico-geographical elements. This involves the examination of not just the history of spatial philosophy, but, equally, the spatial history of philosophy as well.

A further comment needs to be made about this last claim: that the "difference that space makes" is manifest not just in the recovery of abstract philosophical disputations about spatiality and geography (though I shall certainly have cause to dig deeply into the philosophical literature), but also in terms of the relations these abstract spatialities bear to material events and processes. Ideas survive, it seems to me, not merely through their encapsulation in pen and ink, but also through their diffusion through space and time. My argument that modernity contains within it deeply entrenched spatial notions which constrain its possible avenues of development would be considerably dulled indeed if I were not able to show them in operation in social, political, economic and political contexts. Fortunately it is possible to demonstrate that the theories and concepts proffered by those philosophers I will be examining were both influenced by, and exerted an influence upon, the times and places in which these thinkers lived. More to the point there would seem to be much
merit in the argument that it is only through such contextual readings that one can get a firm grasp the meaning of the ideas and concepts as originally elaborated.

My task then is one of locating and rendering explicit some of the connections between the geography of and the geography (latent) in, the project of modernity. The historico-geographical context I have chosen to study encompasses the western European philosophical landscape during roughly the middle third of the seventeenth century. During this period the first truly recognisable formulations of "modern" philosophy were initiated. More to the point, during the seventeenth-century discussions of "the difference that space makes" were much more central to both the rational and experimental philosophical projects. Even if it is granted that the late eighteenth century work of Hume, Kant and others significantly recast seventeenth century problematics, it cannot be doubted that they themselves looked to the preceding century, and the work of Descartes, Hobbes, Newton and Boyle for much in the way of concepts and inspiration. This period also witnessed what has been referred to as the first "bourgeois" revolution (in England in 1688), following more than half a century of turmoil in England as well as on the continent. My thesis is that the material historical geography of the period can be connected with novel changes in the spatial thought in that period's philosophy. Ultimately I contend that one can derive from this analysis a better understanding of the possibilities as well as the limitations on spatial thinking generally and the discipline of geography specifically and the relationship of both to the project of modernity. During the seventeenth century, certain spatially determinate philosophical distinctions were established, such as those between "primary and secondary qualities", self and substance, etc. The fact that many of these distinctions remain central to the project of modernity even after Kant and Hegel implies that the roots of modernity must necessarily be traced back at least this far.

Prior to embarking upon the investigation of the spatiality of philosophy and the philosophy of spatiality it is necessary to consider some basic methodological points. In the remainder of this introductory chapter I will evaluate two of the major streams of research into the history and philosophy of space and spatial relations. First, I will consider the mainstream historiography of geography which tends to take as its object, not spatial relations or spatiality
taken generally, but rather some partisan or otherwise particularistic version of
geography. This sort of approach tends to lapse into the sort of "whiggish"
historicism which sees the history of ideas as moving in relation to just that
hypostatised perspective. Margarita Bowen's account of the relationship between
philosophy and geography in the seventeenth and eighteenth centuries is an
especially appropriate, and telling, example insofar as it combines just this sort of
historicism with an ambitious attempt to map into broader intellectual arenas of
philosophy and natural science. The other sort of approach to the philosophy of
space I wish to consider here derives its impetus from phenomenology, trying to
understand spatial relations in terms of some transcendental model of "human
spatiality". While this approach, at least in its transcendental manifestation,
conceives of spatial relations in a much more open ended fashion than
historicisms such as Bowen's, it nevertheless suffers from a number of
drawbacks which threaten the validity of her project. In the final section of this
chapter I will elaborate a methodology for this thesis which attempts to avoid the
pitfalls identified in the above two streams of research while also incorporating
their respective strengths.

1.2 Historicism in Geographical Thought

The most straightforward, and 'mainstream', program within the
historiography of geography and spatial philosophy, assumes a linear path of
progressive evolution of spatial and geographical ideas. This form of
'historicism' is rooted in the assumption that intellectual development is both
discursive, that is to say that it develops intersubjectively, and that it is
diachronic, in that the relevant narrative relates present conditions to past
experiences, often with a view to future oriented ideals. The history of
geography, within this modality, is traced largely in terms of the stringing
together like beads on a string of all those imputations which invoke specific,
recognisable textual signifiers such as "Geography", "cosmology", "space" and
"place". Undoubtedly part of the appeal of this sort of approach is the relatively
uncomplicated narrative it can provide, anchored in time and space by certain
touchstone personalities and texts. These personalities and texts, Eudoxus,
Strabo, Ptolemy as well as Varenius' Geographia Generalis and Kant's
Geographical lectures to take just a few examples, then become iconographic way stations in the development of the geographical discipline. This undergraduate view of the history of Geography tends to run along at a jaunty pace; starting with the Greek empiricists, moving then to Ptolemy and Strabo, through the long and putatively backward silence of the "Dark Ages", resurfacing in the environmental determinisms of Campanella and Bodin, through Carpenter and Varenius in the seventeenth century, and on to the epic reformulations of Kant. Subsequently the "geographical tradition" hives off into various national or regional schools, such as the German "chorographers" Humboldt, Ritter and Hettner; the later French "genres de vie" tradition of Vidal de la Blache; the British "imperial" tradition of MacKinder and others; and the American regional and cultural traditions of Hartshorne and Sauer. Of course, there are marked variations in emphasis and understanding from one history of geography to another, and each is as interesting for what it excludes as for what it includes. However, all would seem to be historicist in the semantically oriented sense introduced above. Still, as a genre these simplistic chronologies are relatively innocuous, even if they tend also to overlay their semantic historicisms with the discursively 'unifying' theme that "progress" is cumulative when charted along the temporal axis. This latter of course is another analytically distinguishable historicist thread present in contemporary historiographies of geography.

In addition to these basic conceptual and thematic historicisms, I note a third strand of historicism which generally pervades the narratives under investigation here. Rarely, it seems, have historians and philosophers of geography considered geographically the potential relationships between changing political, social and cultural landscapes and the intellectual matrices

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13 See for example Preston James and Geoffrey Martin 1981: All Possible Worlds: A History of Geographical Ideas; and also J.N.L. Baker 1963: History of Geography (Oxford: Basil Blackwell), though it must be noted that the former maintains much less philosophical depth than the latter.

14 The signal treatment of which, in English, is undoubtedly Anne Buttimer's 1971: Society and Milieu in the French Geographical Tradition (Chicago: Rand McNally)


which both resulted from and also impinged upon them. For example, R. J. Johnston's *Philosophy and Human Geography*, while initiating the developmental tracing of four epistemological themes in twentieth century geographical research, all too rarely stops to consider the reciprocal constitutive influence of geographical events and processes on those selfsame epistemological themes. Why certain ideas appeal at some times and not others, and the difference this undoubtedly makes for the trajectories of disciplinary development remains unaddressed in Johnston's work, and consequently the narrative becomes rather ambiguous. Harvey's statement that "geographers inevitably practice politics while politicians just as inevitably engage in geographical practices" is cited but not taken up, a move which serves to throw this lacunae in Johnston's work into even sharper relief. Fortunately, recent work by Harley and others on cartography, by Livingstone on teleological themes in geography, and by Cosgrove and others on the social and political "iconographies of the landscape" are significant indicators that this prevailing tendency in the the literature is being challenged. An important hallmark of the work of these geographers is their abiding interest in stretching their narratives 'horizontally', across social, political and other spaces, as well as 'vertically' along the temporal axis. These geographers understands that intellectual events abstracted from their material contexts are mute; unable to tell us why and in what ways ideas - spatial and otherwise - really matter. In a recent paper on the relation between (geographical) science, magic and religion in the early modern period, Livingstone makes such an approach explicit: "My approach, while broadly chronological, is... more thematic in emphasis but in full recognition that these themes, far from being discrete entities, merge and intertwine in important ways." For the most part though, examinations of the history of geography have remained straightjacketed within a diachronic

17 R.J. Johnston 1983: *Philosophy and Human Geography: An Introduction to Contemporary Approaches* (London: Edward Arnold)
18 Johnston 1983 p.110 The citation of course comes from David Harvey 1973: *Social Justice and the City* (Baltimore: Johns Hopkins Univ. Press) and is all the more ironic for the fact that Johnston deploys it as an example of an *esoteric* principle of "structuralist geography" rather than as the *exoteric* principle which Harvey obviously intends it to be!
19 See the collection of articles in Denis Cosgrove and Stephen Daniels 1989: *The Iconography of Landscape* (Cambridge: Cambridge Univ. Press) and also Livingstone 1984,1988,1990.
historicist framework. Even where this has been recognised, its normative valence has generally been confirmed, as in Hartshorne's classic statement:

If we [geographers] wish to keep on track - or return to the proper track...we must first look back of us to see in what direction that track has led.21

A related and more invidious trend in the historiography of geography, a fourth historicist strand if you will, is exemplified by those treatments which begin with a preformed conception of geography which is subsequently projected backwards into their historical narratives. Such works are markedly different in important respects from the more straightforward historicisms of James and Martin and J.N.L. Baker. This stream of historicist research presents the sometimes compelling illusion that the path of disciplinary development has somehow 'culminated' in one or another particularistic view. Of course the a priori selection of themes in this mode is conjoined with the 'second historicist strand' identified above which assumes that intellectual development is progressive and cumulative along the temporal axis. To take a recent example, in his history and philosophy of geography James Bird has fashioned a narrative which is designed to underwrite his own neo-positivist geographical programme.22 The selectivity and canalising of material necessarily intrinsic to such a project should be so obvious as to hardly require much comment. While Bird does claim to inquire into the implications of changing ideas about intellectual certainty for the discipline of geography, he nevertheless accepts uncritically a naive realism which rests on the "importance of external validation by correspondence with the real world [whatever that is], comparing consequences with the output of our work."23 The unfortunate result, for an account which promises a critical understanding of philosophical history, is to accept rather uncritically a naive form of realism which, as other more thorough

21 Hartshorne quoted in Stoddart 1986 p.2, though of course this citation does not necessarily entail a lockstep adherence to the tendencies of the past on Hartshorne's part. Stoddart has shown though how such sentiments were indicative of the "power of evolutionary thinking" for both the style and content of geographical research. See especially Stoddart 1986, Chapter 8.
23 Bird 1989, p.236
treatments have shown, is itself a social product. After a fashion, the very totality and positivistic confidence of his narrative effects its own deconstruction.

Margarita Bowen's account of "Geographical Thought from Francis Bacon to Alexander von Humboldt" is probably a better known example of what Porter has aptly called, "the Whig heresy of writing history backwards to justify some perceived orthodoxy". While her work, an unabashed attempt to portray Humboldt as the primary agent of Geography's rescue from the "dark ages in the history of geography", has the virtue of a far better grounding in primary philosophical material than either Johnston or Bird, she nevertheless both misconstrues and even misses a great deal of material which is actually quite central to her project. In Bowen's work all four strands of historicism thus far introduced converge to shape which is certainly as complex as it is contentious (judging from the vigour of the reactions to the book). Preconceived themes regarding the centrality of Humboldt's work for modern geography are joined with a semantically suspect fixation on the signifiers space, place etc in a narrative of progress and culmination which manages to avoid any meaningful engagement with the material context of the works she examines. All of this is especially ironic and disturbing given the high importance her intellectual hero, Humboldt, placed on questions of material context and social advocacy!

In his critical review of her book, Joseph May dwells primarily upon the problems engendered by Bowen's attempt to conceive of the seventeenth century Dutch geographer Bernhardus Varenius as some sort of synthesiser of Baconian and Cartesian epistemologies. His critical exploration of this claim rests on an

24 Roy Bhaskar has referred to this sort of realism as "naive realism" which contrasts with his own preferred brand of "transcendental realism"; see Roy Bhaskar 1979: The Possibility of Naturalism: A Philosophical Critique of the Human Sciences (Brighton: Harvester); and for a discussion of realism in geography see Andrew Sayer 1985: "The Difference that Space Makes" in Derek Gregory and John Urry (Eds) Social Relations and Spatial Structures (London: MacMillan) pp.49-65.

25 How refreshing it would be to encounter historiographic narratives which trace the paths of significant intellectual stitches dropped, rather than trading on the glib illusion that the passing of time always correlates with positive progress made!

26 quoted in Livingstone 1984 p.271

27 Bowen 1980 p.10

examination of a central epistemological passage in Varenius' Geographia Generalis and its relations to Bacon's and Descartes' mutually divergent notions of "certainty" and "proof". May's substantive point is that, contra Bowen, Varenius cannot easily be portrayed as a synthesiser of Baconian and Cartesian epistemologies for the obvious reason that their notions of certainty are largely exclusive and even oppositional. As far as it goes May's discussion is erudite and well informed, though he oddly uses it to support his "...major misgiving that the approach adopted by Margarita Bowen...offers no control over the philosophical material". What is strange about this claim, of course, is precisely that, far from offering no control, Bowen's approach actually imposes so much control that important voices, contrary and otherwise, are stifled! Indeed it seems, contra May, that it is precisely this preponderance of control which causes Bowen to read the (dis)similarities between Bacon and Descartes in the way that she does. To take just one instance that May does not himself discuss, Bowen's historicist project blinds her to both Descartes' own highly ambivalent feelings about mind-body dualism, as well as his own writings on the concept and study of space contained in his Principia Philosophae (1644). As I will show in subsequent, Descartes' postulation of "relative space" actually flew in the face of the absolutist conceptions adopted by post-Baconian empiricists such as Boyle and Newton and which was recodified by Kant. To ignore Descartes' ontological thinking (especially much of it is explicitly spatial) can only be detrimental to Bowen's overall project, since Descartes himself conceived of them as a whole with his epistemology. Moreover, since her case could have been constructed following the thread from Bacon to Boyle and Newton, without even trying to (mis)construe Descartes as a rote empiricist, one is left wondering why she evidently felt compelled to do so in the first place. The most likely answer brings me back to my original point; namely, that it is the preponderance of control, epistemological and methodological, exerted by her historicist project, rather than what May takes to be the lack of it, which results in the submergence of important claims and counterclaims, spatial and otherwise.

29 May 1983, p.85
30 This lacunae is doubly disturbing given that Bowen explicitly discusses Descartes' Principia. See Bowen p.63. I treat Descartes' own formulation of ontological dualism in chapter 3.
These problems of historicism are, for the most part, as obvious as they are numerous. Fortunately, few historians of geography have been as spectacularly whiggish as Bowen, though historicism still manages to be difficult to banish in practice. Seemingly ever present is the latent tendency to write history backwards, from some preconceived point of historical culmination. Perhaps part of the irresistibility of this tendency lies in the very *diachronic* nature of consciousness embedded within the condition of modernity. Still, not all historiography follows the relatively obvious and blatant historicist format critiqued above. Rather than writing simply from the perspective of some static present, scholars have sometimes (re)written their histories in terms of defined processes or structural dynamics. Derek Gregory has recently observed that even the more praxically committed variants of political economic approaches have had little time for engaged historical geographies of human social and material processes.\(^\text{31}\) Hobsbawm, for example, has presented the "General Crisis of the Seventeenth Century", as an expression of the inexorable and spatially invariant unfolding of capitalistic development. And intellectuals aligned with the "Frankfurt School" have schematised the critical historical transformations of the seventeenth through twentieth centuries in terms of the progressive ascendance of a highly technologically oriented form of rationality. In the *Dialectic of Enlightenment* Horkheimer and Adorno have claimed that:

> On the way from mythology to logistics, thought has lost the element of self reflection, and today machinery disables men even as it nurtures them.\(^\text{32}\)

In contradistinction Trevor-Roper and Hill take more functionalist approaches focussing on the impact of Protestant individualism and bureaucratisation respectively.\(^\text{33}\)

\(^{31}\) Derek Gregory 1989: "Areal Differentiation and Postmodern Human Geography" in Derek Gregory and Rex Walford (Eds) *Horizons in Human Geography* (Totowa, NJ: Barnes and Noble) p.71

\(^{32}\) Max Horkheimer and Theodor Adorno 1972 (1944) *The Dialectic of Enlightenment* Translated by John Cumming (London: Allen Lane)

\(^{33}\) The debate over the "General Crisis" hypothesis which was begun by Eric Hobsbawm's paper "The General Crisis of the Seventeenth Century" in *Past and Present* in 1954 remains a milestone in seventeenth century studies. See the collection of essays in Geoffrey Parker and Lesley Smith (Eds) 1978: *The General Crisis of the Seventeenth Century* (London: Routledge and Kegan Paul) and also the discussion in Chapter 2 of this thesis.
The problem of reconstructing past theorisations of space is beset with difficulties other than those of the specific forms of historicism thus far identified. Foremost among them is the fact it is not possible *a priori* to be sure of just what to look for in attempts to elucidate the historical development of geography and spatial thought. In Europe at least, the institutionalised pursuit of explicitly geographical knowledge did not gain any sort of foothold in the burgeoning universities until the end of the eighteenth century.\textsuperscript{34} Prior to this, geography as a recognisable institutionalised discipline was largely non-existent, with only rare and short lived periods of efflorescence and achievement. For the most part "geography", as such, was considered, prior to the nineteenth century, to be a kind of physicalist propaedeutic, to natural philosophy on the one hand, and civil philosophy on the other.\textsuperscript{35} So a central methodological problem then is to develop a way of tracking the development of geographical thought prior to its canalisation into an institutionalised discipline with recognisable signs and practitioners. Quite obviously one cannot be content to look for signs of a geographical imagination only in specific operationalisations of the term itself.

An apparent proxy for geographical thinking in philosophy might be found in an analysis of those terms which concern or describe the process of distancing and spatial distinction, both social and physical, which are basic to any geographical sensibility. However, words, signifiers, like "space", "place" and "extension" are used variously from one thinker to the next, without their meanings always being readily or completely apparent. Moreover, interpretive difficulties are greatly exacerbated by the inter-referentiality of texts within the seventeenth century intellectual context. Elements of some philosophical position might be absorbed into new syntheses without explicit cognizance of their spatial content, thus creating intellectual 'Trojan Horses' for subsequent generations (A point which will be taken up in subsequent chapters). One would have to be very careful therefore in attempting to chart the course of spatial thought in terms of the changing valence of spatial terms identified *a priori* of their highly unstable and contingent local expressions. I will address the methodological difficulties this raises in the final section of this chapter.

\textsuperscript{34} Stoddart 1986, esp Chs. 2 and 3 where the history of geography chairs and departments at European universities is traced.

\textsuperscript{35} Both Locke and Rousseau held to this conception to geography as merely prelimin ery background education for their idealised citizen. See Gay 1969 and Jean Jacques Rousseau 1968: *The Social Contract*, translated and with and introduction by Maurice Cranston (Harmondsworth: Penguin).
My point in this rather polyglot enumeration of the different sorts of historicism is to suggest that some form of historicism may actually be unavoidable in any historical account, even one concerning the intellectual history of geography. To some extent organising themes cannot but be selected prior to the development of an historical narrative. Nevertheless I do not concur with those who might suggest that a logical corollary of this principle, a 'Principle of Unavoidable Historicism' if you will, is that we must abandon all hope of producing a useful narrative. On the contrary, the recognition of the complexity of historicism, as a modality of theorising as well as a deeply rooted element of our intellectual tradition itself, puts the onus on us to deploy a perspective which, while remaining open to contrary and competing voices, still manages to hold to some broad spatial themes of human intellectual, political, cultural, economic and social development which fundamentally unite the narrative. At the very least of course, we should try to be as realistic as possible about our own diachronic prejudices and also those of others whom we interpret and utilise. Without doubt an approach which endeavours to operationalise such strictures will perforce be interdisciplinary in nature, drawing both conceptual and empirical support from diverse human, and even perhaps physical, sciences. In support of such an approach Clarence Glacken has written that those who

stay within the limit of [their] discipline sip a thin gruel because these ideas [of nature and space] are derived from broader enquiries like the origin and nature of life, the nature of man [sic] and the physical and biological characteristics of the earth.\textsuperscript{37}

\textsuperscript{36} In part, this motive is operationalised by the "New Historicists" who are moving history closer to literary theory (and vice versa) in an effort to create new narratives which dissolve the distinction between culture and history as "foreground and background" respectively. See Aram Veeser (Ed) 1990: \textit{The New Historicism} (New York: Routledge)

\textsuperscript{37} Glacken cited in Livingstone 1984, p.294
1.3 Phenomenology and Human Geography

In many respects it can be maintained that the generalised tendency to operationalise one or more of the above forms of historicism in the history of geography has led to a situation where discussants are merely talking past one another. After all, by privileging, epistemologically and/or ontologically, from the outset some particular conception of geography, the possibilities for engaged critical debate about geography itself will no doubt be considerably foreclosed upon. Nevertheless it is also true that spatiality is an intrinsic and unavoidable component of both the philosophical and material aspects of modernity. The problem then involves the possibility of adding the spatiality of material and philosophical processes without predetermining, a priori of the empirical experience, the results of that investigation. In this section I will discuss a perspective, Husserlian phenomenology, which appears to hold out the possibility of achieving this largely inductive goal through its unique perspective on the human structuring of lifeworlds, within the context of a transcendental view of human subjectivity, and also spatiality. Central to this discussion will be the specifically geographical elaboration of these phenomenological ideas by John Pickles.38

Phenomenological approaches, as elaborated by philosophers such as Husserl, Merleau Ponty, and Schutz (ignoring for a moment their marked differences) explicitly hold out the possibility of striking the necessary balance between historicism and relativism talked about above. Their explicit purpose has been to provide a way of elucidating and critiquing the 'naturalness' of the "natural attitude" by disclosing "the world as it shows itself before scientific enquiry, as that which is pre-given and presupposed by the sciences."39 In other words phenomenological approaches focus upon re -problematising those ideas about the constitution of the lifeworld which have come to be "taken for granted" within the human and physical sciences. They are therefore ontologically as well as epistemologically oriented, seeking to uncover the ways

39 Pickles 1985, p.3 This is a statement common to most versions of phenomenology, irrespective of their other differences. See David Ley 1978 and also the entry for "phenomenology" in R.J. Johnston, D. Gregory and D. Smith (Eds) 1986: The Dictionary of Human Geography, Second Edition (London: Basil Blackwell)
in which the objects of any given science are conceived prior to scientific investigation itself. Of course such an approach will have an impact on the structuring of academic disciplines. In the case of geography Pickles claims that:

[Cartesian science] has distorted [geography's] own conception of its subject matter and basic concepts. In particular [it has] resulted in a conception of spatiality most appropriate for the physical sciences.40

Moreover, this "distortion" - a term which hints at Husserl's foundational project - is perpetually reified by a geographical methodology which epistemologically presupposes it. Spatial scientific models, such as Christaller's location theory, are often faulted for presuming, and valorising through this presumption, a specific set of assumptions about the constitution of spaces, and the spatiality of rational actors, themselves. It is this rather unique sensitivity to ontologies as well as epistemologies which makes phenomenology an attractive intellectual candidate for examining the history and philosophy of concepts of space. Few perspectives are as well positioned as phenomenology claims to be to offer a window onto some of the ways in which our views about what exists in the world influence our ideas about how to attain certain knowledge about it, and of course vice versa.

The appropriation of phenomenological ideas, especially over the past two decades, has inspired a rather wide variety of geographical perspectives. Some geographers appear to have taken phenomenology merely as an inspiration and point of departure for the elaboration of "humanistic" epistemologies which foreground, over and against the constitution of any 'objective' physical world, the instillation of that world with meaning. This focus on the instillation and maintenance of 'meaning', it will be noted, shifts the epistemological ground away from positivism's reliance on mathematical discursive modalities, as objective lenses onto the 'real' world, towards a preoccupation with the subjective construction of the "lifeworlds" of individuals and collectivities.41 Such a phenomenology claims to truly 'ground' science in the world of subjective experience, labelling positivism's claim to have rendered this irrelevant long ago as ideology. Of central interest in such "constitutive"

40 Pickles 1985 p.4
41 E.V. Walter has referred to this as the project of recovering the "expressive intelligibility of space" 1988: Placeways: A Theory of the Human Environment (Chapel Hill, University of North Carolina Press)
phenomenologies are those mechanisms which mediate and shape relations between subjects as 'world producers' and the objects they encounter as 'objects'. Thus David Ley's work has shown a marked predisposition towards empirical situations in which important elements of worldviews, or their symbolisations, are under pressure of change or challenge.\textsuperscript{42} Instability and flux of meanings and lifeworlds are key here; "coalitions rather communities" as Ley puts it, which reveal the human world as the result of the "complex interaction of meaning, activity and constraint".\textsuperscript{43} Ley, especially, inverts the positivistic tendency to see social action as contained within an unchanging and universal physical space arguing instead that:

\begin{quote}
...humanistic geography is centrally concerned with a view of phenomena as they are known in their essential meaningfulness in everyday life.\textsuperscript{44}
\end{quote}

As appropriated by Ley, Buttimer, Tuan and others, constitutive phenomenology has become a rationale for the development of humanistic approaches in geography. These "geographical phenomenologies", in John Pickles' opinion, celebrate the human capacity to create meaningful worlds without bothering too much about any putative 'ontological' issues, at least insofar as these are taken to be in some sense foundational. In fact Husserl's explicit requirement, with which Pickles is identifying, that a thoroughgoing phenomenology must return to the ontological constitution of the "things themselves" ("ding an sich") has been rejected in these "constitutive" circles as unreasonably foundational. According to Pickles, "geographical phenomenology", rooted in the writings of Schutz and Merleau-Ponty rather than those of Husserl or Heidegger, "[has] treated phenomenology more as a guiding motivation rather than a methodological conception, and its evaluation proceeded in terms of already given categories."\textsuperscript{45} Pickles further claims that the rejection of an ontological component to phenomenological research ultimately results in the inability to probe the constitution of the "natural attitude" itself.

\textsuperscript{42} I am especially thinking Ley's work on American inner city neighbourhoods; 1974: \textit{The Inner City as Frontier Outpost: Images of a Philadelphia Neighbourhood} (Washington, DC: AAG Monograph Series #7) and also with R.A. Cybriwsky 1974: "Urban Graffiti as Territory Markers" \textit{Annals of the Amer Asn of Geogr.} 64, 491-505.
\textsuperscript{44} Ley 1983, p. 132
\textsuperscript{45} Pickles 1985, p. 47
Instead the "natural attitude" is left to its own devices, as it were, with the unfortunate result that much humanistic geography ironically runs the risk of reifying positivistic ontologies! Behavioural studies, such as Downs' and Stea's "mental mapping" experiments, which seek to manipulate the interface between "objective reality" and "internal representations" of that "reality" are an obvious case in point. Geographical phenomenologies, then, become to some degree tautological in that they repeatedly presume those deeply embedded spatial concepts which they (sometimes) propose to treat critically. By downplaying the possibility of transcendentally based human spatialities, geographical phenomenology simply offers no solution to the critical dilemma caused by the fact that while objectification makes the human sciences possible, it, by definition, separates the researcher from a context of which s/he is unavoidably a part.

In his critical appraisal of phenomenology and geography, Pickles has argued for a much more strongly Husserlian transcendental approach. Such an approach would interrogate our "natural attitude" about the world with a view to showing how sciences ground themselves in their own "regional ontologies". Briefly put, the idea of a "regional ontology" would appear to indicate the overall, and perhaps even largely inchoate, tendencies exhibited by the sciences to impute or assume spatial attributes. As such the term "regional" is deployed both figuratively, to represent the possibility of different ontologies within different scientific "regions", and also literally, to point to the fact that any science must necessarily "spatialise" its objects. In so doing of course, they presuppose, rather than discover, much of the form and substance of their own activities, at least insofar as problems of space are concerned. The Husserlian approach is meant to go considerably beyond the 'mere' concern for subjective worlds problematised in "geographical phenomenologies". To do so after all leaves intact the "genetic" and "eidetic" components of positivistic science.

46 Roger M. Downs and Donald Stea 1977: Maps in Minds (New York:Harper and Row). Of course this is not a blanket condemnation of mental mapping studies, but rather their tendency to orient themselves around implicit Archimedean points.

47 This point is enunciated in Pickles 1985 p.125 as "Ricoeur's dilemma".

48 Where Pickles talks about the a priori nature of all objectifications it seems that he stresses the idea that sciences ground themselves as objectively prior to the experiences they purport to analyse. But it also seems that there is another more powerful claim to be made: that all objectifications also necessarily impute the "directionality" of their own realm of possible results. I doubt that Pickles would disagree with this stronger claim, though it does not seem to be stressed as much as the more general one. See for example Pickles 1985, p.128-133
Instead it is necessary to seek "an existential conception of science [itself] understanding science as a mode of man's [sic] being-in-the-world; a mode of being which discovers or discloses either entities or their being as objects of theoretical concern". What is at stake in such distinctions is the elaboration of a transcendental phenomenology which will recover the epistemological promise of the empirical sciences by perpetually re-acquainting them with their own necessarily metaphysical foundations.

For present purposes it is not necessary to follow Pickles' argument all the way to its end point in its call for a universalist, foundational "phenomenological geography". Indeed it may be that such claims which smack of ontological universalism are no less debatable than the relativistic humanisms they are purported to replace. The assumption that the myriad "regional ontologies" which underlay the universe of partially overlapping and contesting sciences can somehow be unified in a "transcendental subjectivity" is a strong one indeed. Pickles argues that the goal - his goal - of "phenomenological geography" is:

...to attain a fundamental illumination - using phenomenology - of the basic problems of [geography] as a positive human science by bringing out its inner structural relations. These "inner structural relations" would presumably include that spatiality which Pickles implies is a common unifying feature of all "regional ontologies".

It is clear on the basis of this statement that Pickles' phenomenology does indeed seek a universal ontological understanding (of spatiality) which can ground a "revitalised" science of geography. But there are a number of unanswered questions which are germane to the full and appropriate evaluation of this strong claim. First, it is worth pondering how a phenomenological geography such as Pickles proposes could possibly escape the jaws of its own incisive critique. If I am correct in summarising phenomenology as centrally concerned with (re)problematising the resolution of epistemological and ontological boundary problems (spatial ones in this case), then how do its own boundary demarcations, between the "regional" and the "transcendental" for example, escape the same relativising critique? For the purposes of this work the

49 Pickles 1985, p.127, italics in original.
50 adapted from Heidegger, Pickles p. 141
most immediate example of this difficulty proceeds from the relation between subjects and objects. The directed and intentioned structuring of "objects", which is primarily what phenomenology of the Husserlian variety seems to be designed to cast into sharp relief, is of course dialectically related to the structuring of subjects. It is unclear to me how one can possibly move from the elucidation of "regional ontologies" to a universal phenomenological spatiality, unless one implicitly assumes also a transcendental (scientific?) subjectivity. To claim that "space is not be found in the subject, nor does the subject observe the world 'as if' that world were in a space; but the 'subject', if well understood ontologically is "spatial" seems merely to beg the issue. Defining the "subject" as somehow equivalent to the "spatial", "if properly understood", and then defining the "spatial" in terms of "regional ontologies" would seem merely to return one to the problem of subjectivity, at the level of its putative 'regionality'?

In light of the abiding post structuralist preoccupation with subject-object relations, it seems clear that no current epistemological programme, let alone a phenomenological one such as Pickles proposes, can skirt these central problematics of subjectivity. Gregory has questioned the whole project by observing that "paradoxically it is their very importance which ensures that [concepts of subjectivity] cannot provide a constant foundation for the human sciences. They are the explanandum, not the explanans."52

This objection is, as it turns out, intimately connected with Pickles' most detailed discussion of space and spatiality. In an isolated comment about subjectivity, Pickles claims that "technologically determined space [such as that deployed by Isaac Newton] assumes a distinction between subjectivity and objectivity, yet such a distinction is historically a modern one and ontologically a derived one."53 The purpose of the citation is to prepare the way for a Heideggerian concept of spatiality as "...a place cleared and freed for settlement and dwelling".54 The phenomenological project of developing a regional ontology of geographical science would presumably therefore entail a delineation of the ways in which subjects situate themselves spatially towards objects and towards each other. Such a delineation may be fairly obvious in the case of the

51 Pickles 1985, p.168
52 Gregory 1989b, p.70
53 Pickles 1985, p.158
54 Pickles 1985, p.165
idealised Newtonian version Pickles briefly mentioned, though I will have cause to question even this idealisation in subsequent chapters of this thesis. Still, the central question of contextuality remains; a "place cleared and freed" for whom, by whom, and from what? The subject of such statements is left unclear or ambiguous, a lacunae surely prone to lapsing back into prevailing discursive modalites rather than exposing them. One rather paradoxical result is that the phenomenological programme proposed is silent about its own phenomenology. More to the point, important questions regarding its own material and philosophical contextuality remain murky and ambiguous.

This aporia surfaces unavoidably in the context of Pickles' appropriation of Heidegger's writings about spatiality and technology. Here Pickles seems to appropriate Heidegger's concept of spatiality as a "place freed for dwelling" in order to provide a touchstone for his "phenomenological geography". Yet if one concurs that the distinction between subject and object is assumed in the description of Newtonian "technologically determined space", and is itself "historically modern", then Pickles' use of Heidegger becomes highly problematic. Heidegger's productionist metaphysics clearly traced the technological paradigm back to Greek classicism which was, he believed, responsible for the installation of the equation between the "Good" and the "True", where the "True" is defined as objectified, devivified experience. The history of philosophy down to Heidegger's day then was subsequently conceived in terms of the progressive penetration of this technological logic into all spheres of human existence. In this Heidegger was merely echoing the discontent of the German intellectuals of his day with the dehumanising effects of technological logic and, in particular, its debilitating effects on the German "Geist". While his philosophical solution was, in some measure, an attempt to subvert the crude teleology of the Nazism he politically embraced, it remains true that he believed that the way forward, beyond the alienating productionist epoch, was to embrace a fundamental authoritarianism. As Zimmerman claims:

Heidegger argued that authentic individuation could only occur within the context of an entire generation willing to submit to its common destiny. The explicitly political Heidegger sought to achieve his own

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authentic individuation by surrendering himself to what he believed were the "powers of being" at work in National Socialism.\textsuperscript{56}

Clearly this is not the place to elaborate upon the highly charged and complicated connections between Heidegger and National Socialism, a topic well treated in a number of recent works.\textsuperscript{57} My point with respect to Pickles' phenomenological geography, is that inadequate attention to the contextuality of subject-object relations may compromise the necessarily fine balance between "concernful involvement" on the one hand, and the urge to transcendentalism on the other.\textsuperscript{58} By not treating the historical contexts of the Heideggerian thought he appropriates, Pickles leaves open the possibility that they, like the proverbial Trojan Horse, could subvert his own stated goal of phenomenological understanding.

There is another point touching on the problem of contextuality which needs to be raised in the critical evaluation of Pickles' Husserlian phenomenology. One thing which is quite striking about the whole enterprise is how \textit{unempirical} it actually is. Despite arguing for a phenomenological science over and against the more common attitude of anti-empiricism or anti-scientism, the work itself contains precious little empirical application. This lacunae becomes most marked in the last chapter where the attempt is made to develop a basic phenomenological understanding of "human spatiality":

The task is to clarify the regional ontological structure of the 'geographical', to provide a critique of the taken-for-granted conceptions of space and the geographical, and to explicate a place centered regional ontology of human spatiality.\textsuperscript{59}

This framework, which is admittedly only preliminary, is still developed in a manner completely abstracted from the study of "lifeworlds" or even of broader

\textsuperscript{56} Zimmerman 1990, p.45
\textsuperscript{58} Pickles 1985, pp.37,128
\textsuperscript{59} Pickles 1985, p.169
historico-geographical processes. Phenomenologically speaking, it would seem to be contradictory to attempt to evaluate this claim solely on abstract philosophical terms, yet there is no other option presented, an empirical engagement of the framework not being included. Further, it may be argued that the conclusions contained in Pickles' last chapter are actually somewhat premature and can only actually be epistemologically grounded in phenomenological examinations of real lifeworld processes and events. One needs, I think, to leave aside the philosophical case for a Husserlian "transcendental subjectivity", at least for the moment, and engage in actual empirical research in a phenomenological mode. Certainly it is worth observing that those geographers, such as Ley and Tuan, whose encounters with phenomenology have come through direct empirical fieldwork have tended to back away from such "grand theories".

Whereas the standard tactics in the historiography of geography have tended to reify conceptions of the subject matter formulated prior to the empirical experience at the epistemological level, it may be that "phenomenological geography", such as proposed by Pickles, does so at the ontological level. On the basis of this critique it remains unclear whether a transcendentally phenomenological approach could actually deliver an understanding rooted firmly in the experience of the "other". Moreover, questions raised about the historical and philosophical contextuality of phenomenology itself suggests some of the ways in which it may itself be intentioned and historicised. Of course it remains true that these conclusions are based upon only a small sampling of historiographic and phenomenological approaches, though these have been selected in terms of their explicit attention to questions of space. What is required, if one wishes to develop a more highly contextual understanding of spatiality and spatial philosophy, is an approach which combines historiography's potential to unite ideas and material processes with a broadly phenomenological sensitivity to ontological problems of "being in the world". One possible reconciliation of these objectives is proposed in the final section of this chapter.

1.4 Philosophy of Space in the Seventeenth Century
In the last two sections I have examined two possible approaches to the genealogy of conceptions of space and spatial relations. The importance of developing an understanding of conceptions of space during this period stems from the fact that they appear in the same historico-geographical context as does much of what is commonly referred to as the "project of modernity". Since the trajectory taken by the intellectual and cultural complex called modernity has undoubtedly had significant impacts on the development, and indeed the possibilities for development, of all physical and social sciences it is germane to our understanding both of modernity and of geography to examine the intellectual treatment of space during this period. Yet, as I have shown, much of the geographical research which takes a generally historiographic approach seems almost irresistibly to lapse into some form of historicism. At the very least, historical research may be fundamentally compromised in the project of better understanding philosophical categories of time and space, by being deeply rooted in the diachronic imagination of modernism. And, as I have also shown, research programmes which claim the ability to break the hegemony of the dominant "taken for granted" worldview are no less problematic. Transcendental phenomenologies, of the Husserlian sort championed by Pickles, are ultimately based on an as yet unwarranted, and perhaps even unwarrantable, assumption of a transcendental subjectivity. "Constitutive" phenomenologies, insofar as they generally shy away from the stronger claims to transcendentalism, may be a better alternative. Certainly their hermeneutic sensitivities can be lauded, despite the fact that there appears to have been few if any attempts to apply such an approach to the genealogy of spatial ideas. This discussion will now turn to the elaboration of the framework to be employed in this thesis.

What is needed is the establishment of a clear and fine balance between too much, and too little, control over the empirical material. In this work I will investigate the thesis that, despite all the grand universalising statements about the objectives and methods of a despatialised, universal, objective science, - what both Morris Berman and Steven Toulmin have referred to as the seventeenth century flight from the "local" - the importance of time and space simply could not be obviated. The demonstration of this claim will take me back to the latter half of the seventeenth century, during which many basic epistemological and ontological concepts were receiving their first recognisably "modern" elaborations. Galileo, Hobbes, Descartes, Locke, Newton and Boyle are among
those who wrested philosophy from its backward looking scholasticism and gave it the imprint which it bears even to the present day. To take just one example which will be elaborated in chapter 3 and 4, disputes over the Cartesian distinction between *res extensa* and *res cogitans* had profound implications for the structuring of spatially imbued categories such as public/private, subject/object and self/other. A geographically sensitive analysis will allow us to look anew at the discontinuities and continuities of competing positions and perspectives. It may be found that, at the ontological level, they share much in common, when viewed from the point of view of their spatial commitments. Such an analysis allows us to probe more deeply the distinction between Modernity and its subvariants and the earlier tradition of the "ancients" from which it most vociferously departed. In the light of this reintroduction of space into philosophical debates, our own contemporary potential to be in some sense "postmodern" might be more adequately assessed.

But it must be recognised that these ontological elements, which are the primary focus of this thesis, were conceived in, and are related to, a particular historico-geographical context. Intellectual trajectories are far more likely to undergo radical transformations as part of generalised social, political, economic and cultural processes, than singly, as part of some internally driven and culturally isolable "scientific revolution". It is surely disingenuous to consider it a mere 'accident', or of little empirical or theoretical importance, that the intellectual revolution which is arguably the foundation of Modernity was institutionalised first in western Europe, and especially England, in the late seventeenth century. As Jacob has pointed out in *The Cultural Meaning of the Scientific Revolution*, the development of natural scientific methodology was supported by, and supported, the emergence of a new nexus of religious, economic, and political interests. In a similar vein, Van Leeuwen has written on the parallels between attempts to resolve the seventeenth century Anglican

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60 Of course, this was, at least in part, precisely Kuhn's point, though he seems to have downplayed the reciprocal impact of scientific ideas on non scientific arenas and also the significance of many scientists' roles outside the scientific community itself. See Thomas S. Kuhn 1970: *The Structure of Scientific Revolutions*, second enlarged edition (Chicago: Univ. of Chicago Press)

61 In the next chapter I will spell out more clearly the remarkable degree of historico-geographical specificity pertaining to the 'advances' of the 'scientific revolution'.

"Rule of Faith" controversy and the elaboration of experimental scientific method. Others have indicated the even more obvious linkages between the "rise of modern science" and the technical requirements of pre-industrial, pre-capitalist European society. The point I want to stress is that, to adopt the vocabulary of historians of science, "externalist" views of scientific development cannot be held separate from "internalist" perspectives which focus primarily on the putative linear progression from, say, Copernicus through Kepler, Galileo and Descartes, culminating in Hobbes. Instead, the integration of social, political and other processes with intellectual ones necessarily implies that there is an indentifiable and significant geography of the scientific revolution as well as in it.

In this way I hope to operationalise a "geographical imagination" which is not just another element in the intellectual toolkit. After all, the deeply rooted position of spatial issues in all aspects of scientific discourse discussed here points to the inestimable assistance a fully fledged geographical imagination may lend to a more complete understanding of human development in general. "Space matters", to invoke a popular geographical battle cry, not just because putatively aspatial discourses, such as the "scientific revolution" can be shown to have committed abstract 'hostages to fortune' of a spatial nature. Spatial concepts deeply implicated, ontologically as well as epistemologically, within disputations about physics and metaphysics can be shown to have had direct and indirect influence upon the developmental possibilities open to those discourses. Nor does space matter only insofar as it can be shown that the seventeenth century trajectory taken by scientific discourse is related to a set of geographically constituted human interests. However fruitful and important these perspectives may be, they are still only two of the 'trees' of which a larger critical-geographical 'forest' is comprised. Where I propose geography might achieve its fullest


64 The literature on the historiography of science is vast, though many have contended that it can be classified as either "externalist" or "internalist" in perspective. See for example the essays in Roger Stuewer (Ed) 1970: Historical and Philosophical Perspectives on Science, Minnesota Studies in the Philosophy of Science, Vol.5 (Minnesota: Univ. of Minn Press) and also David Bloor 1982: "Durkheim and Mauss Revisited: Classification and the Sociology of Knowledge" Studies in the History and Philosophy of Science 13 pp.267-97.

65 This geographical perspective hearkens to David Harvey's observation that the submergence of space in the human sciences entailed necessarily a specific spatial structuring. See Harvey 1989.
potential is in the elucidation of the relationships between the spaces 'in' its subject matter and the spaces 'of' its subject matter. These two strands of the geographical imagination can be united in a concept of spatiality which opens up the possibility of tracking the dialectical co-development and co-dependence of modes of rationality and their intentionalities which in turn influence material space time events.

One of the most complex and far reaching aspects of the intellectual process of drawing the partitions between science/non-science, fact/value, physical/metaphysical, etc, involves the way in which the very partitions themselves were rendered transparent to the analytic gaze. Part of the genius of the new system was that this partition process, once underway, included as part of basic matrix the denial and effacement of its own partitions as social and cultural creations. Galileo, Descartes and Newton did not adopt the distinction between primary and secondary qualities simply because it was a fruitful metaphor. They adopted this ontological partition because they knew it to be True. Mathematical expressions of physical relationships, and conversely, physical relationships which could be fit into mathematical equations, were held to be true because mathematics, and especially geometry, was believed to produce the highest level of epistemological certainty. Moreover, as an artificial partitioning of nature into computationally digestible chunks, this partition loses its identity as a partition once it is ideologically contrasted with the 'long philosophical night' which preceded it. It is clear that the major philosophers of the day perceived of the preceding scholasticist and alchemic traditions as confused partitionings of the 'true' nature of the world. Consequently their own systemic postulations were not to be taken as 'partitions' per se, which would have been artificial, but rather as emancipatory rectifications of prior erroneous conflations, such as Hermeticism and Aristotelianism. This process has been neatly aphorised by Pierre Bourdieu, in a more contemporary context, with the more general observation that "we tend to produce the naturalisation of our own arbitrariness".

66 Starting with Francis Bacon natural philosophers recognised progressively more veracious levels of knowledge, each with their own methodology. On Bacon's account, mathematical deductivism, shorn of empirical content, was rejected for a more integrated emplacement of mathematics on the "ladder of the intellect" See Francis Bacon 1960: The New Organon and Related Writings edited by Fulton H. Anderson (New York: Liberal Arts Press) p. xviii.

Much about the spatiality of philosophy at the dawn of modernity is most perspicuous and accessible at the locus of the fundamental partition between physics and metaphysics established during the seventeenth century. Indeed, this partition is also complicit in the linguistic redefinition which distinguished, to the modern mind, the realms of the "philosophical" and the "scientific". More specifically, the partition between "physics", as a positive field of knowledge about an objectively accessible world, and "metaphysics", as an ephemeral, fundamentally subjective realm of 'mere speculation', has had a major formative influence on western European philosophising in the modern period. This has had the effect of elevating "science" to a truly exalted status even as it has denigrated all those fields of study which could not easily conform to the new intellectual partitions, in a process which Morris Berman, echoing Max Weber, has referred to the "disenchantment of the world". As geographers have increasingly come to realise, the objects of their study, "spatiality" or spatial relations, occupy a highly ambiguous position with respect to this partition. While, for example, Chemistry could locate itself quite comfortably within the physical side of this conceptual surface, and Theology could be squarely ensconced in the metaphysical half, geography, perhaps no less than history, problematically straddles this divide. As scientific institutions and popular culture developed around this partition it became something of a self-fulfilling prophecy, creating further problems of disciplinary autonomy and legitimacy for Geography, and especially human geography. There can be little doubt that, in part, it was fear of being relegated to the 'metaphysical' camp, with the concomitant loss of institutional support and prestige, which compelled many of the human sciences, including geography, to take the "quantitative revolution" in the middle part of our own century.

But, an important problem remains, which has so far been largely held in abeyance. If one accepts that the partition between physics and metaphysics is central to post-seventeenth-century western science, then one is forced logically, also to accept their fundamental union. This follows irrespective of whether or not one accedes to my claim that this partition is ideological, in the sense that it is part of a general set of ideas about the world which are conceived of as Truths.

rather than as (mere) ideas. This union also amounts to more than just saying that physical principles, in their existence as as special class beliefs, are also necessarily metaphysical. More prosaically, there is more to the union than the claim that there is both a 'science of politics' as well as a 'politics of science'. This common claim, like most truisms, seems to me to reify the distinction its seeks to criticise by accepting the partition as a partition right from the outset. After all, it is fairly obvious that postulating the distinction between physical and metaphysical discourses presupposes the reality of the distinction which cannot avoid losing its meaning outside of the dichotomy itself. Physical objects cannot exist as such without metaphysical objects against which to contrast them. In the case of conceptions of space for example, Piaget has shown how children learn concepts of abstract space through contrasting space "here", with spaces "there", spaces of comfort, with spaces of discomfort, etc. Consequently the ideology of their radical separation, present from Galileo onwards, is in fact a backhanded assertion of their connection, both in the specific instance of Piaget's space and also in terms of the broader bonds between physical and metaphysical realities.

The adoption of the physical/metaphysical partition as an organising theme for the thesis is meant to augment the discussion of spatial issues at the ontological and epistemological levels by focussing the analytic gaze on a site where the "natural attitude" modern philosophy inculcates about questions of space and spatiality can easily be disclosed as problematic and highly charged. By attempting to show some of the ways in which concepts of space stretch across this basic partition I hope to reproblematise both those spatial issues and also the partition upon which they are predicated. Likewise, the decision to concern myself almost exclusively with the primarily philosophical and scientific texts of the seventeenth century is part of an overall strategy for recovering the latent or hidden spatiality of some of modernity's key early programmatic statements. Figure 1 (above) shows the intersection between analytic frameworks which I plan to operationalise in this thesis. On one level I will attempt to let the

69 Discussed in Robert Sack 1980: Conceptions of Space in Social Thought: A Geographical Perspective (Minneapolis: Univ. of Minn. Press) p.122ff
philosophical material 'speak for itself' as far as is possible, in a manner not entirely unlike standard histories of philosophy. However, this strand will be tempered by the attempt to conjoin with it a sensitivity to the significance of material events and the social and political biographies of those who worked with philosophical and scientific ideas. With these two aspects united in a more or less holistic account it should be possible to say something about the abstract philosophies of space and spatial relations and (as well as distinct from) the institution of a geographical 'science'. Geography's possibilities, as well as its constraints in a modern or postmodern era can thereby also be brought more clearly into view.
Plan of the Work

In chapter 2 I will present a brief historical geography of seventeenth century philosophy. There I will try to locate the philosophical developments which are signal to modernity in their appropriate space-time contexts. In some measure this will be recognised as a project of intellectual biography, that is to say, placing the intellectual careers of important thinkers in historical geographical context. It cannot possibly be of little significance, after all, to our understanding of the "scientific revolution" that Europe in the seventeenth century underwent marked political, social and economic turmoil. As Steven Toulmin has recently observed with respect to precisely this period:

The general crisis of the seventeenth century was, in short, not just economic and social, but also intellectual and spiritual: the breakdown of public confidence in the older cosmopolitical consensus.\(^7\)

In their attempts at systematicity and certainty seventeenth century thinkers were in effect trying to come to terms with an ambiguity which was not just intellectual, but also social, political, economic and cultural. But I certainly do not wish to go overboard in the other direction either, suggesting in the manner of much "externalist" historiography, that the thinkers and their ideas were solely a product of their times.\(^7\) The ideas developed during this period were in important respects individualistic responses to the practical as well as philosophical situations they found themselves in. All of them imputed a socially as well as philosophically therapeutic role to their own formulations and thought of them as correctives to some generalised malaise. But once articulated, individual philosophies became part of broader social and cultural contexts and could be interpreted and subtly reshaped by broader forces; what Toulmin has referred to as the "hidden agenda of modernity".

In the third and fourth chapters I will work to respatialise critical connections between physics and metaphysics which were initially effaced in the thought of Newton and others connected with the Royal Society in England. Of course, the severance of the relationship between physics and metaphysics was

\(^7\) Toulmin 1990p.71
\(^7\) See the earlier discussion of "Historicism" above, and also the discussion of "internalism" and "externalism" in the historiography of ideas in Chapter 2
only rendered complete with the work of David Hume and Immanuel Kant at the end of the next century. Still, the recovery of this connection in this historico-geographical context, so long buried that we now tend to consider it counterintuitive, is of central importance for making sense of the divergent conceptions of space and spatiality which different intellectual groups put forward. In chapter 3 I will compare and contrast ontologies of self and substance in two very different systems of natural philosophy. Both Cartesian "plenism" and Newtonian "atomism" vied for recognition as the one "true" description of the natural world. However, in so doing, both systems had to confront the knowing subject's relationship to the objects under study. As is well known, this problem involved some form of dualism which I will interpret in terms of the nascent partition between physics and metaphysics. Chapter 4 will take a basically similar analysis to a rather higher philosophical scale, seeking out connections between the primarily physical scientific discussion elaborated in chapter 3 and corollary theories about the organisation of political and social space. Both of these chapters will, I hope, assist in the reconstruction of some of the critical and fascinating connections between theories of space and the constitution of identifiably "modern" subjectivities.

A concern with theories of space and and their relation to issues of subjectivity are central to the fifth chapter. This chapter starts with a discussion of the seventeenth century dispute between those, such as Descartes and Hobbes, who adopted a "relational" conception of space, and those, such as Newton and Boyle, who championed the more familiar (to us moderns) "absolutist" view of space. While these disputes were often carried out in explicitly physical, as opposed to metaphysical, terrain, especially in the work of Newton and the Royal Society, they can be shown to be fundamentally connected with a fairly specific and constrained conception of the individual knowing subject. For the most part subjectivity was never explicitly theorised in these writers, and indeed therein lies much of my interest in that issue. By the end of the seventeenth century a particularistic conception of the subject, and his/her relation to objects in the world and other subjects had been incorporated into the "natural order". The critical interrogation of this model of subjectivity has become a central feature of contemporary debate in the human sciences.
In the last chapter I attempt, in a preliminary fashion, to sum up some of the results of this analysis. Of particular interest here are the possible implications of my analysis for the development of an explicitly self conscious geographical discipline. What impact might the entrenchment of particular modalities of space and spatial relations in seventeenth century philosophy have had on the potential configurations of a geographical discipline? It seems clear, even at the outset, that geography, like all the other disciplines, would have been shaped and delimited in its possible configurations by those epistemological and ontological models to which it looked for guidance and, more importantly, legitimacy. By extension, this examination of spatial thinking and geography can be brought to bear on issues surrounding the putative "end" of modernity and possibilities for a truly postmodern succession.
Chapter 2

Into Modernity's Basement:
An Historical Geography of Seventeenth Century Philosophy

2.1 Introduction
2.2 The Seventeenth Century Crisis of Confidence
2.3 Political Economic Aspects of Cartesianism and Baconianism
2.4 Concluding Comments
2.1 Introduction

Recent debates in the historiography of science have tended to revolve around the problem of reconciling "internalist" and "externalist" perspectives. These days few researchers seem willing to defend the exclusivity of past tendencies to see intellectual development either as unfolding according to some "internalist" logic or as mere passive responses to external processes of a social, political, economic or other nature. In a way the division between "internalism" and "externalism" in historiography is particularly acute in the area of the history of ideas, since the subject matter of this pursuit is oddly both tangible and ephemeral at one and the same time. While ephemeral and almost interminably fluid in interpretation, ideas, such as those about political and natural order, are the undeniable substrate of all material practices. What actors believe to be real, natural and desirable will have a profound impact on the formation of their actions. Even so, recent suggestions that epistemic facts, to take the argument a step further, are social and political facts have generated a great deal of critical discussion. However such debates are ultimately resolved it is important to remember that what is at issue are the means of our contemporary theorisation of past events, certainly not the 'events themselves'. The overriding historiographical problem, in the absence of any privileged point of reference, perforce centers on how to fashion an understanding of past events which links them with present conditions as we theorists in the 'here and now' perceive them. The 'events themselves', if taken as the pristine goal of "correct" historical understanding, will forever elude our efforts, since we cannot ever know, a priori, if our understanding is moving in the "right direction", or even what that "right direction" might look like. The notion of a "right direction" is an ontological as well as an epistemological undecidable. Of course the problem admits of some circularity since to hold to a belief in the possibility of positivistic knowledge, about history or anything else, at some point implies an a priori standard against which knowledge claims may subsequently be evaluated.

2 David Bloor 1982: "Durkheim and Mauss Revisited: Classification and the Sociology of Knowledge" Studies in the History and Philosophy of Science 13 267-297, see also the subsequent debate of Bloor's "Strong Programme" in the same journal.
3 This point may be applied as a critique of Hartshorne's comment cited above.
And the prejudices this imposes on the empirical material were discussed in the introductory chapter. Theoretically speaking, ends become conflated with means and the whole intellectual project develops a subtly anti-hermeneutic closure.

Still, there should be little cause for concern that historical theorisations may never achieve an 'undistorted' and/or 'comprehensive' picture of whatever period we're interested in. After all, in every time and place the actors themselves have perforce acted with only "partial", locally rooted, and often highly idiosyncratic understandings of their situations and the potential consequences of the choices open to them. Since there is nothing preventing actors from acting on partial or even erroneous notions, then the whole idea of coherence in historical narrative is greatly complexified. In the seventeenth century intellectual context with which I am concerned this is no less true. The philosophical systems of Descartes, Hobbes, Newton, Boyle and others were self consciously developed by those individuals as responses to the historico-geographical context they perceived themselves to occupy. The divergent epistemological, political, and theological proposals of Hobbes, Descartes and the "rationalists" on the one hand and Boyle, Newton and the "experimentalists" on the other were designed in the context of different experiences of the events then sweeping England and Western Europe. The personal biographies of these men (and they were almost always men, female intellectuals being rare and in any case considered 'oddities') can be shown to dovetail with the material processes within which they were enmeshed in the delineation of their philosophical frameworks. Thomas Hobbes, forced into self exile after 1640 by the political instability of the English Civil War, worked out a careful system for analysing the circumstances of political integration and disintegration. Robert Boyle also devoted much of his youthful attention to moral and political order, and in fact was first attracted to the ideas of the Greek atomists via their ethical discussions. Subsequently both men became convinced of the utility of closely articulated moral and natural philosophies. Despite these commonalities, the systems they developed were markedly different, and were seen to be so by their contemporaries. These connections, between ideas and context, are the subject matter of this chapter. These partial and highly variable interpretative

topologies will be crucial to any attempt to improve understanding of intellectual change and its myriad relationships to material events and processes.

In this chapter I will introduce some of the major seventeenth century philosophical figures discussed in this thesis in terms of their relationships to the times and places in which they lived and worked. It is my contention that the philosophical ideas, about ontology, epistemology and spatiality, examined in later chapters can be more deeply understood if some attempt is made to elucidate the manner in which the practitioners themselves formulated and sought to deploy them. There is, to use the terms I have employed in the introductory chapter, a geography of as well as a geography within seventeenth century intellectual ferment. Ideas about metaphysical and physical spaces are undoubtedly related to the time-space contexts of their introduction, deployment and diffusion. Indeed, the whole notion of intellectual "discovery" can itself be readily shown to have been implicated in the ascendance of new ideas about truth, error and proper methodology. In the next section of this chapter I will present some of the cultural, social, economic and political dimensions of the generalised turbulence and lack of cultural confidence which arguably typified at least the first two thirds of the seventeenth century. Two very different philosophical responses can be shown to have developed by intellectuals working within this historico-geographical context. About mid-century Rene Descartes and Thomas Hobbes proffered innovative, and highly iconoclastic, models of certain knowledge which were, somewhat paradoxically, used to underwrite conceptions of political order which were profoundly conservative and even reactionary. In the decades following the elaboration of "Cartesian Rationalism", as it has come to be known, other intellectuals, centred on Oxford University and Gresham College in London, promoted an epistemology, which, if rather more conservative, was nevertheless conjoined with a much more liberal ("Latitudinarian" is the term which was often applied, tellingly, at the time) political perspective.5

5 Micheal Hunter has speculated about the relationship between political and epistemological preferences in seventeenth century England. He makes the intriguing observation that Cambridge University, which remained largely Royalist throughout the Civil War, tended to harbour many more adherents to Cartesianism than Oxford, which early on adopted the Parliamentary cause. Of course the connections are difficult to evaluate given the fact that university posts were often political sinecures, and that the political allegiances of office holders would often shift markedly with changes in the political wind. See Micheal Hunter 1981: Science and Society in Restoration England (Cambridge: Cambridge Univ. Press).
2.2 The Seventeenth Century Crisis of Confidence

Regardless of the particular variant of the perennially popular "general crisis" model of the seventeenth century which one favours, it is fairly clear that an atmosphere of generalised crisis did in fact prevail at the time. Toulmin contrasts this period to the relatively sanguine humanism of the sixteenth century, epitomised by the writings of Michel de Montaigne.\(^6\) The metaphysical poet John Donne (c.1571-1635) was arguably speaking for this era of anxiety when, in a threnody tellingly entitled "An Anatomy of the World" (written for a young woman he apparently never met) he wrote:

Tis all in peeces, all cohaerance gone:
All just supply, and all relation:
Prince, Subject, Father, Sonne, are things forgot,
For every man alone thinkes that he hath got
To be a Phoenix, and that there can bee,
None of that kinde of which he is, but hee.\(^7\)

For Donne, the distemper of the age was as deeply rooted as it was intractable. As he wrote the poem not long before his ordination as a minister of the Anglican Church the controversies between Catholicism ("Popism") and Anglicism, and between the latter and the rapidly proliferating Protestant sects may have weighed heavy upon him as he wrote.\(^8\) More than mere hegemony was at stake as the new Protestant sects managed to challenge nearly the entire corpus of theological orthodoxy, thus undermining the dominant worldview and institutions. Issues of religious faith appear to have had an economic and political role to play as many of those on the leading edge of these social and

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7 As Toulmin points out, this poem is seldom included in selections of Donne's poetry in spite of its stunning originality in comparison to his other works. This is doubly interesting given that this very poem has become an important touchstone of much contemporary history and philosophy of science. The full text of "An Anatomy of the World" can be found in H.J. Grierson (Ed.) 1979 (1933): Donne's Poetical Works, London: Oxford University Press. This is a middle period poem for Donne; composed when he was forced by his penury to write obsequious dirges for the elites of his day. Later poems, written after he was ordained a minister of the Anglican Church, are more ecclesiastical in subject matter and style.
8 Donne, born to a Catholic family, received his early education and upbringing within England's small but close knit Catholic community. Fired from his position as secretary to a minor noble, Donne lived in relative penury. His fortunes changed only when he renounced his Catholicism and took orders in the Church of England. This biographical transition is mirrored in his poetry. See Charles Coffin 1958(1937): John Donne and the New Philosophy (New York: Humanities Press).
economic changes rejected traditional theologies, both Catholic and Anglican, and embraced one of the upstart Protestant sects.

Of course, these theological conflicts are but one aspect of the general crisis of the period. During the seventeenth century Europeans and the nations in which they lived were subjected to seemingly unprecedented turmoil, transformation and even wholesale destruction. In France the rivalry between the houses of Bourbon and Valois divided the country politically, socially and religiously, creating conditions for repeated and inconclusive factional conflict during the first half of the seventeenth century. Of course this was as nothing compared to the terrible human cost of the Thirty Years War, fought between the Catholic Holy Roman Empire and the Protestant states of northern Europe, during which it has been estimated that more than 25% of the Germanic populations of Northern Europe were exterminated. And England, having just concluded what was even then seen by many as a "Golden Age" roughly coincident with the long reign of Queen Elizabeth, was to experience during the seventeenth century repeated civil and political conflicts culminating in civil war, first between Charles I and his Parliament in the 1640s, and then between the Parliament and the protestant independents who controlled the army during the 1650s. During the century, five monarchs were coronated, of which one (Charles I) was beheaded, and another (James II) was driven from the throne in the virtually bloodless coup d'état of William of Orange, whose own monarchy managed to close the century on a relatively peaceful note.9

But the point of the General Crisis hypothesis is blunted if it is interpreted solely in terms of the political and military havoc and the ambiguous and often inchoate cultural instability of the period. To be sure an horrific amount of blood was spilled over questions of religious and political power during this century throughout Europe. But there were other processes unfolding which would ultimately impose a great deal more turmoil and change than these more overt conflicts. Social and economic processes progressively undermined the

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principle foundations of feudalism and laid the groundwork for a new political economy based on commodity exchange. The long Enclosure movement, underway in England since the middle ages, was rapidly reaching a point where the established social and economic order was deprived of the land base and tenure system needed to support it.¹⁰

![Figure 2: Enclosures of Common Fields 1700-1800](image)

As this process gained momentum in the late seventeenth century, it had the effect of foreclosing on the already meagre livelihoods of small holders and peasants in many parts of the country. Large scale production of wool and agricultural products on the enclosed lands was rapidly becoming the dominant industrial pattern. Fewer labourers were needed to work the land under the new

¹⁰ H.C. Darby 1973: "The Age of the Improver 1600-1800" in H.C. Darby (Ed) A New Historical Geography of England (London: Cambridge Univ. Press) contains some useful maps about the extent of enclosure during the early modern period. Figure 1 come from p.323 of this text.
conditions and, more importantly, these were increasingly employed not the basis of reciprocal obligations between landholder and peasant, but rather on a more impersonal commodity basis. Perhaps, symbolic of the passing of the feudal order in England was the passing of an Act just after the Restoration in 1660 formally abolishing manorial obligations. Ultimately many of the displaced peasants were driven from the land and into the burgeoning cities where their labour power was commodified just as the land they had previously worked had been. The towns and cities of England also began to acquire new functions as economic and political centres, increasingly highly specialised, within new regional and national hierarchies. As Hohenberg and Lees put it:

Protoindustrialisation...flourished best not as town or country, but as a complementary system involving both rural and urban places and the various elements of a regional urban hierarchy.

The development of political economic complementarity was acted out at the level of the state as well, as the state become the locus for the administration and regulation of the body politic as well as for the circuit of capital circulation in the nascent commodity economy.

The stanza from Donne's "Anatomy of the World" quoted above would appear to address all three levels of "general crisis" introduced in the last few paragraphs. "All just supply and all relation: Prince, Subject, Father, Sonne, are things forgot" might refer to the immanent collapse of the feudal political economy as well as the threat then posed to orthodox theology by the battles between Catholicism, Anglicism and Protestantism. And clearly the last three lines of the stanza, in which "Every man alone thinkes that he hath got to be a Phoenix" bespeaks a sense of the anarchy of a society swirling with alternative worldviews, none yet strong enough to impose dominance, and the net product of which, as Donne surely realised, would have been to cheapen them all. Remember though, that Donne penned these lines in 1612, six years before the

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13 Though his discussion is primarily theoretical, Giddens has observed the shift from "traditional" states to "modern" ones in terms of the shift from a reliance on "authoritative resources" to an increasing emphasis on "allocative" ones. See Anthony Giddens 1987: The Nation State and Capitalism (Berkeley: Univ. of California Press) pp.85; 142ff
outbreak of the Thirty Years War and almost thirty years before the English Civil War, so one must be careful in casting him as anything more than a prescient observer.

Irrespective of my own interpretation of the poem, Donne himself in the same poem located what he took to be a major contributing factor to the malaise:

And New Philosophy calls all in doubt,
The element of fire is quite put out:
The sun is lost, and the earth, and no man's wit
Can well direct him where to look for it. (my italics)

What seems to me to be uniquely MODERN about Donne's poem "An Anatomy of the World" is the fact that he locates the cause of the ennui in a "New Philosophy" which is surprising recognisable to contemporary eyes. Donne, according to Charles Coffin, expressed poetically what he took to be the replacement of a more morally and aesthetically balanced epistemology with a new purely mechanistic and instrumental ethos. The "element of fire" which is "quite put out" is that which is central to both the Alchemic and Aristotelian traditions, as a primal element also a means of elemental transmutation. While the disavowal, so unavoidable after Copernicus and Kepler, of the Aristotelian cosmology of superimposed spheres leaves the cultural vacuum expressed in the last two lines. Donne expresses poetically a common seventeenth century preoccupation with the relationship, to put it in Aristotelian terms, between the parts and the whole of society in a situation of paradigmatic reformulation.

So far I have interpreted Donne's poem as a regretful paean to a passing age. But Donne's poetry is not merely an expression of the seventeenth century doctrine of senescence; that is, of the millenarian notion that the post-diluvian world was approaching its final cosmological judgement. Donne in fact straddles the divide between the old and the new regimes, that is between the "Ancients" and the "Moderns". While adroitly integrating the developments of the "new philosophy" with cultural and social processes, he himself opted for

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14 Coffin, 1958 pp.9-11
15 For more a brief sketch of the Aristotelian cosmology see the introductory section of chapter 3, and especially the diagram of Fludd's cosmology
16 For a discussion of senescence theories as they relate to conceptions of nature and space see Clarence Glacken 1964: Traces on the Rhodian Shore (Berkeley, Calif: Univ. of California Press) pp.355-428
the comfort of the old regime, ending out his years as a scholastic clergyman deeply repentant of his youthful self. Despite this backward looking conservatism Donne still managed to put his finger on one of the signal problematics of the "new philosophy". In seeming anticipation of impending developments in natural philosophy Donne wrote in 1611:

Our Bodies why do we forbear?
They're ours, though they are not we, Wee are
The intelligences, they the spheares.\textsuperscript{17}

Moreover Donne homes right in on the very heart of seventeenth century ontological debate sparked by Cartesian dualism when he marvels at

That subtile knot [linking "intelligences" and "spheares"; mind and body] which makes us man [sic].

Donne's primary concern, especially in his later poetry and sermons, is to uncover the potential implications of this "subtile knot" for social and cultural solidarity. The project of seventeenth century philosophy, whether in its rationalist or experimentalist guises, was also centrally concerned with the reconciliation of this "subtile knot". And indeed, this thematic has preoccupied much of the western philosophical tradition ever since.\textsuperscript{18}

I have presented Donne as an astute commentator on his age, and in fact as one of the first to perceive the order which was emerging out of the turmoil of his time and place. Donne was, however, one who's loyalties were deeply divided between those aspects of the ancient regime whose passing he regretted, and the, as yet, unfulfilled promise of the new epoch. Thus it can be fairly said, I think, that Donne straddled the divide between the ancient Scholastic tradition and the nascent Project of Modernity. However, even as Donne wrote, others were constructing innovative new models about the possibility and procedures for procuring certain knowledge about a radically reconceived cosmos. Against the conservatism of Donne, Francis Bacon (1561-1626), for example, clearly took the side of the "moderns". Over the next few decades Thomas Hobbes, who had served as Bacon's amanuensis, Rene Descartes and Pierre Gassendi would

\textsuperscript{17} Grierson 1979, "

elaborate quasi-Baconian programs into more complete physical and
metaphysical systems. Robert Boyle, Robert Hooke and others would ensure the
lasting intellectual hegemony of their rather different Baconian schema, by
institutionalising it in the Royal Society of London.

2.3 Political Economic Aspects of Cartesianism and Baconianism

In 1662 the "Royal Society of London" received its official charter from the
only recently restored Charles II. Counted among its charter members was a
diverse assortment of clergy, "schoolmen", nobles, military men, and
merchants. The poet Abraham Cowley, the experimenter Robert Boyle, the
mathematician and architect Christopher Wren, nobles such as Lord Brouckner
and the Earl of Northampton, as well as theologians such as Henry More and
John Wilkins were all early members. Though the Royal Society had, for all
practical purposes, existed for many years at Oxford University and Gresham
College, its formal institutionalisation under Royal patronage was of high
significance for the resolution of philosophical battles then raging. Under its
banner clergymen, anxious about the apparent marginalisation of God in
Cartesian ontologies and epistemologies (as expressed in the "Rule of Faith
Controversy")20, and new economic and political elites, interested in securing
their lease on power and developing tools for exploiting the incipient bourgeois
space economy, worked to develop a new system of knowledge production. This
new philosophical system, more an 'accommodation' of new and old intellectual
paradigms in the context of a rapidly changing political and social landscape than
a "revolution", very quickly became a powerful mechanism for shaping and
legitimising knowledge claims. Before the end of the seventeenth century the
sanction of the Royal Society, or at least of prominent members of that Society,
became almost mandatory for the acceptance of any claim to 'true' knowledge.
Inability to secure such a sanction meant, in many cases, that one's knowledge
claims would not be accepted as "true". More to the point, once certain

19 The term "schoolmen" referred to those who worked within the established Aristotelian
framework, especially with its reliance upon syllogistic logic. During the seventeenth century
the moniker acquired a derogatory status as increasing numbers of intellectuals sought to distance
themselves from this paradigm.

20 Henry van Leeuwen 1963: The Problem of Certainty in English Thought 1630-1690 (The Hague:
Martinus Nijhoff)
individuals and institutions became representative of the "correct" processes of intellectual discovery and justification, knowledge claims existing outside the new structures *could not* be accepted.

Figure 3: Frontispiece to Sprat's *History of the Royal Society*

The program of the Royal Society explicitly hearkened back to the vision of a "New Atlantis" promulgated by Francis Bacon at the beginning of the
seventeenth century. And in fact Bacon himself was adopted as the intellectual patron of the Society (see Figure 3). The adoption of Bacon as intellectual progenitor of the Royal Society may well have been driven as much by his aristocratic legitimacy as by his ostensible scientific achievements, given that the mid seventeenth century harboured a profusion of similar scientific programmes. To be sure his vision of a "Solomon's House" where natural experimentation would not only be supported, but that experimenters themselves would be able to occupy positions of social prestige and stature must have appealed to those working outside the Aristotelian tradition. But other groups, such as that organised by Samuel Hartlib and John Dury promulgated similar utopian visions. And the programme of the Royal Society also bore strong resemblances to the Lincaean Academy established by Galileo at Turin which Hobbes, Boyle and others visited while on their "grand tours" of the continent during the middle decades of the century. Even more proximately in time and space, the Academie Francaise was established within a few years of the Royal Society by Louis XIV's lieutenant Colbert. During the seventeenth century there was a veritable efflorescence of ideas and plans for model scientific communities.

Why then, given the broad range of similarly oriented alternative programmes, did the Royal Society of London so rapidly become the very embodiment of experimental rationality? Certainly the high esteem in which it was held was widespread throughout the European continent as is suggested by Count Magalotti's description of a meeting of the Society:

They observe the ceremony of speaking to the president, waiting from him for permission to be covered, and explaining their

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22 There has been considerable debate about Bacon's status as a scientist; see Rose Mary Sargeant 1986 and Margaret Jacob 1988 for further discussion of this point.
24 Margaret Jacob 1988: The Cultural Meaning of the Scientific Revolution (New York: Alfred A. Knopf), p.61. The Academie Francaise was founded on the strength of the activity of the Montmor Academy which was itself a continuation of the work of the circle centred on Abbe Marin Mersenne in the 1620s and 30s.
sentiments in few words relevant to the subject under discussion; and
to avoid confusion and disorder one does not begin before the other
has ended his speech. Neither are opposite opinions maintained
with obstinacy, but with temper, the language of civility and
moderation always being adopted among them, which renders
them so much the more praiseworthy...25

Moreover, the hegemony of the Royal Society is also demonstrated by the
numerous scientific controversies which were invariably decided in favour of its
members.26 Surely, given the myriad potential alternatives, and the multiple
intellectual groupings which opposed both Scholasticism and Cartesianism, it is
of some interest and significance that the Royal Society should become, so
quickly and completely, an internationally recognised arbiter of experimental
progress and rationality. It was neither the largest nor the best established of the
new scientific societies during this period. Several of the Italian societies had
been operating since the early seventeenth century. More importantly the Royal
Society, though Royally chartered, was not Royally patronised financially, an
impediment which caused the Society to lurch from fiscal crisis to fiscal crisis
through the end of the century. By contrast, as Heffernan has observed, the
French "Academie" was well funded by the state (which recognised its value as
an instrument of economic expansionism).27

The explanation of the Royal Society's rapid acquisition of intellectual hegemony
comes, I think, comes in two parts. First it is worthy of note that the structure of
the Royal Society and its philosophical program was such that a number of
interests could comfortably ensconce themselves within it. It is significant that
charter members included among their number clergy, military officers, nobility,

25 Count Lorenzo Magalotti on the Royal Society, 1669 in Andrew Browning (Ed) 1967: English
Historical Documents, Vol. VIII 1660-1714 (London:Eyre and Spottiswoode) p.481, though the
Count was not without reservations about the Society; see Chapter 4.

26 The classic example of such a controversy is probably that between Leibniz and Newton over the
invention of the infinitesimal calculus. Though recent study has convincingly argued that the
two men likely developed the method more or less simultaneously, Newton's claim was secured
by the official and unofficial backing of the Royal Society. The Newton/Leibniz debate over
the constitution of space was similarly decided in Newton's favour, and on even more dubious
grounds. See also the dispute between Boyle and Hobbes about Boyle's air pump trials discussed
in Chapter 4.

27 Mike Heffernan 1990: "From Knowledge to Power: The Geography of Geographical Knowledge
in Late Nineteenth Century France" Paper presented at the Annual Conference of the American
Assn of Geographers.
and merchants as well as practicing experimental philosophers. Figure 4 indicates

![Table](image)

Figure 4: Social Composition of the Early Royal Society

the rather high preponderance of members of the society who were not on the face of things experimental philosophers.\textsuperscript{28} Also interesting is the fact that this

\textsuperscript{28} Micheal Hunter 1982: \textit{The Royal Society and its Fellows 1660-1700} (Chalfont St.Giles: British Society for the History of Science); There are, it must be admitted, problems involved in interpreting the classifications Hunter has adopted in his presentation of the social composition of the Society. Robert Boyle, to take a prominent example, was both an important experimenter and also a member of the landed aristocracy (He was the youngest son of the Earl of Cork and maintained estates at Stallbridge in Dorsetshire and in Ireland.) Hunter is not clear about how categories were adduced. Still, the data collected by Hunter do give some sense at least, of the
social composition of the society survived virtually unchanged through the end of the seventeenth century. This social heterogeneity may have been important insofar as it afforded the Society entrés into several different class grouping, for the purposes of soliciting financial support and also disseminating results. Thomas Sprat, in his elegiac "history" of the Royal Society (1667) affirms this heterogeneity as a positive check against

Two corruptions of learning, which have been long complained but never removed. The one, that Knowledge still degenerates to consult present profit too soon; the other that philosophers have been always Masters and Scholars, some imposing and all the others submitting...  

The former "corruption" occurs where intellectual work is too narrowly focused upon parochial interests or "present profit". The phrase "present profit" is undoubtedly apt also given the explicitly pragmatic orientation which influenced the work of the Society. A review of early editions of the Transactions of the Royal Society shows an emphasis on solving technical problems related to the production of agricultural commodities and industrial production. And the statues of the Society drawn up by Robert Hooke, the Society's first "Curator of Experiments" called on the society to "...improve the knowledge of natural things, and all useful arts, manufactures, mechanick practices, and inventions by experiment..."  

The latter "corruption" recognises as an enemy common to all experimental philosophers the moribund Scholastic tradition, and also Cartesianism as well. John Wilkins, and Joseph Glanvill both recognised that the empiricist preoccupation with "matters of fact" and direct epistemological access to natural phenomena could be reconciled with a religious doctrine which stressed faith as a necessary correlate of epistemological certainty and a relatively free relationship between humanity and God.  

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29 For example, Robert Hooke's Curatorship of Experiments for the Society was paid for by the specific subscription of a local businessman.
31 This quotation is contained in Margarita Bowen 1980 p.102.
32 van Leeuwen, 1963 Ch. 3.
experimental spheres of influence began to emerge which, rather than competing, actually augmented one another. Subsequently, to take just one example, Anglican theologians were able to mobilise the Society's guiding principle of "Nullius in Verba" ("Take the Word of No one") to elaborate an ostensibly scientific solution to the "Rule of Faith" controversy. As van Leeuwen has noted:

The solution by English Protestantism to a theological problem as it was expanded in the Royal Society...is integral to a complete historical understanding of British philosophy.\textsuperscript{33}

Parallelisms of these sorts, as might be expected, served to reciprocally strengthen both the overall program of the Royal Society, as well as that of its constituent interests.

Even while occupying an intellectual and social space at the intersection of multiple interests, the program of the Royal Society also assimilated and institutionalised opposition to the alternative philosophical programs of hermeticism, Scholasticism, and especially Cartesianism. The task of the Royal Society, as seen by its proponents, was to carve out a space for philosophical disputation which steered clear of alternatives which they associated with social and political disorder. This implies that the social heterogeneity boasted by some of its members was not necessarily followed up with an equal heterogeneity in scientific or political ideology. Judging from such rudimentary measures as the prominence of certain persons in the Transactions, and as proposers of new members, the image develops of a society in fact dominated by a relatively small, much less 'heterogeneous' core of active persons.\textsuperscript{34} Primarily these men sought to foreclose on both political absolutism as well as renewed republican populism as potential solutions to the political turmoil of the middle third of the century. It is certainly not hard to believe that many, especially in the aftermath of the English Civil War, harboured a profound anxiety towards anything which might

\textsuperscript{33} van Leeuwen 1963 p.152

\textsuperscript{34} The eight most frequent proposers of new members in the Royal Society (1660-1700) were, in descending order John Wilkins, Dean of Ripon and later Bishop of Chester who had steered the Oxford Philosophical Society during the 1640s and 50s; Sir Robert Moray, Lord of the Exchequer; Earl of Northampton; Viscount Brouckner, mathematician, Chancellor to the Queen and first president of the Royal Society (see Figure 2); Henry Oldenburg, philosopher and first secretary of the Society; Paul Neile, courtier and astronomer; Robert Boyle, natural philosopher and youngest son of the Earl of Cork; and Seth Ward, mathematician and Bishop of Exeter and later Salisbury. Data derived from Hunter 1982.
threaten the tenuous peace of the Restoration. As Margaret Jacob informs us, even discussions about ostensibly abstract topics were highly charged:

Natural philosophical and religious language informed discussions about the nature of political authority, the rights of the church, the relations between master and servant, husband and wife, and lord and commoner.\(^{35}\)

Robert Boyle no less than Thomas Hobbes believed that the then current state of anarchy, understood in terms reminiscent of Donne's "Anatomy of the World", could be resolved through an appeal to scientific reasoning and, in effect, an "ethical geometry". Consequently, the connection between 'right method' in natural philosophy and civil stability was a prominent feature of debate during this period.

At another point on the intellectual landscape were those working to foster the development of an intellectual infrastructure which could underwrite a political absolutism perhaps similar to that achieved by Louis XIV in France after 1661. Thomas Hobbes, to take perhaps the most prominent English example, did not conceal the fact that the goal of all his philosophising, even including his physical science, was absolutist monarchy:

What public faith is there, when there is no public? What is it that can be called public...without the King?\(^{36}\)

Like Rene Descartes and Pierre Gassendi in France, Hobbes believed that science was essentially concerned with private applications of a "reductive-composite" method, with experimentation playing only an adjunct, rather than constitutive, role. Perhaps from his early tenure as Bacon's amanuensis, Hobbes acquired a belief that experiment should augment, but not drive, scientific progress. John Aubrey relates as one of the signal moments of his intellectual development, the story of Hobbes' discovery of geometric reasoning,

\(^{35}\) M. Jacob 1988 p.79

which Hobbes deemed useful precisely because it was a complete logical system "created by man" (sic). One offshoot of Hobbes' system was a reformulation of a basically orthodox classification of the sciences (Figure 5). This privatisation of science however was conjoined with arguments for entrenching absolute royal prerogative over all intellectual activity (A point discussed in greater detail in Chapter 4). Just as the sovereign would incorporate the body politic in the Leviathan state, so too must absolute authority over private intellects be allowed in order to cancel out any possible deleterious effects of improperly applied philosophical method.39

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38 John Aubrey 1957: Brief Lives Introduction by Oliver Dick (Ann Arbor: Univ. of Michigan Press) 147-159. It is generally accepted that the story probably came from Hobbes himself, who maintained cordial relations with Aubrey, despite the latter's involvement with the Royal Society. It was Aubrey in fact who presented to the Society the well known portrait of Hobbes.
While Hobbes championed the application of "modern" geometrical reasoning and experimentation in natural philosophy, he appears to have believed that this regime could underwrite an profoundly pre-modern social and political order. Hobbes' dedication to the Royalist cause is well known, despite the fact that it is interleaved with what was, for that time, a rather unorthodox theology. He often likened his Leviathan state to the authoritarian city-states of medieval Europe and even drew occasional comparisons with the early Roman Empire. His employment, for much of his life, had been with the aristocratic Cavendish family, and in fact many of his early mathematical forays may have been inspired by his patrons' interest in military applications. Just before the outbreak of hostilities in England, Hobbes went into self imposed exile in France, eventually becoming acquainted with the circle of scientists centred on Mersenne as well as the court-in-exile of Charles II. It is interesting, and probably a direct consequence of his political conservativism, that Hobbes never interposed himself directly in political machinations. Unlike Boyle, Newton and other experimental philosophers to whom he objected so strongly, Hobbes never occupied public offices and rather obsequiously sought to ingratiate himself with those of higher social rank in the hopes of improving his sometimes precarious livelihood. In this respect Hobbes appears to have lived his life consistently with his philosophy that government rests solely and irrevocably with the sovereign.

If Hobbes stands out today for his political philosophy, then it may fairly be said that one of René Descartes' major achievements was to elaborate more clearly the deductive rationality upon which Hobbes' politics was based, though not explicitly.

Born into a family of minor prominence in 1590 Descartes was educated at the Jesuit College de la Fleche. There he received a basically Scholastic education founded upon the texts of Aristotle and the writings of Augustine, Aquinas and other Catholic intellectuals. Descartes was later to completely disavow the teachings he received at la Fleche for reasons he felt were epitomised in a series of three dreams he had annually on the evenings of

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40 Tuck 1989, pp.12ff
41 Descartes of course never framed his work as an epistemological vindication of Hobbes' politics. What I am claiming instead is that there is an implicit, though no less striking complementarity between their positions. Hobbes himself may have recognised this when he depicted himself as a kind of "underlabourer" to Descartes during the late 1640s. Tuck 1989, p.
Nov. 10, 1619, 1620, and 1621. Interestingly, like Hobbes, Descartes eschewed direct political involvement choosing instead to absent himself from France almost entirely after about 1620. Though he served in both Catholic and Protestant armies during the early years of the Thirty Years' War it is debatable that he ever saw any combat. Instead he seems to have been engaged as a sort of 'gentleman soldier', an occupation which afforded him the chance to travel and study fairly independently. Later in life he retreated completely from even these commitments and lived a reclusive existence at various places in Protestant Holland.

But if some intellectuals did continue to uphold the idea of absolute monarchy, perhaps out of some revisionist nostalgia for an Elizabethan 'Golden Age', it was also true that the times had passed them by, at least in England. By the time of the Restoration the long enclosure process, coupled with the dislocations of the Civil War and Republic had pretty well erased all vestiges of the feudal political economy. Commodity production, albeit of a decided proto-industrial nature, entailed the need for new and more keenly instrumental ways of thinking about human and technical problems. If the economic system was increasingly to be organised on a commodity basis then it would be necessary for even its 'information content to be more in tune with the distinctive rhythms of capital circulation. Circles of scholars at Tew and Oxford, as well as that centred on Samuel Hartlib responded to this need by eschewing Cartesian attempts at grand theory and the knowledge of ultimate causes as esoteric and groundless. Though specifics vary from group to group, all of them propounded some form of parliamentary monarchy and religious toleration which was generally subsumed under the rubric of "Latitudinarianism". The pursuit of knowledge would be directed towards the achievement of economically utilitarian goals and would therefore be based firmly on the reality of the world as accessed through the human senses. As Robert Boyle put it, the only right subject for natural philosophy was the observation and verification of "matters of fact"; concrete

44 Some have wondered if Descartes might have been present at the Battle of the White Mountain in 1620 at which the fortunes of his future close friend Elizabeth of Bohemia were ruined. See Vrooman 1970, p.167ff.
45 J.R. Jacob 1977, Chapter 1
visually accessible phenomena which could be repeatedly produced and observed under carefully controlled experimental circumstances. Unlike Hobbes and Descartes, under this regime experimentation was to become not merely an adjunct to knowledge, but a central constitutive element of it. Moreover the criteria for experimental adjudication were a product of ongoing public negotiation, as opposed to the more Cartesian preoccupation with the private and the narrowly mathematical. This interest in concrete replicable, technologically oriented phenomena lent itself easily to problems of industrial and agricultural production (to which a sizable proportion of the Royal Society's early proceedings were devoted) and also helps explain their preoccupation with details of methodology during the 1650s and 1660s.

There is another major difference between the philosophers of the Royal Society, and the experimental programme more generally, and the of the Cartesian epistemology. Whereas the latter maintained only a limited interest in the world of practical technical affairs, the former group was almost entirely defined by just such an interest. It is striking to observe how much of the work of the early Royal Society was devoted to problems of agricultural production, medicine and the development of machinery. This is not to say that the members of the Royal Society devoted themselves, contra Sprat's protestations, overmuch to "present profit", but only that the "present profit" of such a diverse group of members took a diverse range of forms. While there were were relatively few merchants or businessmen among the early membership, many early members of the Society were themselves involved in various levels of government administration and business activity. Robert Boyle himself was appointed in 1660 to the "Royal Council on Foreign Plantations", whose mandate was to regulate the economic activities of the American colonies. While many appointments were undoubtedly political sinecures, it is clear that Boyle actively involved himself in the affairs of the Council and advocated an experimental approach to the problems they sought to address. Of course Boyle was not the only important member of the Royal Society to blend science with
political and economic administration. Isaac Newton himself was appointed Warden of the Royal Mint in March 1696, later adding the honour of Master of the Mint, titles he held until his death in 1727. During his tenure at the Mint Newton presided over a comprehensive recoinage designed to alleviate the chronic English currency crises of the late seventeenth century, and argued persuasively for what we today refer to as fiscal "monetarism". Newton also occupied a seat in the Commons for a short time between 1701-2 though, according to Richard Westfall, he "was not prominent in any respect" of that capacity.49

2.4 Concluding Comments

The foregoing represents a preliminary attempt to bring an understanding of the major themes of seventeenth century history, primarily with respect the England, together with an inquiry into the intellectual responses these themes and events elicited. Especially I have attempted to show how those figures which loom large in the next three chapters of this thesis, Descartes, Hobbes, Boyle and Newton, reacted to the situations in which they found themselves. Part of their reactions involved the development and deployment of philosophical systems designed to steer epistemological and socio-political development in specific directions. Of course these historico-geographical processes did not act alone in stimulating the elaboration of a socially and politically functional experimental philosophy. The atomistic natural philosophy of Boyle and Newton was also a continuation of an intellectual trend which included Copernicus, Galileo and Bacon whom they embraced, as well as Descartes and Hobbes whom they did not. From this perspective it seems at least plausible that part of the reason for the remarkable success enjoyed by the Royal Society in defining the new science can be traced to two historico-geographic facts. First, the programme of the Royal Society seems to have cross-cut the prevailing intellectual debates of the day in a highly inclusive manner. The

programme of the Royal Society seems to have delineated ontological and
epistemological partitions which could appeal to the felt needs of a majority of
then extant interest groups. Theologians as well as scientists and nobility as well
as gentry could profitably accede to the programmatic demands of the Society. Of
course the broad appeal of the programme of the Royal Society would necessarily
lend it further impetus. Undoubtedly the Rationalist programme, especially as
elaborated by Hobbes into its political as well as its epistemological dimensions
could not boast such ecumenical appeal! The second reason for the quick
ascendence of the Royal Society is that it was quickly absorbed into a variety of
powerful social interests. The social heterogeneity of the membership (Table 2)
maintained over the first forty years of the Society's existence attests to the
powerful actors to which it could lay claim in territory disputes or other
difficulties.
Chapter 3

"Ontology and the Spatiality of Subjectivity: the interpenetration of physical and metaphysical spaces 1"

3.1 Ontologies of Self and Substance

3.2 Hobbes' and Descartes' Plenist Ontology

- Theories of Substance
- Theories of Causality and Motion

3.3 The Plenist Construction of Subjectivity

- Varieties of Seventeenth Century Dualism
- Hobbes' 'Limited' Dualism

3.4 Human and Physical Ontologies and their Spatiality
3.1 Ontologies of Self and Substance

Perhaps the most basic rudimentary distinction embedded within discernibly *modern* human and physical sciences pertains to the distinction between inert physical material and the reflective consciousness which perceives it. At first blush this may seem a facile statement, in the sense that the very suggestion invokes a distinction which might appear to verge on tautology. After all the distinction between reflecting and non reflecting substances would seem to be logically prior to any discussion of ontological partitioning at all. But this is just yet another example of the problems intrinsic to attempts to understand components of the 'western intellectual tradition' as contextually specific and unique from a perspective largely *within* that tradition. Nevertheless, historians and philosophers of science, as well as anthropologists and other social scientists, are discovering that the ontological partition between substance and self is not at all evident, or even universal. Berman and Yates remind us that the commonplace, *modern*, distinction between self-individuating consciousness and the brute material world upon which it is the nature of this consciousness to reflect was in fact an *innovation* of seventeenth century philosophy.¹ The fifteenth and sixteenth century Hermetic tradition, for example, did not posit an oppositional dichotomy of subject and object. Nor did it array a factual, material reality over and against a reflective, privately cogitating "I". This tradition, with its epitome in the alchemy of Paracelsus and the numerology of Fludd, was founded on radically different connexions between microcosm and macrocosm, subject and object, and self and substance. Hermetic culture, to use Berman's phrase, was a "participatory culture"; one in which an "ecstatic merger of self with nature" meant that scientific study was at one and the same time part of the process of self creation as well as technical manipulation:

Thus alchemy was - from our viewpoint - a composite of different activities. It was the science of matter, the attempt to unravel nature's secrets; a set of procedures which were employed in mining, dying and glass manufacture and the preparation of medicines; and simultaneously a type of yoga, a science of psychic transformation...the alchemist did not confront matter, he permeated it.²

² Berman 1981 p.92
Likewise, in numerology the Ptolemaic cosmology was united with the ancient Judaic cabalarian philosophy in which certain combinations of numbers and arithmetic operations were believed to put one in touch with the divine essence. Even well into the seventeenth century, the century of Descartes and Newton,

![Figure 6: The Ptolemaic Universe According to Robert Fludd (1619)](image)

the recognisably 'modern' oppositions between subject and object, in terms of what Berman calls "non-participating culture", was not yet articulated with what it meant to think scientifically.
Robert Fludd's numerological formulations (Figure 6)\textsuperscript{3}, published early in the seventeenth century, became one of the first lightning rods for the coalescence of the new empiricism, represented in the 1620s and 1630s by the two Minorite friars and intellectuals Marin Mersenne and Pierre Gassendi.\textsuperscript{4} Mersenne and Gassendi recognised that their critique would necessarily have to proceed on at least two fronts. First, they would have to refute the Hermetic identification of the practical sciences, the "sciences of the forge", as the sciences of material transmutation and direct ecstatic merger which, they believed undermined Church authority. Second, they would have to offer an alternative whose ontological and epistemological structures would preclude a lapsing back into Hermeticism by coopting what they took to be the doctrine's most significant elements. In so doing however, they would also have to avoid being identified with the Aristotelian tradition against which Hermeticism was also a reaction, at least if they were going to be able to promote their schema as an intellectual advance. The core of their attack, which was joined by other philosophers after the initial salvos in the early 1620s, was the Baconian idea that appearances were all that could be known with certainty and that the physical matter one studied was devoid of animating forces. Still the task faced by the two friars, who earnestly hoped to combine their vast intellectual resources and their convictions about religious and spiritual order into a new rapprochement between reason and faith, was rife with intellectual complexities and nuances.

It was this intellectual context that René Descartes entered and it was to the cause of this "new science" that his work was to greatly contribute. Descartes' work was possibly one of the first positive systematic accounts of the new natural epistemology and was itself founded upon a novel partitioning between subjects and objects. Even so, Descartes' work, and also that of Thomas Hobbes, looked back to Hermeticism at least insofar as they theorised motion and cause to be intrinsic to matter. Unlike most contemporary dualisms, mind was taken to be not a thing, but an activity or motion of the brain. As Hiram Caton has argued, Descartes' "true man" would be one who was able to operationalise an

\begin{enumerate}
\item Berman 1981 p.101
\item Our understanding of the place of Bacon in the pantheon of early modern science is currently under much reconsideration. Briggs, among others, has contended that we have taken too much of our image of Bacon from the highly selective view of him held by members of the early Royal Society, especially Abraham Cowley and Thomas Sprat who wrote much of the "official" history of the Society during the 1660s.
\end{enumerate}
understanding of both the unification of mind and body and also the transcendency of the latter by the former. In England especially, interest in Descartes' plenist physics waned quickly, as philosophers sought a more complete break with philosophies of nature tainted by mystical notions of intrinsic causality. Boyle, Newton and the Royal Society can be seen as, in a sense, "completing" the transition from Hermeticism to Empiricism which Bacon and Mersenne began and which Descartes and Hobbes carried forward through mid century. With the atomist philosophy institutionalised in the Royal Society the mid century partition between subjects and objects was enhanced and buttressed through its alignment with the partition between physical and metaphysical approaches to knowledge. Of course none of this is meant to suggest the achievement of any culminating historical moment beyond which these questions became somehow 'static'. Rather, what was achieved through this period was much more a strategic concordance of philosophical and contextual predispositions which has, in fact, displayed a remarkable robustness.

In this chapter I will trace some of the relationships between theories of substance and objectivity and corollary theories of self and subjectivity. In their largely modern guises, these distinctions can be shown to have become increasingly tied to other more spatially imbued distinctions, such as those between "microcosm/macrocosm", as Livingstone has recently shown for the late sixteenth century work of John Dee and Leonard and Thomas Digges, and also for the relation of public and private spheres as centrally problematised by Hobbes. These revised cognitive and cultural 'distances' between ourselves and nature were also quickly articulated with the spaces of incipient capitalism and religious Protestantism. Further, the elaboration of the new Cartesian form of subjectivity, the "analytic of finitude", as Foucault has consistently demonstrated, created new possibilities for the elaboration of new disciplinary spaces in post-seventeenth century society. Interestingly however, analyses in this vein have often tacitly assumed the positivistic separation between physical

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and human sciences. In the instance of studies of Hobbes, for example, this has resulted in the tendency to contend that, at best, Hobbes' physical and political sciences are only analogously integrated. Such interpretations simply do not stand up to a close reading of the interconnections between the author's texts and his times. Foucault's analyses are an important exception to this sort of bifurcated thinking, for example in his examination of classification structures in The Order of Things where he deploys the concept of the "episteme" in a deliberate move to integrate the cultural-intellectual-political whole. Perhaps more to the point, Foucault's work evinces a deep and abiding interest not merely in the themes of subjectivity, space, science and power as analytically distinct, but in their dynamic historical confluences in (discursively) ordered "epistemes".\footnote{This is true irrespective of the critiques which have been directed at his historical periodisations, which J.G. Merquior to take one example, considers to be unwarranted 'totalising' accounts. See Merquior 1985: Foucault (London: Fontana Press).} After a Foucauldian fashion, I will argue that the philosophies of Descartes and Hobbes are in fact most comprehensible only if one suspends the contemporary tendency to concede the radical separation of physical and metaphysical realms. While these two philosophers certainly did distinguish between physical and metaphysical discourses, the practice of dichotomising them was a subsequent development more closely allied with the program of Royal Society experimentalists such as Robert Boyle and Isaac Newton. The decision to orient my analysis with the "plenist" perspective of Descartes and Hobbes will allow me to show more clearly both the relation of Newtonian science to that which preceded it, as well as its divergence.

The positioning of Cartesian plenism midway between ontologies of the pre-modern and modern worlds, its location "at the edge of modernity" as Grene puts it\footnote{Marjorie Grene 1985: Descartes (Brighton: Harvester Press) p.92}, renders it a very fruitful locus for the development of an analysis of modern subjectivity. Here is a second Foucauldian aspect to the analysis laid out in this thesis. Beyond merely recounting a specific seventeenth-century ontological debate about the distinction between substance and self, I hope to provide some indications as to how these distinctions were implicated in a broad set of emerging power relations. The specific case I will touch on, in the concluding sections of the chapter involves the intersection between the post Cartesian discourse of subjectivity and issues of gender. In subsequent chapters I
will try to elucidate some of the specifically spatial consequences of these reconceived relations and divergences in what Foucault referred to as "knowledge/power". In Chapter 4 I will introduce more explicitly the Foucauldian interpenetration of power and political spaces with the more abstract "spaces" discussed here, which is critical to an understanding of, to paraphrase, how "extension was substituted for localisation" in the intellectual theory and practice of early modernity.\(^{10}\)

### 3.2 Hobbes' and Descartes' Plenist Ontology

**Theories of Substance**

Hobbes and Descartes were both committed to the reality of an objective world constituted of "corporeal substance" upon which the individual subjective consciousness contemplates. The immediate object of the senses, "corporeal", or "extended", substance was conceived to be that 'stuff' which is "extended" into the three geometric dimensions, length, breadth and depth, and also time. Descartes' well known thought-experiment on the true nature of extended substance had systematically stripped away as "secondary" all qualities, such as colour and hardness, which were not immediately translatable into mathematical expressions. Ultimately all that remained subsequent to this reductive process were those "primary" qualities without which extended substance simply could not be conceived.\(^{11}\) These "primary" qualities, of geometrical "extension", were then taken to be constitutive of all perceptible matter. Both Hobbes and Descartes would have agreed with Galileo who wrote in *Il Saggiatore*:

No sooner do I form a conception of material or corporeal substance than I feel the need of conceiving that it has boundaries and shape; that relative to others it is great or small; that it is in this or that place and in this or that time, that it is moving or still....nor can I, by any effort of imagination, dissociate it from these properties.\(^{12}\)

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\(^{10}\) Michel Foucault 1986: "Of Other Spaces" in *Diacritics* 16, translated by Jay Miskowisc


Corporeal substance therefore is that which can be perceived to be "extended" into the three dimensions of Euclidean geometry and time. Moreover this ontology of extended substance, which was derived from Descartes' prior commitment to epistemological sceptical realism, was conceived to be absolutely true and universal of all physical substance.

It must be noted that the very question raised by seventeenth century philosophy regarding "what is physical substance in and of itself?" was a novel one. Both the Platonic and Aristotelian philosophical traditions, as well as their scholastic offspring, maintained some measure of intentional suffusion of noumenal and phenomenal entities in their physical ontologies. For Plato physical substance was not simply "physical" in the modern sense at all; it existed in the world always through the moulding of primordial matter by non material "ideal forms". While Aristotle disagreed with Plato's appeal to "ideal forms", he nevertheless contended that substances did have a nature which is completely determined prior to human attempts at classifying their sense perceptions of substance. Perhaps more to the point Aristotle argued that everything in the world had a predetermined place and functionality. While gravity, after Newton, was taken to be an impersonal force of blind nature, for Aristotle it was the product of an "excitement" internal to a substance as it neared its place in the natural order. The achievement of seventeenth century philosophers was to restate the problem as one of classifying the world according to a revised notion of physicality which eschewed the appeal to anything beyond our sense perceptions of the things themselves. As a reaction against Scholastic attempts to weave a Christian teleology into cosmological theories, in the works of Sebastian Munster (1489-1552) for example, Bacon can be said to have spoken for his century:

Matter rather than forms should be the object of our attention, its configuration and changes in configuration.14

But there is a catch to this attempt to recast the ontological partition as one between physical substances, which are empirically verifiable, and metaphysical (meta)substances, which are not empirically verifiable and are hence ephemeral

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14 Francis Bacon 1960 Aphorism #51
and "secondary". Descartes' extreme scepticism, which caused him to doubt the authority claimed by scholastic texts and also the evidence of his own senses, is wholly escaped by the rules of mathematical reasoning and especially by Euclidean geometry. The theorems of geometry and especially Descartes' own transformational geometry (by which he was able to transform more complex natural relations onto Cartesian two dimensional surfaces) were held to be somehow part of that special class of "innate ideas"; a form of privileged non-metaphysical description language. Virtually all other seventeenth century thinkers had also accepted the physical veracity of geometry and mathematics, even if they happened to disagree with Descartes' own formulations of it. In his preface to the Principia Mathematica, Newton stated that

Geometry itself is founded in mechanical practice and is nothing but that part of universal mechanics which accurately proposes and demonstrates the art of measuring.

Though mathematics, or at least arithmetic, had long been privileged in Hermetic epistemology, its Hermetic heritage of esoteric self creation was, by mid century, severed. Once mathematics' claim to epistemological privilege was secured through its firm grounding in empirical study, the partition between primary and secondary qualities, between physics and metaphysics, had a firm anchor. Primary qualities were then taken to be those sensible attributes which could be expressed in quantitative mathematical terms, while "secondary" qualities were those which could not be so expressed, at least not readily. Extension into geometrically constituted space, space abstracted from the things within it, become the lowest common denominator of all corporeal substance. Even so, the philosophical status of mathematics and geometry still manages to be a locus for much debate on the partition between physics and metaphysics.

15 Rene Descartes Third Meditation
17 Descartes recounted that his discovery of the veracity of geometry was in fact a revelation which came to him in one of three dreams which he experienced in the winter of 1619. See Jack Vrooman 1970: Rene Descartes: A Biography (New York: G.P. Putnam's Sons) p.56ff; and James Garrison 1987: "Newton and the Relation of Mathematics to Natural Philosophy" in Journal for the History of Ideas 48(4) pp.609-627. Hobbes took a rather more pragmatic view, contending that as a human construction geometry was aptly matched to human theorising about the world and that there was no need to postulate the existence of some specially privileged scientific language.
It would be a mistake, however, to consider the relationship between physical extension and Euclidean space to be a straightforward identity relation. For plenists such as Descartes and Hobbes, space and physical extension were not identical concepts at all. And even their philosophical opponents, including Robert Boyle and Isaac Newton, did not consider space to be coterminous with extension. Both camps were very careful about the distinction between space, whether conceived as an independent substance in and of itself (Boyle and Newton) or as a property of substances (Hobbes, Leibniz and Descartes), and substance, as that material which tangibly exists in the world. As I shall go to some lengths to show in Chapter 5, space and extension were conceived, by seventeenth century thinkers at least, to be very special and distinct ontological categories. But my historiographic project is complicated by the many subsequent observers who have proposed that space and extension are, at least in practice, the same thing. Yves Simon, in his The Great Dialogue of Nature and Space, claims that "...extended substance is ...Archimedean space; it is the non qualitative space of the Greek geometricians."\(^{18}\) The philosopher Marjorie Grene, in her primer on Descartes, also conflates space and extension.\(^{19}\) Frankly I suspect that much of the confusion arises from the difficulty of dissociating oneself from the intellectual tradition which is problematised herein. One result is that these thinkers project into their interpretations as "natural" and beyond refutation spatial conceptions which submerge important distinctions between space, geometry and substance in seventeenth century thought. Even so, this conflation is also undoubtedly a result of the fact that Descartes, Hobbes and others were often lamentably imprecise and even contradictory in their definition and use of these critical distinctions. One perhaps unintended result of this confusion has been to muddy waters crucial to the intelligible rendering of the vigorous debate between plenists and atomists and also spatial relativists and absolutists.

If the notion of "substance" seems as yet unclear, one might contrast it with the atomistic ideas of the major camp opposing Cartesianism. It is interesting to note that figures such as Henry More, Isaac Newton and Robert Boyle, though they entertained youthful attractions to Cartesian philosophy, diverged from it markedly in their variously inspired desires to discover the

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\(^{19}\) Marjorie Grene 1985 p.127ff
ontological minima required to support the reality of corporeal substance. Enacting a different epistemological program, they agreed that all matter, in addition to being generally classifiable as Cartesian "corporeal substance", was also at base constructed of simple "atoms". As the basic ontological units of corporeal substance these atoms were thought to be incapable of being further subdivided either in practice or in principle. "Atoms" are conceived to be, as Newton himself put it, "solid, massy, hard impenetrable, movable particles".20 Implied in this particle ontology was, of course, the notion of microcosmic void space, to be understood as the empty space between the atoms. This latter notion became a central point of contention in the debates between Thomas Hobbes and the Royal Society in the 1650s and 1660s (discussed in Chapter 4). Still, the idea of the world being made up of atoms whizzing around in a cosmic void was not new; marking in fact a renewal of a central tenet of Epicurean philosophy.21 What was novel to seventeenth century atomism, especially after Newton, was an elegant theory of force and interaction between atoms which didn't rely on the clumsy mechanical idea, employed even by Boyle, that the particles themselves were comprised of "little beards and hooks... which entangle them" and that this could explain their interaction.22 As well, this period saw the rapid development and diffusion of scientific technologies, such as Robert Hooke's microscope, which seemed to affirm the reality of an atomic world.

But, as 'obvious' as such a position may seem to contemporary eyes, Descartes, Hobbes, and others, did not feel this way at all. For them the postulation of corporeal substance did not entail atomism, but in fact led to something quite contrary to atomism. As "plenists" they contended instead that, by definition, extended substance must be infinitely divisible. Pierre Bayle (1647-1706) argued that if

...the parts of a finite extension have a magnitude greater than zero...[then]...they must be divisible in principle, since whatever has magnitude has parts, and whatever has parts is divisible.23

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20 From the 31st Query appended to Newton's Optics, cited in Berman p.115.
22 Robert Boyle 1675: Experimental Notes of the Mechanical Origin or Production of Fixtness (Printed by E. Flesher for R. Davis, Bookseller in Oxford) p.9
By logical extension, plenists rejected the concrete and easily apprehensible dualism between atom and void, between particles and the forces that act upon them externally, conceiving instead of a cosmological "plenum"; an ontological field of continuous substance. Thomas Hobbes, for example, argued that since Boyle had not, to his satisfaction at any rate, demonstrated the philosophical necessity of his notion of 'void' space, his atomism was philosophically unsupportable. Therefore, both the Principle of Sufficient Reason, and Occam's Razor, were taken to demand that Boyle fall back to the plenist position that all space was 'full' of something and that our human senses are simply inadequate to the task of fully apprehending all that is physically present. With this ontology, which denies the Newtonian separation of substance from force, physical analysis shifts to the examination of discernable instances of "local motion" within the plenum.

Certainly it is worth noting here that the plenist position as thus far elaborated is quite consistent with the epistemological scepticism which was adopted by Descartes and Hobbes. Doubts about the veracity of sense date could lead quite easily to doubts about the epistemological status of claims that given spaces are 'empty' or 'full'. Cartesian scepticism, however, was not simply a revival of the Socratic scepticism of "open-mindedness", what Descartes himself referred to derisively as "doubting for the sake of doubting". Even so, as Caton has shown, Cartesian scepticism ambivalently rooted itself in a conception of single point (optical) perspective as intrinsic to modern subjectivity. Their willingness to doubt even the evidence of their own senses, and with them the empirical axiom that the world of appearances is all that there is, does not prohibit them from concluding that positive knowledge about the world is possible.

Theories of Causality and Motion

Another important strand of thought which is implicated in the relationship between ideas regarding corporeal substance and the problem of

24 See my discussion of Thomas Hobbes' dispute with Robert Boyle over the air pump trials in Chapter 4.
25 Descartes, Discourse on Method p.22
26 Caton 1973 p.28
subjectivity involves the analysis of physical causality. So far I have avoided the problem of how extended substance, as conceived by Hobbes and Descartes, was supposed to be instilled with causal power. How is it, after all, that plain, unthinking 'lumps' of corporeal substance come to exert influence on each other? At this juncture the ideas of plenists diverge markedly from the ideas of most of their contemporaries. In a nutshell, the dispute was between those, such as Hobbes, Leibniz and Descartes, who argued that causality was a constitutive part of a cosmological "plenum" of which extended substance was merely a perceptible manifestation, and those who countered that causality was not a constitutive, or "primary", quality of corporeal substance but rather related to the combined extrinsic agency of humanity, nature and the prime mover God. For Plenists, on the one hand, causality and motion are intrinsic elements of the plenum, while for atomists, on the other, they are wholly separable from the constitution of atomic substance. The differences expressed here are indeed subtle, often ambiguous and beg a great many questions, but they are also critical to a fuller understanding of the spatiality of modernity. Insofar as the discussion is maintained on a strictly physical level, the issue of causality can be plausibly argued either way. But when one considers the moral, political and cultural factors brought to bear on the issue, the dispute becomes much more intractable and intellectually rich.

Hobbes and Descartes held that causality is invested in substance at the ontological level, and added that it is also related to a hierarchical chain of superordinance culminating in the "prime mover", God.\textsuperscript{27} Let me elaborate on the first point of this analysis of causality, which proposes a "plenism" based on the singularity of "action by contact". Hobbes defended eloquently, most notably against Robert Boyle and Isaac Newton, the proposition that causality could only be attributed to the physical contact of bodies of matter. Hobbes' plenist ontology, postulated that the world was composed of corporeal substance which existed in a sort of flux, or "æther", of varying densities. At some points the densities and/or motion of this plenum are such that even our senses, crude receptors though Hobbes and Descartes conceived them to be, could discern the presence of

\textsuperscript{27} This is the Cartesian expression on the doctrine of the "great chain of being" - see Arthur O. Lovejoy 1936: The Great Chain of Being (Cambridge: CUP)
extended substance. In some parts of their writing, motion in the plenum was theorised to be comprised of the continual reconstitution of phenomena in successive external spaces over a particular contiguous series of points in time. If one adheres to plenism, then it logically follows that causality must be inherent to the plenum, since the plenum is all encompassing, and therefore all action must necessarily happen by contact. More to the point, this æther would have to be invested with its own intrinsic motion which served to impart force to bodies according to their own relative moments of inertia. Leibniz, though writing rather later than Hobbes or Descartes, concurred:

A body is never moved naturally except by another body which impels it by touching it, and thereafter it advances until it is stopped by another body which touches it. Every other operation on bodies is either miraculous or imaginary.

Hobbes' rejection of Boyle's "matters of fact" was thus based upon positive as well as negative criticisms. As far as Hobbes was concerned, Boyle had not demonstrated that the separation of cause and effect could move science towards more satisfactory explanations than simpler alternatives. Nor had Boyle explained why the contentions he was raising were logically necessary conditions for the structuring of physical theories. Hobbes believed it was possible to develop a plenist account of observed phenomena which did not require the postulation of "matters of fact" or of a vacuum. Action at a distance, failed to satisfy, on the plenist view, because it contradicted the conclusions of a simpler physical system which was itself bolstered by its integration with a theory of human perception and understanding.

Obviously a plenist could never accept the postulation of atoms if these were meant to be taken as corporeal "simples". Proposing atoms as elemental minima implies proposing a limit to divisibility which entails the existence of microcosmic empty space, thus contradicting plenism. The plenism adopted by Descartes and Hobbes in fact suggested that matter was infinite in both directions.

28 Note here how Hobbes' proposition of the plenum relies upon an extreme scepticism regarding sense data. By constantly foregrounding this scepticism about sense data they were largely inoculated against lapsing into any variant of "naive realism"

29 Schaffer and Shapin 1985 p.88

of magnitude. Matter was infinitesimally divisible in ever smaller components, as well as being infinitely expandable. Rather than becoming preoccupied with mere external "matters of fact"; "atoms" or "corpuscles" as the experimentalists such as Boyle did, plenists believed that scientists ought to seek after the organising "forms" which shaped the phenomena witnessed by the senses. On the plenist view, the efficient causes of changes in form, in this case their inertia, were constitutive of the interacting substances themselves. The natural momentum of objects in the world was conceived to be oriented towards their continual self creation. In my opinion this integration of cause and effect is precisely what is captured in Descartes' concept of the "conatus", Leibniz' "monads" and Hobbes' "simple circular motion". From a contemporary perspective these notions of internal causality seem contradictory and fraught with difficulty. Therefore, in what follows I will provide only a brief sketch of these concepts which will be sufficient for understand the analyses of subjectivity and mind-body dualism which are built upon them.

In most plenist schemes "monads", "conatus" or "simple circular motion", or whatever else such intrinsic "efficient" causality is called, are linked into a hierarchical "chain of being" with God, as the "final cause", at the topmost pinnacle. Just as individuals have an intrinsic and undeniable will to self preservation, so too was matter theorised to have an inertial "protoforce" oriented toward the preservation of its own natural configuration. Perhaps it might be more accurate to say that God exists as the highest order of ordering principle or force, since most plenists tried to avoid conceiving of God's power as comprised merely of the ability to impress force on objects. Such a view, after all ran the risk of marginalising God's role in the workings of the world to the

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31 The distinction between "efficient" and "final" causes is one of great philosophical antiquity, and hearkens back to the notion of a gradation of levels of understanding, each of which is more certain than the last. "Efficient" causes are generally taken to be those which are observed to be required to produce a particular empirical event. "Final" causes are much more cosmological in nature and often hearken, especially in the thought of the seventeenth century, to the causality wielded by the divine essence.

32 On Descartes' "conatus" there is very little written which is anything but derisive. Leibniz' ideas are best accessed through their original articulation in The Monadology, see also Hampshire 1956. Hobbes' forays into physics came very early in his career, and then, largely in response to Boyle, late in his career. Schaffer and Shapin have included in their book a translation of Hobbes' Dialogus Physicus of 1661 which is a late statement of his physical views.

initial "flick of the fingers" required to set it in motion.\textsuperscript{34} In Descartes' first proof of God's existence, he reasons that there must be a universal hierarchy of perfection:

...I reflected upon the fact that I doubted many things, and that in consequence, my spirit was not wholly perfect, for I saw clearly that it was a greater perfection to know than to doubt...The only hypothesis left was that this idea was put in my mind by a nature that was really more perfect than I was, which had all the perfections that I could imagine, and which was, in a word, God.\textsuperscript{35}

Thus God, as the \textit{final} cause of all things, was given the much more dignified task of having guided and constituted those substantial \textit{efficient} causes which were the objects of scientific method. In fact, final and efficient causes were much more closely intertwined indeed, since it is easy to get the impression that the final causes attributable to God were, in the thought of the era, thought to be discernable in the 'traces', or overall pattern of "directionality" and "intentionality", created by the world of efficient causes.

Obviously true science, the science which would seek after the forms behind the phenomena, would have to be largely an inward process, since plenism ruled out placing too much emphasis on detailed empirical study alone. Contrarily, experimentalists such as Boyle argued that since there could be no apprehensible connection between causes and effects, science would be restricted to the much more utilitarian task of charting correlations between observed and produced "matters of fact".\textsuperscript{36} Experimental study was thus the beginning and the end of Newtonian science. Empirical study would play a different role in plenist science. Rather than providing one with those "matters of fact" so dear to Boyle and other experimental philosophers, empirical work was designed to augment the internal intellectual process of seeing behind mere sensory perceptions. That intellectual process, which elevated geometrical reasoning, was fused with a

\textsuperscript{34} This in fact was the interpretation of Blaise Pascal who quipped "I cannot forgive Descartes for allowing God only a flick of his fingers to the set the world in motion, after which he has no further need of him". \textit{Pensées}, Translated by A.J. Krailsheimer (Harmondsworth: Penguin, 1966), #887 (the \textit{Pensées} are numbered ordinally)

\textsuperscript{35} Descartes \textit{Meditations}, p. 25-26

confirmationist and comparative role for experimentation, in sharp contrast to its more thoroughgoing constitutive role in the science of Newton and Boyle.37

3.3 The Plenist Construction of Subjectivity

Varieties of Seventeenth Century Dualism

It is possible to bring the basic ontological issues into rather sharper focus by noting that the Cartesian postulation of extended substance as the object of the senses unavoidably begs a very important question. It follows logically from the proposition that the senses provide a 'window' onto real corporeal substance, however flawed this window may be, that there must be some central intelligence which collects and rationalises these sense inputs. In other words, the predication of senses necessarily implies a subject, which Descartes equates with the individual privately cogitating "I". Both Hobbes and Descartes recognised that their ontologies of corporeal substance necessarily implied a complementary analysis of the knowing subject. Unlike the Newtonian atomists who would, for the most part, sever or submerge the connection between the subjects and objects of scientific discourse, these seventeenth-century thinkers confronted this issue directly. The resolution of this issue involved, for both Hobbes and Descartes, some infusion of "dualism" into their outlooks. Descartes, the archetypical, though frequently misunderstood, dualist, argued that body, that is to say "corporeal substance", must be in some sense qualitatively different from the "I", the locus of "mind", primarily because of the uniqueness of human thought:

I concluded that I was a thing or substance whose whole essence or nature was to think, and which to exist has no need of space nor of any material thing or body. (my italics)38

38 Rene Descartes Discourse on Method, p.25
Thus "mind" was fundamentally different from, and considered more noble, than mere "body" or physical being. This view of the subject as uniquely and privately constituted over and against the objects of ratiocination, followed quite naturally from that aspect of epistemological scepticism which interposed a "veil of ideas" between the mind and the physical world. This was quite different from the scholastic position which saw the individual mind as constituted through the appeal to the Aristotelian "nous"; a universal ideal of reason and rationality. It was also quite different from the Lockean physicalist view which conceived of mind as a "tabula rasa" to be filled with public ideals of rationality and selfhood.

Now it is an open question, despite contemporary inclinations, whether Descartes actually meant to imply an ontological, "two substance", dualism. In the first place the common imputation to Descartes of a rigid dualism runs the risk of rendering his carefully argued plenism quite incomprehensible. If Descartes is in fact the simple qualitative mind-body dualist painted in many introductory philosophy texts, then he cannot also be the ontological monist his physical plenism clearly implies. Contemporary inclinations to perceive of mind-body dualism in terms of mutually exclusivity, and to project this view back into readings of Descartes, are primarily at fault for muddying these philosophical waters. I do not contest that Descartes often stated his dualism in rather bald terms, especially in the concisely written Discourse on Method and Meditations. Further I think it possible to find at least the beginnings of a rapprochement between plenism and a form of dualism in some of Descartes' own writings. In a letter addressing certain criticisms raised against him, Descartes stated:

It does not seem to me that the human mind is capable of conceiving quite distinctly and at the same time both the distinction between mind and body and their union; because to do so it is necessary to conceive them to be a single thing, and at the same time to conceive them to be two things, which is self contradictory.

39 Richard Rorty 1979: p.50-51
40 A point which is also made by Stanley Rosen, though for different reasons, in his 1989: The Ancients and the Moderns: Rethinking Modernity, (New Haven:Yale Univ. Press).
41 Grene 1985 p.19
Rorty has discussed how Descartes' dualism is strongly interleaved with a kind of "meta-distinction" between unities, wholes, and parts whereby "mind" gives a functional unity to the assemblage of physical parts of which individual subjects are composed.\(^{42}\) In a sense I think that what Descartes recognised here is that the individual subject creates him or her self as an object for self reflection. Thus Descartes probably could not have claimed ontological primacy for the simplistic material-nonmaterial dualism for which he is primarily remembered. Indeed he was acutely aware of the problems of relating unity and diversity, mind and body, in his natural philosophy. Even if it is granted that Descartes never produced a clear account of this crucial interface, his infamous deductions about the function of the pineal gland notwithstanding, it should be evident that he was first and foremost a plenist who sought to integrate into his philosophy a form of subjectively oriented dualism. Once again I note that in the sixth and last Meditation Descartes claimed:

\begin{quote}
I am not only residing in my body as a pilot in his ship, but furthermore, that I am intimately connected with it and that...a single whole is produced.\(^{43}\)
\end{quote}

In any event it is important to note that for Newtonian-minded experimental philosophers this particular problematic, so very central to the relationship between physics and metaphysics, was submerged through strategies to render transparent and universal the cogitations of the individual knowing subject. In this the experimentalists accomplished something of a reconciliation between scholastic modalities, which relied on established traditions of textual authority, and Cartesian rationalism, in which sources of authority were much more subjectively oriented.

But it is critically important to see also that the Cartesian subject is not simply a physical construct deriving from an objectivist epistemology. Above I noted in passing that Cartesian subjectivity was rooted in the priorisation as "natural" of single point visually dominated perspective. The argument that Descartes makes for the "naturalness" of this subjectivity is deeply connected with his moral philosophy. A true "moral science" is, Descartes claimed, one of the three "fruits" of the "tree of knowledge", the other two being medicine and

\(^{42}\) Rorty 1979 p.64
\(^{43}\) Descartes Meditations VI
mechanics. Prior to reaching that science however Descartes proposes an interim moral code based largely in a self correcting asceticism. In the Discourse Descartes states that it is mete to "seek to conquer [oneself] rather than fortune, to change [one's] desires rather than the established order". This follows from his belief that error derives primarily from one's passions outstripping one's reason, rather than from the incorrect exercise of reason per se. Such internalism easily lent itself to the idea that knowledge must be founded upon the private workings of a "single architect" working to conquer him or her self, rather than the experimentalist model of a publicly disciplined collectivity. This moral individualism therefore was an integral and dialectically related element of his physical theories of mind and body.

In basic outline then I have recovered some of the links within Cartesian philosophy between epistemological scepticism, subjectivism and the ontological status of mind-body dualism. Though I have chosen to accomplish this objective through an interrogation of the nexus between ideas of physical and moral 'nature', it is worth noting that others have arrived at similar conclusions through via other routes. Subsequent to this, a number of other points should begin to fall into place. Descartes, for example, was able to identify the incorporeal mind with God and therefore neatly assimilate a comparatively orthodox Christian cosmology into his rational scepticism. This was important since Descartes was writing at a time when Galileo's conviction by the Roman Inquisition for proclaiming the Copernican doctrine as truth in 1633 was still fresh in popular memory. Descartes' correspondence with confidants such as Mersenne belies his anxiety over the potential unorthodoxy of his own doctrines. He even delayed publication of his own Copernican tract for fear it would give offence to religious authorities in France. However the Cartesian framework was supple enough to escape being parodied as an extreme materialism on the one hand or as an extreme theological mysticism on the other. The fact of this suppleness itself may help explain its widespread

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44 Descartes Discourse on Method p.22. Indeed, for Descartes, reason 'incorrectly exercised' is simply not reason at all; it is not a tool which can be misused, but rather a state of intellectual activity which is either achieved or not.
45 Rosen 1989 for example works primarily through the nexus of morality and theory of mind in Descartes' thought. See FN #39
acceptance in England, even by future opponents, during the mid seventeenth century. Humanity was seen by Descartes to occupy a unique position in the "great chain of being"; halfway between brute mechanisms, including all animals, and the divine essence. In this interstitial position human actors are weighted down by their base constitution, though they may rise above their baseness through the diligent application of mind. Thus, as Toulmin has noted, Cartesianism incorporated a strong moral vision into its physical ontology and epistemological outlook. Such universal truths as could be determined by the Cartesian method would be the physical-ontological anchors of an abiding Christian moral philosophy. Descartes himself further cemented the central connection between physics and metaphysics as he saw it in his attacks on atomism:

For if we imagine that beyond the heavens there is nothing but imaginary spaces, and that all the heavens are made only for the service of the earth and the earth only for man, we will be inclined to think that this earth is our principle abode and this life our best. Instead of discovering the perfections that are truly within us, we will attribute to other features imperfections which they do not have, so as to raise ourselves above them. We will be so absurdly presumptuous as to wish to belong to God's council and assist Him in the government of the world; and this will bring us a dross of vain anxiety and distress.

Consequently, this rapprochement between religion and reason can be seen to have been integrally related with Descartes' ontological plenism. Interestingly this reconciliation could not have been open to atomists such as Newton and More, who would have to develop a radically different theological-scientific interface.

47 Descartes Fourth Meditation, in this Meditation Descartes suggests that reason would be meaningless unless conjoined with the freedom to use or misuse it. We may after all misapply the dictums of reason, which in Descartes terms would be a case of mismatching our will to our understanding. The critical point here is that Descartes' epistemology clearly depends upon a prior conception of moral philosophy; it maps into a specific moral landscape.

48 Toulmin, 1990 p.73

49 Grene 1985 p.40; But see also the section of Descartes' Discourse on Method entitled "Some Moral Rules Derived from this Method"
Hobbes' 'Limited' Dualism

Let me now discuss Hobbes' variation on this reconstructed Cartesian dualism, since it can be objected that Hobbes characteristically rejected dualisms of any sort. In fact much has been made in recent scholarship of the intellectual relationship between Hobbes and Descartes. This is so not least because of the many similarities discernable between the two and their partially contemporaneous careers, but also in light of their criticisms of each other found in the "Objections" and "Replies to Objections" to Descartes' Discourse on Method and in other places. During his self-imposed exile in Paris during the 1640s, Hobbes frequented that circle of philosophers centered on the Abbé Mersenne which included some of the most well known Cartesian philosophers of the day. Revealed in these textual 'meeting places' is a highly variable relationship wavering between admiration on many mainly general points and vehement opposition on primarily specific and minor points. Indeed Tuck has gone so far as to claim that:

Hobbes' natural philosophy gives the impression of having been developed as the next move in a game where Descartes had been the previous player.

It is indeed true that Hobbes took a rather harder materialist line with respect to the ontological constitution of the knowing subject, which I have suggested is central to Descartes' own form of mind-body dualism. From his perspective, talk of "incorporeal substance", which Descartes at least arguably conceived mind to be, was not only wrong but oxymoronic:

If a man should talk to me of...immaterial substances; or of a free subject, I should not say he were in error; but that his words were without meaning; that is to say, Absurd.

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51 In this connection, the Abbé Mersenne, as the solicitor of Hobbes' "Objections" to Descartes' Discourse on Method as well as the intermediary in much personal correspondence between Hobbes and Descartes, is a central though often neglected figure. Though Hobbes spent a decade in France during the 1640s and moved within circles very much immersed in Descartes' ideas, the two apparently met only a few times starting in 1648.
52 Richard Tuck 1988 p.28
For Hobbes mind was not at all different from body in the qualitative sense intimated by Descartes, or at least, by other less sophisticated Cartesians. His materialistic monism viewed mind simply as a vastly complicated assemblage of material parts. Notwithstanding the possibility that the operations of the human mind might in practice transcend the rote functionings of mere machines, such transcendence would never merit a qualitative ontological distinction from them in principle. Here Hobbes departed from the line taken by Descartes since he did not want to admit the possibility of "innate ideas" of soul, of God, or of anything else. Instead Hobbes sought to show the workings of God in the marvelously complicated functioning of His mechanisms themselves. Thus Hobbes collapsed the distinctions Descartes hoped to maintain between mere organic mechanisms, human subjects, and the divine essence. In my opinion, however, Hobbes did not go so far as to collapse this Cartesian triumvirate into a rigid monism, nor do I think that he even intended to do so. Rather it seems he developed, in ways which actually align him with Descartes, a plenist version of the dualism between corporeal substance and the divine essence which simply obviated the need for unsupportable notions of "innate ideas". This version of the dualism is dialectical rather than simply analytical, focussing on the dynamic interpenetrations between categories of mind and body, subject and object and primary and secondary qualities. In the next few paragraphs I will elaborate upon this version of dualism as it is expressed in Hobbes own writings.

It is important to see that Hobbes simply could not avoid a form of dualism which stemmed from the fact that the exercise of the faculties of mind is fundamentally a private subjective affair. This is in contradistinction to the objects of ratiocination themselves which were, for Hobbes as much as Descartes, publicly and universally constituted. In an early passage in Leviathan Hobbes argues:

Reason, in this sense, is nothing but Reckoning [to ourselves]...of the consequences of generall names agreed upon for the marking and signifying of thoughts... (my italics)

As individual thinking subjects we "reckon" to ourselves with "generall names" and terms whose meanings are socially "agreed upon" and constituted. Earlier I

54 Remember that Descartes "proved" the existence of God and of the soul through his classification of those ideas as necessarily innate and therefore true.

55 Leviathan p.111
noted how Hobbes unambiguously rejected the postulation of a "free subject" cogitating completely independently of a separate realm of material substance as well as other subjects. Implicit in this rejection of course is a concomitant rejection of dualism of the 'orthodox' mind-body sort, and also of the atom-void sort. This physical analysis raised for Hobbes the political problem which he placed at the center of his natural and political philosophy. Hobbes' physical ontology dovetails with his political philosophy at the point where the very existence of myriad privately cogitating individuals necessarily implies some public political accommodations. The brutal existence of each individual in the human "state of nature", the "war of each against all" would be inevitable as long as individuals formed their actions solely with reference to isolated processes of private judgment. In his own words, what is clearly called for is a "science of politics" which will operationalise the advances of the natural science he developed in his early career and of which he claimed (rather pompously) to be the progenitor. As with Descartes, Hobbes tried to render explicit the connection between his physics and his metaphysics, in the sense that he sought to render the political world amenable to exactly the same sort of integrative analysis he forwarded for the physical world.

This public/private dualism forms part of what I consider to be the more 'limited' physical dualism shared by both Hobbes and Descartes, irrespective of their other differences. Corporeal, extended substance, that is to say "body", is *publicly* constituted because it is, in principle, available equally for the contemplation of all reflecting minds. By contrast, the realm of the mind, irrespective of its corporeal or incorporeal status, is fundamentally *private*. Individual thoughts are available only to the individual thinking them, who therefore occupies a unique and incorrigible position as the sole authority and

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56 *Leviathan* p.166ff
57 There is actually quite a great deal of speculation regarding just how unified Hobbes really conceived politics and metaphysics to be. Most of those who suggest that he was not the strong unifier presented in my account stress the very real slippage between the two aspects of his work. In this camp is Tom Sorrel 1988: "The Science in Hobbes' Politics" in Rogers and Ryan (Eds) 1988 pp.67-80. More compelling however is Gary Herbert 1989: *Thomas Hobbes: The Unity of Scientific and Moral Wisdom* (Vancouver: UBC Press) who points out that Hobbes realised that political philosophy and physics could be complementary parts of the processes of self and world creation.
58 Remember that for both Hobbes and Descartes the existence of substance is ontologically prior to the epistemological act of naming. See *Leviathan*, p. 107 on mental discourse and naming. See also Note #17 above.
communicator of her or his ideas. This is especially the case in the ideal "state of nature" where there have, by definition, been no attempts to understand experience intersubjectively. "Body" is therefore understood to be morally indifferent, while "mind", in the state of nature, is quite simply amoral. As a dualism however, this is 'nominal' or 'limited' because it stays closer to the monistic materialism of Hobbes than to, for example, scholastic ideas about a noumenal "plastic nature" which mysteriously impresses form upon all substance. What Verdon takes to be a fundamental Hobbesian distinction between physical and social cosmologies, is in fact an icon of their transcendence through the continual constitution of "being" in time and space. The theory of the private individual as a political "atom" is not formally different from the theory of mind as a self moving physical mechanism. Hobbes recognised, in ways similar to Descartes, that the brain in and of itself is a mechanical apparatus, but that the mind is actually not the brain, but the brain in motion, continually working out is own self actualisation. The problem in both cases hinges on the transcendence of the particular towards the universal, not just the mediation of an unbridgeable relationship. What is at stake then for Hobbes, and for much of seventeenth century philosophy, is the way in which public and private realms will be conceived and linked.

Newtonian atomists did not significantly deviate from this more limited dualism, though their specific response was to submerge the private incorrigible character of ratiocination by subjecting it to a specifically structured and agreed upon discipline. Moreover they denied that there was anything at all underlying their corporeal-incorporeal conception of the mind-body dualism. As will be

59 Richard Rorty, 1970: "Incorrigibility as a Mark of the Mental”, Journal of Philosophy, 67. Note that this characteristic of "incorrigibility" is central to most western theories of the self.
61 In Leviathan, p.93-4 Hobbes distinguishes between human and animal minds thus: "That Understanding which is peculiar to man, is the Understanding not onely of his will; but his conceptions and thoughts, by the sequel and contexture of the names of things..." Note that this is a process theory of mind, depending on our capacity to reflect upon our own conceptions and therefore to continually recreate our own subjectivity.
62 Descartes and Hobbes analysis of motion and causality as intrinsic to the plenum is relevant here, but is complex and confusing. Their concept of "conatus" suggested an inertial motion "towards" self preservation in all matter, which underwrites their distinctions between brain and mind as "brain in motion". For a more detailed discussion of the conatus concept see William Sacksteder 1979: "Speaking About Mind: Endeavour in Hobbes" Philosophical Forum 11(1) pp.65-79
discussed in chapter 4, they sought to render mind 'public' by institutionalising a particular conception of right method and epistemology. Knowledge claims would be directed and disciplined by being forced to conform to an epistemological format which was connected to a specific set of social interests. Plenists, on the other hand, chose to stress the basic incorrigibility of individual thought, insisting only on the veracity of mathematics, and especially geometry, as the appropriate description language. Either strategy brought with it problems of political and social order. More to the point for present purposes, they also entailed explicit attention to the spatial and temporal ordering of social and political relations. What is clearly sacrificed by both camps is the ontological priority of the dialectical interplay between public and private spheres, which has become so central to contemporary critiques of modernity.

3.4 Human and Physical Ontologies and their Spatiality

As I have shown, the postulation of a closely interrelated ontology of substance and subjectivity has been a relatively under-recognised legacy of Descartes' and Hobbes' thought specifically and plenism generally. Descartes, and Hobbes, created as their central philosophical problematic an ineluctably dialectical relation between ideas about substance and ideas about subjectivity. Each element of the dialectic perforce defines, and gives meaning to, the other, and the distinction itself was shown to rely heavily on the locus of perception and representation in the "local motion" of the brain which came to be known as the "mind". It was only with the more atomistic empiricism of Boyle, Newton and the Royal Society that the partition between mind and body began to be seen not as a complex and multiply imbued dialectic, but rather as an oppositional dichotomy. After Locke especially, the mind became a "tabula rasa" which was to be filled with ideas through education and whose "life" was thought to be detachable, in an idealised sense, from that of the body.

My preference then is to see Descartes, Hobbes and all of those who thought like them, as straddling the divide between hermeticism and experimentalism. There can be no question that Descartes retained the central Hermetic idea that philosophy, while also a means to a technical end, was also part of a process of self creation and purification. Moreover, his whole philosophy, and that of Hobbes too, can be read as attempts to forestall the
emergence of a more depersonalised physical and social cosmology by reviving, in a decidedly 'modern' and innovative manner, certain ideas about connectivity and cosmological integration. Indeed, even Bacon himself, that scion of empirical methodology, is currently being recovered as a kind of "proto-scientist" who actually sought to retain much more of thought that preceded him than is usually believed. Bacon was acutely aware of the relations between truth, beauty and practical morality, as is evident from his short Essays and lesser known Aphorisms, some of which could easily be (mis)taken for Hermetic invocations:

> God's encryption of the world is an enigma, and its Maker is hidden to all but those who can discover the signs of his Wisdom by suffering the scourging of their vanities in the sweet ordeal of Solomonic inquiry.  

All of this brings the argument of the chapter back to that contemporary theorist with whose analysis my own seems most convergent; Michel Foucault. Particularly in *The Order of Things* and *Discipline and Punish*, Foucault enunciates a vision of seventeenth century philosophy, especially that of Descartes, as part of a transitional stage between the modern and premodern philosophies and worldview. In his own lexicon, what I have been talking about in this chapter is all part of the seventeenth century "classical episteme" which mediated the transition from the antecedent "Renaissance" and "Modern" epistememes. And part of what is so compelling about Foucault's analyses is his sensitivity to the relationships between ambiguity and intention in epistemic development. As Foucault has noted, the structure of knowledge during this time period, despite its angry denunciations of much of what went before it, still worked largely to support the existence of God and the Sovereign as the only true "subjects".  

> Claims to objectivity, according to Foucault, often mask subjective motives.

With respect to considerations of the intersection of epistemology, power and questions of subjectivity, the issue of the directed gendering of science becomes quite unavoidable. One reason for this is that the exclusion of a vast assortment of subjective "others", especially women, intrinsic to post Cartesian

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63 cited in Briggs 1989 p.9
64 Michel Foucault 1978: *Discipline and Punish* Translated by Alan Sheridan (New York: Pantheon Press)
subjectivity and intellectual discourse has recently attracted a great deal of critical thought and research. Susan Bordo has recently argued that:

The founders of modern science consciously and explicitly proclaimed the *masculinity* of science as inaugurating a new age...associated with a cleaner, purer, more objective and more disciplined epistemological relation to the world.\(^{65}\)

A bold thread then which runs at least from Bacon's "masculine birth of time" through Descartes' own gendering of the realms of mind and body as masculine and feminine respectively through to Cowley's bold assertion with reference to the Royal Society "Philosophy, I say, and call it, He, For whatso'eere the Painters Fancy be, It a *male* virtue seems to me."\(^{66}\) With subjectivity, that kernel of ideas surrounding what it means to be a rational, modern, being, so thoroughly masculinised in the Post Cartesian era, other "ways of knowing" the world were effectively silenced. Descartes had defined subjectivity as the ability to reason, and reason was, in part, defined through the exercise of an exoterically derived moral code of self governance and self control.\(^{67}\) This model of subjectivity would provide the medium for intellectual and other discourse in the modern era, a way of establishing a cognitive baseline for strategies of assimilation and/or co-optation of all that was unfamiliar in one's surroundings. Uniquely feminine "ways of knowing", which Bordo refers to as "dynamic", "inclusive", "relativistic" and "consensual", were, within the post Cartesian discourse, displaced as epistemologically legitimate.\(^{68}\)

Foucault has referred to the ways in which power relations have intersected with post Cartesian discursive formations in terms of the "micropolitics of the body". In *Discipline and Punish* and later works Foucault developed this concept by examining the ways in which power is exercised over the individual subject, especially through the subject's "internal" constitution as a modern, knowing individual. It is here that we encounter the deep understanding Foucault developed of the myriad ways and means by which epistemic transformations of the kind described in this chapter have been


\(^{66}\) excerpted from Abraham Cowley's "Ode to the Royal Society", *Seventeenth Century English Verse* edited by E.D. Starkman (New York: Bantam Books)

\(^{67}\) Caton 1973, p.32

\(^{68}\) Bordo 1987, p.100
implicated in explicitly *spatial* reconstructions. The definition, control and manipulation of space is integral to an "technology of power". "Starting with Galileo and the seventeenth century", Foucault argues, "extension was substituted for localisation." By this he surely meant that the attempt was made, in this era, to render space inert, inconsequential and transcendable through strategies of objectification and generalisation. If so, then this remark of Foucault's resonates with the observations of both Morris Berman and Steven Toulmin that the seventeenth century "scientific revolution" marked a shift from the local, partial, and the specific to the universal, comprehensive and the general.69 In the next two chapters I will look at two very different aspects of the spatial structuring of scientific knowledge which were implicated in the seventeenth-century initiation of the project of modernity.

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69 See Morris Berman 1984; and Steven Toulmin 1990.
Chapter 4

"The Human Geographies of Seventeenth Century Philosophy: the interpenetration of physical and metaphysical spaces 2"

4.1 Self/Substance Ontologies and Political Geography
4.2 The Frontispiece to Leviathan: Hobbes' Political Geography
4.3 Hobbes, Boyle and the Air Pump Trials
   Technological Space
   Social Space
   The Spatiality of Hobbes' Objections to Boyle
4.4 Spatiality and the Partition Between Physics and Metaphysics
4.1 Self/Substance Ontologies and Political Geography

Up to this point I have tried to present the plenisms of Hobbes and Descartes as far as possible in physicalist terms. Or, to be more precise, I have tended to take a physical scientific point of view in my discussions of the linkages between seventeenth century physics and metaphysics. What I would like to do now is to reverse the order of the preceding narrative and look at the penetration of metaphysical concerns into debates over primarily physical issues, of ontology and epistemology. In particular I will dwell on the case of Thomas Hobbes, who, as I have shown in the previous chapter, employed a plenist physical ontology to underwrite a 'limited' Cartesian dualism. On this physical scientific foundation Hobbes establishes his political philosophy. Hobbes' work seems to me to exemplify the interdependence of physical and metaphysical concerns in an especially perspicuous, and more importantly self conscious, manner. No respecter of nascent scientific discursive boundaries, Hobbes frequently deployed metaphysical arguments in physical disputations, as he did in his disputes with Boyle over the interpretation of the celebrated air pump trials. From a post-positivist perspective it is both telling and fascinating to observe how an argument about the physical status of an experiment on the properties of air should move so easily and readily into a disputation about social and political order. More to the point, problems of political and physical structure, including the structure of social and political space, were considered to be one and same, rather than merely analogous, complementary or otherwise indirectly related. Subsequently, Hobbes, as I will show, develops a critique of Boyle's scientific program which hinges, in large measure, on his social and political geography. Whereas in the last chapter I sought to show the penetration of physical ontological elements into metaphysical problems, here I will focus on the converse metaphysical imbrications of seventeenth century thought. Once the physics/metaphysics partition is reproblematised, from both directions as it were, the stage will be set for an analysis of seventeenth century disputes about space and geography in chapter 5.
4.2 The Frontispiece to Leviathan: Hobbes' Political Geography

Hobbes' political theory is, for the most part well known. In response to the discord of the Civil War and Interregnum Hobbes argued forcefully that civil peace could only be secured through the establishment of a sovereign with absolute dominion over both material and spiritual realms. In \textit{Leviathan}, published in 1651, Hobbes states that:

\begin{quote}
I ground the civill right of Sovereigns, and both the duty and liberty of subjects, upon the known natural inclinations of mankind and upon the articles of the laws of nature.\textsuperscript{1}
\end{quote}

In this single succinct statement Hobbes combines virtually all of the elements of his ideal state; comprised not just of an absolutist sovereign, but also of a balancing of the "known natural inclinations of mankind" (the material of nature) and the "articles of the law of nature" (the artificially derived body politic). Note too that both the duty \textit{and} the liberty of citizens are given careful weight in his formulation, for Hobbes did not consider that citizens ought be expected to follow their sovereign either blindly or slavishly, but through conscious acts of submission which recognise both their own and the common good.\textsuperscript{2} For the time, this marked a novel theorisation of the individual private subject and his/her relations to a politically constituted public realm. In turn, this theorisation of the political problematic was intricately intertwined with a plenist physics.

Though Hobbes rarely thought in explicitly geographical terms, there is nevertheless a fascinating social and political geography implicit in his analyses.\textsuperscript{3} This is most apparent figuratively, insofar as Hobbes' preoccupation is with the problems engendered in contexts where 'spaces' of authority only partly overlap

\begin{footnotes}
\item[2] Under certain circumstances Hobbes would permit subjects to legally break their covenant as subjects to the state; or, more precisely, under certain circumstances such as subjugation by a foreign power, this covenant could naturally dissolve. See \textit{Leviathan}, chapter 14.
\item[3] Where Hobbes did talk of "geography" he tended to follow the common notion that Geography, together with Astronomy comprised Cosmology, which examined the "consequences of the Motion, and Quantity of the great parts of the World, as the Earth and Starres" and thus placed it between mechanics and geometry in his classification of the sciences. \textit{Leviathan} p.149
\end{footnotes}
and are to some extent in contest with one another. Various forms of religion (Presbyterian, Catholic and Protestant), each with their own locally based centres of allegiance vied with secular authorities and even the economic interests of England's larger cities for political preeminence. Hobbes is particularly sensitive to the manipulation of theological and intellectual issues in the furtherance of factional objectives during the period. Still, Hobbes' analysis is geographical in a more material sense as well. After all, what was at stake was more than merely the locus of social and political control. Hobbes' is well attuned to the fact that each of the competing forces he identifies mobilises different, thought partially overlapping control structures. Moreover these control structures and resources are inscribed in the landscape, through the growth and prosperity of some towns over others, the reach of the various ecclesiastical institutions through their hierarchical network of parishes and churches, and the grassroots basis which supported the various Protestant movements. In fact, the chronological analysis of the Civil War in the latter dialogues of behemoth depends quite markedly on an understanding of the conflict as one between a complex patchwork of differently constituted regions. Ultimately, it may be argued that Hobbes political theory marks an attempt to bring these disparate spaces of power into a more convergent harmony, a harmony which he felt must resemble the absolutist nation state of Leviathan.

There may be no better summary of Hobbes' political theory and his analysis of the Civil War than in is encapsulated visually in the frontispiece which precedes Leviathan (Figure 7). In this frontispiece one can perceive the major elements of both his critique of the English polity during the mid seventeenth century as well as the way this critique relates to his proposed solution. It is a finely balanced composition of elements and counter-elements which operates on scientific, political and aesthetic levels simultaneously. A careful reading of this frontispiece even allows us to see, as a sort of 'subtext', the explicit connections Hobbes made between his theories of physical substance and his more readily apparent political and ecclesiastical discourse. What Schaffer and Shapin have referred to, somewhat obscurely, as Hobbes' "political epistemology", the relationship between civil and religious power and a theory

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See especially Behemoth, Dialogue 3, p.126 where Hobbes observes that the interests of the cities must necessarily have been against those of the King, given their growing role in the new circuit of exchange.
of knowledge and linguistic reference, can be inferred from this single frontispiece.\(^5\) This is especially the case given that it is now very clear that Hobbes himself was intimately involved in the construction of the design.\(^6\)

Corbett and Lightbown have suggested that the frontispiece design may be read both from the top downwards as well as across. Read downwards, they claim that one interprets the drawing as showing the office of the sovereign as constitutive of the body politic itself. The panels on either side of the lower half of the engraving, indicating the two realms of spiritual and material authority are therefore shown to be integrated in the Leviathan state, which is the visual apex of the design. Read horizontally, the lower panels shown instruments of civil power arrayed against corollary instruments of ecclesiastical power. It is fairly certain that Hobbes, ever a polemicist, would have intended these visual juxtapositions to be controversial and perhaps even "frightening".\(^7\) What might be "frightening" to English readers in the immediate post Civil War period is of course the constitution of the two sides in such stark and equally powerful terms. All of this seems straightforward enough, though I would add that the engraving can also be read from the bottom \textit{upwards}, as Hobbes' critique of the politically fractured society which, in his view, was England in the seventeenth century. Read this way, one follows the lines of convergence upward, through the political analysis of the Civil War to its final salvation, or so Hobbes hoped, in the Leviathan state. To read the frontispiece as a statement of his epistemological views is less straightforward, as this exists as a kind of "subtext" which informs the \textit{manner} in which the image is constructed as much as its specific content.

\(^5\) By using this term Simon Schaffer and Steven Shapin, in 1985: \textit{Leviathan and the Air Pump} (Princeton: Princeton Univ. Press) p.99, evidently mean simply the implications of Hobbes' physics for his political theory. However, as will emerge in my account, Hobbes' works marks a more robust "epistemology of politics" dialectically intertwined with such a "political epistemology".


\(^7\) See Brown's discussion of this point; Brown 1978 p.27
Figure 7: Frontispiece to Hobbes' Leviathan (1651)
Now let me turn to the content of the panels themselves. Starting from the top right, one sees the temporal military power of the secular sovereign, represented by the fortress, arrayed against the spiritual power of the Church. The next two panels down on either side show symbols of civil and ecclesiastical authority, a regal coronet and a Bishop’s mitre, and the requisite mechanisms of coercion; physical force for the sovereign, and spiritual damnation for the Church. As will be evident in the reading of the upper half of the panel, Hobbes believed that physical and spiritual force constituted a priori as culturally separate entities, could contribute only to an unstable commonwealth. Even acting in concert physical and spiritual “force” would not necessarily have an integrated and unified disciplinary effect on the polity. These forces of public and private compunction would have to be fully integrated if the ideal state of peace was to be achieved. The next two panels down show the armaments and conduct of war pitted against the rules and conduct of scholastic debate. The forks in the panel second from the bottom on the left are the rhetorical “forks” of syllogistic logic. Interestingly, Hobbes places the intellectual institutions of his day squarely in the camp of the Church, not even potentially available to civil authority as such. That Hobbes generally related scholastic modalities with the interests of the Church is also clear from his writings. In Behemoth, for example, Hobbes argues in the first dialogue that

Theological discord in the public domain through the universities was an excellent means to divide a kingdom into factions...[and]...the cause of all our late mischief [the Civil war] was the imposition of abstruse theological disputes [and interests] into the public realm.8

Strategically this was a very powerful connection for Hobbes to make, since much of the thought of the period, even in theology, evoked a generalised rejection of the long established structures of education, disputation and philosophical learning. Read by itself then, the lower half of the Leviathan title page shows both the tensions which Hobbes believed to exist in English society and likewise his analysis of the Civil War they participated in.

The upper half of the design is rather more interesting since it is a representation of Hobbes’ desired Leviathan state. The figure of the sovereign looms large, paternally and beneficently, over an essentially feudal landscape.

His body is composed of the bodies of his subjects all oriented towards him, in the act of making their covenant with him, and he holds both the "sword of justice" and the "shield of faith" (a Bishop's crosier). In words Hobbes described the meaning of this remarkable image:

From this consolidation of the Right Politique and Ecclesiastique in Christian Sovereigns, it is evident they have all manner of power over their subjects...both in policy and Religion; and they may make such laws, as themselves shall judge fittest, for the Government of their subjects, both as they are the Commonwealth, and as they are the Church: for both State, and Church are the same men.  

As one might expect there has been much speculation regarding whose face is attached to the body of the sovereign, with possibilities ranging from either Charles, to Oliver Cromwell, to even Hobbes himself. Yet it seems patently obvious, as Brown has argued, that the face cannot be any other than that of Charles II (see Figure 8), given the fact that Hobbes was not only an avowed Royalist, but had been Charles's tutor, and was known to have been anxious about obtaining Charles's renewed favour during this period. Given these points, any other attribution would seem to be simply spurious.

Let me return to a comment I made above about the landscape over which the Leviathan sovereign rules. Intriguingly the landscape of the engraving seems decidedly feudal; small villages each with their own central church dot an apparently pastoral countryside. There are no roads and no industry in evidence, nor are any of the institutions of seventeenth century capitalism, such as a Bourse, present. Instead this landscape is presided over by a much larger walled city of essentially sixteenth or early seventeenth century design. The crownworks, bastions and the machiolation of the city wall are clearly contemporaneous with Hobbes' own time. Such fortifications, as Parker has observed, while useful in repelling foreign invasions were probably much more

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9 Leviathan, p.575. I note in passing the remarkable similarity between Hobbes' ideal state and that of Plato's Republic: "The society we have described can never grow into a reality or see the light of day...until philosophers become kings in this world, or till those we now call kings and rulers really and truly become philosophers, and political power and philosophy thus come into the same hands" Plato's The Republic translated by Desmond Lee (Harmondsworth: Penguin:1974) p.263

Figure 8: Hollar's engraved portrait of Charles II (1650)\textsuperscript{11}

\textsuperscript{11} Brown 1978 p.34
important as centers of economic and political domination. Such garrisons were of course staffed by soldiers from outside the region, so as to boost their effectiveness in quelling internal unrest. The overall urban plan and especially the design of the cathedral seem to reify the urban center as a focus of spiritual and economic power as well (this latter admittedly not as thoroughly treated in Hobbes' work as are civil and spiritual domains). Note also however is the lack of geometrical imposition on this "ideal" plan. The streets, the buildings and even the cartographic projection itself do not show the imprint of rectilinear thinking which became so common during the century, as evident in Christopher Wren's and Robert Hooke's designs for the rebuilding of London after the Great Fire of London in 1668.

It is thus easy to see why many commentators regard Hobbes' political philosophy as peculiarly backward looking and feudal. However, this perspective is complicated by a number of factors, not the least of which is Hobbes' express abhorrence of the "traditional" as compared to what he took to be the "modern". Still, no doubt there are strong surficial resemblances between his Leviathan state and the feudal city states of the middle ages, which Hobbes himself recognised. However, there can be no doubting either that Hobbes' Leviathan was predicated on a radically different - "modern" - view of the rights and obligations of the citizenry, and the nature of the covenant which was to bind them into a nation-state. On this level Hobbes' thinking evinces affinities, as MacPherson has noted, with more clearly bourgeois political and moral theories of Locke and others. This point may be obscured somewhat by the fact that he portrays his citizens only in the act of relinquishing their political autonomy to the sovereign. This act itself was, however both an act of individual judgement, and also a culminating moment for a new conception of the subjective consciousness of the individual subject as citizen which was integrally related to his physical plenism.

Overall, it may be said that Hobbes' political and metaphysical edifice was intimately related to his plenist physics. Hobbes argued that epistemological unity in physical, as well as political, science should derive from a common

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geometrical style to reasoning and deduction. Consequently there was no contradiction at all when Hobbes argued that his political philosophy demonstrated without ambiguity the maladaptiveness of an atomist physics. To him the mechanical proposal of action-at-a-distance and the related concept of macrocosmic void space entailed a basic constitutive separation of civil (material) and religious (spiritual) domains. Quite obviously the externally verifiable natural laws governing corporeal substance could not be expected to be directly applicable to that which was postulated to have an existence independent of the realm of corporeal substance. In other words, the sphere of "incorporeal substance", if such was admitted to exist, would require a separate and distinct form of investigation and theorising. Hobbes feared that theological attempts to fill the breach with notions of an all pervasive "plastick nature", or popular attempts to proclaim the possibility of direct communion with God (often referred to during this time period as "enthusiasm") would drive a wedge into any attempts by civil authorities to manage peacefully the relationship between public and private spheres. But a third candidate to fill this invidious breach, the experimental programme institutionalised in the Royal Society, while secular in orientation, nevertheless had to be opposed.

4.3 Hobbes, Boyle and the Air Pump Trials

As has been demonstrated above, Hobbes' plenist physics, in both its ontological and epistemological aspects both informs, and is reciprocally informed by, his political philosophy. For the most part I have so far only shown that half of the Cartesian-Hobbesian cosmology which traces the influence of physical structures on metaphysical ones. But I now want to consider the other half of the equation, and demonstrate that Hobbes' political philosophy was brought to bear directly on his celebrated controversy with Robert Boyle and the

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15 On the concepts of "plastick nature" and "enthusiasm" see Glacken 1967 p.393ff; Lydia Gysi 1962: Platonism and Cartesianism in the Philosophy of Ralph Cudworth (Berne, Switz:Herbert Lang); Henry More 1662: A Collection of Several Philosophical Writings; and John Ray 1692: The Wisdom of God Manifested in the Works of Creation.
Royal Society over the proper interpretation of Boyle's air pump experiments.\footnote{This controversy is the subject of Schaffer and Shapin 1985: Leviathan and the Air Pump: Hobbes, Boyle and the Experimental Life see Note #5} What for Boyle was a set of experiments which was to set the model for right method in experimental philosophy, was for Hobbes emblematic of the same sort of divisive structures which he had criticised in the English polity. The stakes in this instance were higher, however, since Hobbes recognised that the structures of philosophical knowledge could have a profound effect on the possibility of inculcating the sort of civil society he felt necessary for the securing of civil peace. Consequently, in the late 1650s, when the results of Boyle's experiments with the air pump were becoming well known, Hobbes began to elaborate a strong critique of them based upon his earlier work mapping physics into metaphysics, and specifically his political theory. One might even claim that Hobbes himself reversed the trajectory of his earlier work, attacking Boyle on the grounds of the metaphysical spaces - political, social and cultural - his physical pronouncements could be shown to imply.

As has been suggested in the last chapter, experimental scientists, at least those of the Royal Society's stamp, very carefully circumscribed the object of their experimentation. Whereas plenists were compelled by their ontological monism to seek after causal explanations, experimentalists such as Boyle claimed that certainty about causes was not possible.\footnote{In De Corpore Hobbes stated categorically that "All phenomena is local motion, and nothing but local motion" a statement emphasised also in his Dialogus Physicus, a translation of which is contained as an appendix to Schaffer and Shapin 1985} After all, Boyle noted, specific replicable results could often be obtained from a variety of causes, and so the imputation of a cause, or even a set of causes for any given phenomena would unavoidably be less certain than statements merely about the phenomena itself. Consequently Boyle argued that scientific experimentation ought be used primarily for the determination of "matters of fact"; that is to say observable, and replicable, "effects" shorn of all considerations of causality. As Schaffer and Shapin have it, Boyle's "...overriding concern was to protect the matter of fact by separating it from various items of causal knowledge". It was primarily to this end that Boyle, and others, elaborated an experimental paradigm, during the
1640s and 1650s, which was subsequently institutionalised in the Royal Society after 1662.\(^{18}\)

In a ground-breaking sociological analysis of Boyle's dispute with Hobbes over the interpretation of the Air Pump trials conducted during the 1660s, Simon Schaffer and Steven Shapin operationalise a threefold classification of the new experimental paradigm. They claim that the analysis of scientific disputes can be fruitfully broken down into three closely circumscribed, though interrelated, discussions of the "material, social and literary technologies" deployed by disputants:

- a material technology embedded in the construction and operation of the air pump;
- a literary technology by means of which the phenomena produced by the pump were made known to those who were not direct witnesses;
- a social technology that incorporated the conventions experimental philosophers should use in dealing with each other and considering knowledge claims.\(^{19}\)

As far as it goes, their analytic framework serves their purpose very well allowing for the articulation of a sensitive analysis of the physical and metaphysical bases for the Hobbes-Boyle dispute. Also this framework allows them to investigate the more general hypothesis that "solutions to the problem of knowledge are also solutions to the problem of social order".\(^{20}\) However, it seems clear that the emphasis placed on the common term "technology" may mask a bias towards explicitly and self consciously wrought scientific instruments and procedures as entirely constitutive of seventeenth century natural philosophical research. To be sure the seventeenth century concatenation of the revived interest in immediately practical knowledge with a valorisation of the physical trappings of science render this bias quite defensible. However, such focus also seems to somewhat efface the multiplexity of spatial problematics in the structuring of scientific knowledge. Much of their work can

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\(^{18}\) During the 1640s and 1650s the nucleus of the future Royal Society met irregularly at various sites, especially at royalist Oxford University. Though hardly an objective source, Henry Oldenburg referred to these precursors to the Royal Society as "the Oxonian Sparkles". See Oldenburg's dedication to the first volume of Transactions of the Royal Philosophical Society of London reprinted 1963 by the Johnson Reprint Company, New York.

\(^{19}\) Schaffer and Shapin 1985 p.25

\(^{20}\) Schaffer and Shapin 1985 p.14
be read from the geographical point of view as an analysis of the elaboration of a
class of "spatial technologies" which articulated with and cross cut the other
three technologies as well as broader questions of social and political geography.
After a fashion, they themselves come to this selfsame realisation when they
observe, in the conclusion of their work, that their use of spatial terminology has
alternated between the figurative and the literal. But insofar as they have
discussed elements of the "space" of scientific experimentation, and the "spaces"
opened up or closed down by the experimentalist paradigm, they oddly conclude
that such usages are "novel".21

Still, not all spatial ordering is "technological" in the sense that they use
the term. The fact of the matter is, especially during the seventeenth century
when science, as we know it now, was as yet embryonic, most of the actual work
was conducted in converted and sometimes temporary spaces, spaces originally
designed for other purposes entirely. For example, the diarist John Evelyn
himself records that much disputation of scientific interest and importance
during the late seventeenth century happened in London’s burgeoning coffee
houses.22 Moreover, scientific figures such as Boyle and Hooke, did much of
their experimentation at home, the latter converting his parlor to the purpose.
The Royal Society itself had to adapt to several different lodgings during the
1660s and 1670s, though its members quickly realised that they would enhance
their prestige and scientific eminence if they had their own specially designed
spaces. More subtly, technological space, as constituted though the
epistemological priority afforded scientific instruments of vision, such as
Hooke’s microscope, which tended toward the reduction of experience to visual
quantitative format. These are also of course connected with the more macro
level spaces in which they existed and were operated. Subsequent work by both
Schaffer and Shapin has become more explicitly spatial in both of these two
respects.23

21 Schaffer and Shapin p.332. They are evidently unaware of those geographical treatments of
philosophy, science, and geographical science which operate at both the microcosmic and
macrocosmic levels; for example the work of David Livingstone 1980; 1984; 1988 and Derek
Gregory 1978.

22 John Evelyn 1881: Diary and Correspondence of John Evelyn, FRS edited by William Bray
( London: George Bell and Sons), especially relevent are entries made in December and January
1660/61.

23 Simon Schaffer 1989: "Glass Works: Newton's Prism and the Uses of Experiment" in Gooding,
Pinch and Schaffer (Eds) The Uses of Experiment ( Cambridge: Cambridge University Press) 67-
In what follows I will seek to add to Schaffer and Shapin's analysis through the employment of a more overtly spatial analytic framework which concentrates on some of the spatial aspects of the social and technological organisation of scientific experimentation. Consequently I will be interested in some of the ways certain practitioners, such as Boyle and Newton, constituted certain social and physical spaces as legitimate for knowledge production. The spaces so used can be seen as fluid, changeable composites of a wide range of social, economic and political spaces (using the term both figuratively and literally). What is available to legitimise a given knowledge claim varies contextually, especially during a period when the scientific societies themselves are not yet unassailable objectifying resources, and so the contestation of knowledge claims will necessarily be a highly charged and fluid affair. In the two brief discussions which follow, of the technological and social spaces of knowledge production, I will be interested in the further interleaving of these explicitly scientific spaces with aspects of the broader human spatial context. It is at this point specifically that the dispute between Hobbes and Boyle shifts from being a sterile academic dispute to being a contestation of fundamentally different social and political geographies in the context of Restoration England.

Technological Space

Gaston Bachelard has claimed that all "scientific instruments are reified theorems".\(^{24}\) By this Bachelard would seem to be implying a number of things. First, and most obviously, all scientific instruments share the characteristic of being mechanisms which direct the experimenter's attention to some sorts of occurrences, rather than others. Implicit in their employment is the postulation, itself a sort of theorem, that their construction renders perspicuous some important aspect of natural structure or process. Thus "artificial instruments and methods" such as Hooke's microscope were widely believed to function as passive "extensions of the senses", not intervening in natural actions at all, but merely magnifying them for human witnessing.\(^{25}\) Thus the incredibly detailed

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103; Steven Shapin 1988: "The House of Experiment in Seventeenth Century England" ISIS 79 373-404 in which he claims "The career of experimental knowledge involves the circulation between public and private spheres" p.400

24 cited in Schaffer 1989 p.67

25 See for example the excerpts from Hooke's Micrographia in Brian Vickers 1987: English Science from Bacon to Newton pp.99-159; Schaffer and Shapin 1985 p.36
engravings of Hooke's microscopic investigations were meant as completely accurate renderings of what really existed (See Figure 9). Part of the power of such instruments was precisely that they were perceived to be largely passive, their work defined solely in terms of magnifying what was already in existence. It is nevertheless true, however, that such instrumentation almost invariably attempted to reduce the "truth" of a scientific matter of fact, such as the structure of a Flea, to a geometrical, single point perspective, visual rendering. After

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Hooke, the question "What is a flea?" was answered primarily in terms of just these sorts of renderings, even though it should be clear that vision in and of itself does not even come close to exhausting the total empirical experience of phenomena. Even where this fact is recognised, the tendency has nevertheless been to attempt to reduce empirical phenomena, such as heat and magnetism, to visual equivalents.

But Bachelard's claim is true in a second, more subtle manner as well. Most scientific instruments cannot easily be classified as mere "passive" mirrors or magnifiers of nature. Certainly Boyle's air pumps, and also Newton's prisms do significantly more than just show us what is already present in nature. The power of such "active" instruments lies in their putative ability to tease out of the confusion of empirical experience some subset of phenomena which are subsequently theorised to be somehow significant. Boyle's air pump was believed to provide a way for viewing the effects of vacuum on other material things, such as inflated bladders and even animals. Newton's prisms, especially the "two prism experiment" recorded in his *Opticks*, (though originally conducted in the 1660s) were likewise thought to provide a privileged locus for the scientific study of the composition of light. Their significance lies, for subsequent scientific work, in the socially and politically contested claims that these experiments constituted a special class of benchmarks, or as Newton put it, "experimentum crucis".

Bachelard's claim recognises the fact that the acceptance of any instrumentality as epistemologically privileged renders the underlying principles of its construction self evident, and so reflexively sanctions their perpetuation. Once Boyle's, or Newton's experiments were accepted by the majority of their peers as successfully reducing some phenomena to its fundamental elements, then all debate about those fundamental elements becomes precluded. It would be very difficult indeed to retain the instruments while markedly differing with their ontological presuppositions. From this perspective Hooke's microscope can be seen as reifying a particle ontology which the instrument itself was expected, in principle, to be able to completely reveal.

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27 The distinction between "active" and "passive" instruments in science comes from W. D. Hackmann 1989: "Scientific Instruments: Models of Brass and Aids to Discovery" in Gooding, Pinch and Schaffer (Eds) 31-65
The case of Newton's prism trials is more complicated, since his interpretation of the results was destined to remain a site for debate and disagreement even up to his death in 1727. His experiments were accepted only as experiments, and the epistemological closure he sought to impose on studies of light was rejected by a variety of authorities including Hooke.²⁸ It is in this sense that "instruments are reified theorems".

For Boyle, and the other Royal Society experimentalists, the series of trials which explored the properties of a chamber evacuated of air with

![Figure 10: Diagram of Boyle's Air Pump](image)

²⁸ Schaffer 1989
a small hand pump (Figure 10)\textsuperscript{29} were taken to prove beyond doubt the reality of void space and the ontological superiority of atomism over plenism. The pump shown above of one of Boyle's own design completed around 1660 and could accommodate glass vessels ranging up to thirty quarts in volume. The simplest experiment involved employing the pump's "sucker" to draw air out of the chamber and observing the progressive difficulty encountered after multiple repetitions of this process. Weights could be hung on the sucker and so the 'force' which the evacuated chamber was exerting on the sucker could be quantified and correlated with the amount of air evacuated. Other trials, described by Boyle in \textit{New Experiments Physico-Mechanical} included observing the effects of pump evacuation on lit candles and inflated bladders placed in the chamber.\textsuperscript{30} Of course the experiments could also be reversed, observing the effects of air compression within the chamber. Out of these experiments came Boyle's celebrated doctrine of the "Spring of the Air" in which he conceived of ...air...to be such a heap of little bodies, lying one upon another, as may be resembled to a piece of wool. For this consists of many slender and flexible hairs, each of which may indeed, like a little spring, be easily bent or rolled up but will also, like a spring, be still endeavouring to stretch itself out again.\textsuperscript{31}

Though Boyle professed himself loath to enter "so difficult a controversy" it is nevertheless clear that he tended to think that his air pumps trials demonstrated the existence of void space, and therefore the superiority of atomism over plenism.\textsuperscript{32}

It is useful to pause and make a few preliminary conclusions about the spatial attributes of scientific equipment. The analytic path I have been following thus far suggests that such instrumentalities can have the effect of directing the scientific gaze towards certain ontological conclusions and away from others. Thus, Boyle's air pump, and also Hooke's microscope, suggested to seventeenth century experimentalists that the world was made up of atoms in a void. As I

\textsuperscript{29} Schaffer and Shapin 1985 p.27ff  
\textsuperscript{30} my citations from Boyle's \textit{New Experiments Physico-Mechanical} come from Vickers 1987; but see also Stewart op cit and Robert Boyle 1675  
\textsuperscript{31} Vickers 1987 p.52  
\textsuperscript{32} Shaffer and Shapin 1985 p.45, concerned primarily with the epistemological structure of Boyle's experimentalism, downplay his ontological peregrinations. Yet is clear from Boyle's own writings, such as those cited above, that he was not averse to conceptualising beyond observed "matters of fact".
will show in the next chapter, such instruments lent credibility to theorisations of space itself as an "absolutely" constituted vessel in which natural and human processes are contained, and which is to some extent independent of those processes. But all of this pertains only to spatiality considered at the abstract level. There is a much more immediate spatiality to the seventeenth century explosion of interest in material instruments as a necessary part of scientific pursuits which concerns the spatial relations of their production, distribution, exchange and consumption within an incipient commodity economy. During this period instruments were for the most part made to order from plans drawn up by experimenters such as Boyle by specialists in working whatever materials were required. Few experimenters actually built their own instruments as Da Vinci had done a century and a half before. The desire to procure instruments from certain recognised craftspeople or locations, became not only a resource for validating the results obtained with them, but also lent itself to the development of new professional and regional specialisations. Venice for example, was known during the seventeenth and eighteenth centuries as the best place to obtain glass for the production of high quality lenses.33

There has as yet been very little work on the circulation of scientific instruments as commodities. While it is no doubt true that the smallness of the market during the seventeenth and eighteenth centuries would have rendered the direct economic impact negligible, it is still true that this period saw the development of new professional and regional classifications which have remained with us to the present. Schaffer and Shapin have observed that Boyle's air pump was seventeenth century "big science", being relatively expensive and difficult to build and maintain. The question then arises as to how these instruments were financed and to whom belonged the rights to use them and exploit any useful results produced. In the case of the seventeenth century the question of financing is much less complex than it is today, since most experimenters were then in the habit of financing their own instruments. Boyle himself was aided in this regard by being the son of the Earl of Cork, Descartes came from a family of minor French nobility, and others such as Wren

33 Schaffer 1989 pp.96-99. This fact led to a problem for Newton's claims about his prism experiments once a Venetian experimenter reported being unable to reproduce Newton's results. The battle lines were drawn in this case in terms of Newton's method and craftsmanship on the one side and the superior Venetian materials on the other. The result was for a long time inconclusive.
and Hooke paid their way through an amalgam of professional callings.\textsuperscript{34} Any answer to the latter question, regarding the ownership of experimental results, is much less clear even though it was becoming an increasingly important issue as results were produced which were commercially exploitable. Thomas Sprat, in his highly polemical History of the Royal Society, tells us that the institutionalisation of the Royal Society provided "the most solid honour" to the discoverer of useful scientific facts, and also "...the strongest assurances of still retaining the greatest part of the profit" derived from them.\textsuperscript{35} Thus there is not only an ontological geography inherent in scientific instruments, there is also a much more immediate, though rarely researched, geography of scientific instruments, pertaining to their production and diffusion through space.\textsuperscript{36}

\textbf{Social Space}

But these experiments became an icon for more than just an alternative ontological regime. Besides their content and outcomes, as Boyle repeatedly emphasised, experimental trials were meant to provide a shining example of the correct method for producing and legitimating scientific knowledge claims. Bound up with Boyle's ontological claims about the "spring of the air" and the reality of the vacuum, was an epistemology which was markedly different from that proposed by Descartes and Hobbes. While the stakes of the new enterprise were, of course, Boyle's "matters of fact", the \textit{modus operandum} was to 'externalise' private ratiocination through imposing strict adherence to a closely specified experimental procedure. The experimentation, discovery and justification of scientific knowledge were to be rendered, as far as possible, public, in marked contrast to the reflective private ratiocination of Hobbes' and Descartes' epistemology. Whereas Descartes and Hobbes utilised empirical studies primarily to \textit{inform} and guide their deductive scientific processes, for Boyle and the Royal Society empirical study was the \textit{essence} of their method. Absent also from the Royal Society programme was the essentially Hermetic soteriological aspect of philosophical investigations which was still to some

\footnotesize{\textsuperscript{34} Both Wren and Hooke had considerable reputations as architects and planners, both being asked to site on the Commission which oversaw the rebuilding of London after the Great Fire of 1666. See T.F. Reddaway 1937: "Wren's Plan for Rebuilding London" Town Planning Review
\textsuperscript{35} Sprat excerpted in Vickers 1987 p.166
\textsuperscript{36} Schaffer and Shapin begin to hint at the existence of these geographies in their rudimentary diffusion map of air pump reports p.228.}
degree present in Descartes and Hobbes. For the Royal Society self creation was completely beside the point of scientific pursuit; fact was severed from value and the end of science was conceived to be, very simply, technical knowledge about the external world.

Around the revised goals of natural experimentation, a new community developed which not only defined the proper procedures for knowledge production, but also would act as arbiter of scientific disputes. After 1662 the production of knowledge

...was to be established by the aggregate of individual beliefs...Matters of fact were the outcome of the process of having an empirical experience, warranting it to oneself, and assuring others that grounds for their belief were adequate.

The solution to the problem of just who could be accepted as a legitimate producer of a 'matter of fact' ensured that social conservatism and political power would be unavoidable elements in the scientific process. But control over experimenters and experimentation was more pervasive than simply this. If the technological spaces discernable in seventeenth century scientific instruments helped reify a particular ontological structure, so too was this structure assisted by the necessarily social component of their use. After all, especially in the case of elaborate instruments such as air pumps and, later, leyden jars, the very small number of machines inevitably meant that access to them had to be negotiated by prospective experimenters, and new versions of existing instruments themselves had to be judged to be commensurate with the old ones if knowledge was to be produced. But these technologies were also social in the sense that they usually required the cooperation of several people to operate them "correctly". Finally, communications between experimenters were also disciplined in a specific way designed to enhance objectivity and, as Schaffer and Shapin put it, open up a "space" for benign controversy. All of these functions were

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37 See chapter 1 on hermetic tradition, and also chapter 3 on ontology and subjectivity in Descartes and Hobbes.
38 Schaffer and Shapin 1985 p.25
39 Schaffer and Shapin 1985 p.51 "...the language game Boyle was teaching experimental philosophers to play was based upon implicit acts of boundary drawing..." On the rhetoric component of seventeenth century science see Vickers 1987; Briggs 1989 and also Lisa Jardine 1974: Discovery and the Art of Discourse (Cambridge: Cambridge Univ. Press).
incorporated in the scientific societies which began to be formally instituted in Europe in the late seventeenth century.

In the first place, "social technologies" were implemented for adducing just who could be accepted as a legitimate producer of knowledge and witness to experimentation. At this time there was not yet a professional scientific occupation which would remunerate its incumbents, the appointment of Robert Hooke as "Curator of Experiments" in 1662 for a very modest, and irregularly paid stipend notwithstanding. Thus the ranks of the Royal Society (as well as other societies elsewhere) tended to be dominated by those men who could afford the leisure to follow scientific pursuits. Generally speaking membership in the Royal Society was extended to hegemonic elites; clerics, nobility and military officers were all curried as potential witnesses whose social positions lent their observations of an experiment extra credibility. As well of course, "gentlemen" experimenters such as Boyle (a son of the Earl of Cork) were also admitted, as were persons with university postings, even they weren't necessarily pertaining to "science" as such. The social space represented in the membership of the early Royal Society was consequently an intriguing admixture of the politically and theologically conservative and the philosophically innovative. Undoubtedly much of the success of this society derives from its ability to map its scientific agenda into the hegemonic political and economic landscape of Restoration England.

Legitimacy too flowed from adherence to rules ensuring that experimental space and discourse were structured after a highly specific fashion. Communication of results was to be in a plain style, though "prolix" since "the florid style was to be avoided as a hindrance...it was like painting the eyeglasses of a telescope". Boyle counselled that scientific reports were to be dispassionate and prolix in the extreme so that readers would be able, as far as possible, to conceive of the experiment as it actually occurred.

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40 Apparently the provider of the endowment out of which Hooke's wage was to be paid was less than whole hearted in honouring this obligation
42 Schaffer and Shapin p.66
43 The format for scientific reports taught students today seems to have been elaborated first in Boyle's own reports, written more than three hundred years ago. In fact the similarity is remarkable, and even a little unnerving. See Vickers 1987 and Stewart 1979 for further
discourse was closely controlled by the "new scientists", it is equally true that the spaces in which demonstrations and exchanges took place were equally carefully controlled. Count Lorenzo Magalotti visited the Royal Society in 1668 and described the social architecture of the Society's proceedings:

They observe the ceremony of speaking to the president, waiting from him for permission to be covered, and explaining their sentiments in few words relevant to the subject under discussion, and to avoid confusion and disorder one does not begin before the other has ended his speech. Neither are opposite opinions maintained with obstinacy, but with temper, the language of civility and moderation always being adopted among them, which renders them so much the more praiseworthy.44

This account is, of course, as interesting for the iconography it creates as it is for any accounting of the actual state of affairs. Magalotti's description goes on to describe the actual physical layout of the demonstration hall in which the Royal Society's weekly meetings were held (Figure 11), adding the fascinating note that

![Figure 11: Sketch of Royal Society Proceedings Based on Magalotti and Shapin](image)

discussion and examples of Boyle's scientific prose. At several points in Boyle's writing he even apologises for the prolixity of his reports, but points out that this is absolutely necessary if his reportage is to be complete and accurate.


a mace (permitted the Society by virtue of its royal charter) was ceremonially laid on the table at which the President sat prior to convening meetings. As Shapin notes, Thomas Sprat reacted vehemently to any suggestion that the Society in any matter observed rituals of authority, though the clear outlines seem to emerge of a "ritual" of putatively non-ritual equality and free concourse among experimental equals.

Further, a distinction between contexts of discovery and justification created Goffmanesque frontstage and backstage spaces which were potent resources in adjudicating rival knowledge claims. "Discoveries" made in private laboratories, where control was much less strict, had to be capable of being replicated in the public demonstration spaces where a different order had to be maintained. As Shapin notes (citing Kuhn), experiments were not shown merely to confirm what was already known, but to produce new knowledge. Yet it is obvious that the experimenter would have to have much foreknowledge of the results to be obtained from a given public trial, or he would be unable to know for sure whether or not it succeeded! There was thus a fine and uneasy balance to be struck between the demonstration of knowledge in public, and the careful, meticulous rehearsal of that knowledge in private. This translation of private experience into public experience however was not as simple as it might otherwise seem given both the nature of the spaces in which experimenters worked and also the fragile nature of the results. The case of one of Hooke's attempts to demonstrate the phenomena of "anomalous suspension" of water in the air pump in the early 1660s is instructive as an instance of private "success" running afoul of public unwillingness to so interpret the demonstration before them. "During the early phases of the career of anomalous suspension in England, the experimental leaders of the Royal Society were of the opinion that no such phenomenon legitimately existed." Hooke's "demonstration" of exactly that phenomenon was therefore rejected as a result of flawed apparatus or operation, and he was instructed to return to his private laboratory and

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46 See Wesley Salmon 1970: "Baye's Theorem and the History of Science" in Roger Steuwer (Ed) Historical and Philosophical Perspectives on Science (Minneapolis:Univ. of Minnesota Press for a discussion of the distinction between "contexts of discovery" and "contexts of justification", which questions how sharply this distinction may be drawn.

47 Shapin 1988 p.400
48 Shapin 1988 p.403
"practice" it further until such time as he could produce more satisfactory results!

Both the legitimacy of witnesses and experimenters as well as the socio-spatial construction of the experiments themselves became obvious sites for the contestation of knowledge claims. Such contests, often waged solely in terms of the social structure of the experiment (who is said to have witnessed what) were often won by those with the greater store of the predefined social resources. Naturally, those who were close to the Royal Society enjoyed an obvious advantage, as no less a continental experimental philosopher than Christian Huygens was to discover on announcing air pump results anomalous with those obtained by Boyle.49

The Spatiality of Hobbes' Objections to Boyle

Hobbes rebelled against both the ontological and epistemological aspects of this new scientific paradigm. In Chapter 3 I intimated some of the reasons, physical and metaphysical, which he took to be proofs against the vacuist ontology. On purely physical grounds Hobbes believed that he had developed a plenist physics which assimilated Boyle's "matters of fact" without the superfluous postulation of a vacuum. Consequently, in his view, the onus was on the vacuists to prove why the concept should survive the appeal to Occam's Razor and the "Law of Sufficient Reason". On metaphysical grounds, Hobbes equated the "Greshamites" vacuum with the notions of "incorporeal substance" and "plastick nature", which he had already dismissed as politically dangerous. By emptying phenomena of their temporal and spatial relations, their motions and causalities, Boylesian pneumaticists provided ample resources for those who would subvert civil authority for their own sectarian ends. A whole meta-level of reality was supported by such a notion as "vacuum" which could develop a ritual, hierarchy and hegemony of its own, divergent from the path to civil order. Hobbes finds a similar breakdown in Aristotle's Politics:

49 Schaffer and Shapin 1985 pp.244-245 on the episode occasioned by Huygen's discovery of the phenomenon of "anomalous suspension". This result was only legitimised after Boyle had managed to produce it himself in London.
Vacuism was to be strenuously rejected, not just for physical scientific reasons, but because it was politically dangerous, endowing fertile ground for the growth of dissent. This is why the discussions of epistemology in the early sections of Leviathan properly belong there as a preface to the presentation of his political philosophy, and therefore form the "subtext" of my reading of the Leviathan title page.

Hobbes argued that the fellows of the Royal Society were in fact creating a closely disciplined structure of domination over the production of knowledge. He attempted to expose as ideology that Society's claim to represent an unprejudiced, value free concourse of philosophical ideas. Even if the Society could guarantee a true egalitarianism of ideas, such heterodoxy would still be invidious to the body politic. Hobbes observed that the Society was, in any event, not open and public, but closed and private. Further, Hobbes particularly attacked the social and technological spaces within which that programme was contained, and represented, at every turn trying to show that these spaces were, in and of themselves, divisive and partisan to the interests of a specific group rather than cohesive and unifying as polemicists such as Thomas Sprat and Joseph Glanvill claimed. If the scientific instruments of Boyle and Hooke were rejected as not providing a microcosm of natural world, then Hobbes believed that, by the same token, the closed society is inadequate to the task of representing a true public epistemology.

In the Dialogus Physicus, Hobbes starts his attack in the Royal Society by undermining their claim to have effected the egalitarian production of knowledge in open, accessible public spaces. Not only did Hobbes find evidence of elitism and oligarchy in the fact that membership was in fact relatively restricted, but he also pointed out that the structure of its proceedings was in fact defined a priori of any actual experimentation as such, thereby prejudicing the results. Remember that Hobbes' political dualism dwelt upon the public
transcendence of private realms. In the programme of the Royal Society a
similar distinction is maintained, though it is to be mediated (not transcended)
in a different way. Hobbes could in fact argue against this programme in two
ways. First, he noted that the space was not in fact public, since there were
controls on who could attend and, more importantly, on the role and character
expected of an spectator. Count Magalotti had made the same observation,
himself declining to enter the Royal Society's meeting place because

I understood that one is simply not permitted to go in as a curious
passerby, and I would not agree to take my place there as a scholar, for
one thing because I am not one...Thus, therefore, I got as far as the door
and then went away, and if they do not want to permit me to go and be a
mere spectator...I shall certainly be without the desire to do so.53

Magalotti's principled refusal to enter the closed space of the experimental hall is
all the more interesting, of course, because he was precisely the sort of
"gentlemen" witness they were keen to attract.

But even if admittance to the proceedings of the Royal Society had been
completely open and free, Hobbes still had another, possibly insurmountable,
objection. For Hobbes a "public" space not conceived as merely the ultimate
concatenation of private spaces, but rather, was constituted through the
conventicle between citizens and sovereign. If this was his definition of
"public", then the antics of the Royal Society were completely beside the point:

Are not those phenomena, which can be seen daily by each of you,
suspect, unless all of you see them simultaneously? Those experiments
you see in the meetings, which experiments indeed are well known to be
few, you will believe to be sufficient, but are there not enough, do you
not think, shown by the high heavens and the seas and the broad
earth?54

Hobbes' geometrically oriented deductivism was therefore considered to be the
ultimate "public" methodology, transcending the particularities of place,
rendering a true "science of just and unjust".55

His second and more sustained line of attack was directed against the
material technology of the air pump itself. Hobbes presented a number of

53 Shapin 1988 p.389-90
54 Hobbes, Dialogus Physicus p.351
55 Behemoth p.39
alternative hypotheses which might explain the observed effects of the trials. All of them depended a root on denying that the vessel was empty. He contended that the constituent parts of the air pump simply could not be assembled so well as to absolutely exclude the possibility of leakage. In this Hobbes was beating Boyle at his own game since that was a line of reasoning Boyle himself employed against the rival claims of Huygens, and Von Guericke. Alternatively Hobbes argued that, even if the chamber was indeed devoid of air, its place had to be taken some other more elemental matter, some "purer air" or "æther", which could be shown to account for the experimental results obtained. In the Dialogus Physicus, Hobbes deploys his concept of "conatus", defined as that "simple circular motion" which is constitutive of the plenum to offer simpler explanations for several of Boyle's air pump demonstrations.

To be coherent with the sort of political monism espoused by Hobbes, it was insufficient to attempt to iron out the procedures whereby private contexts of discovery could be transformed into public contexts of justification. Hobbes was undoubtedly quite correct when he repeated pointed out how the veracity of such mechanisms often boiled down to the arbitership of some social grouping. The ability of such groupings to appropriate resources of legitimation had proven deadly during the 1640s and 1650s, and Hobbes clearly saw no difference between that and the scientific programmes of the 1660s. Instead, Hobbes sought to reverse the epistemological directionality. If it was politically dangerous to try to transform private thought into public affirmation, then perhaps private thought should be firmly anchored to a publicly constituted epistemology. Geometrical reasoning adhered to strictly by private minds would serve as a metaphor for sovereign political authority. Furthermore, such epistemological monism was given the status of a moral imperative as Hobbes sought to return to philosophy its soteriological and self creative characteristics. Whereas Boyle sought to elaborate a space in which dissent could safely take place, Hobbes sought to render dissent impossible through universal affirmation of the monist socio-political space of Leviathan. I shall let Hobbes have the last word on this matter:

56 Behemoth p.125  
57 Schaffer and Shapin p.107
...content with Hobbesian physics, I will observe the nature and variety of motion. I will also use the same Hobbesian rules of politics and ethics for living.58

4.4 Spatiality and the Partition Between Physics and Metaphysics

The blurring of the distinctions between physical and metaphysical argumentation which I have demonstrated in Hobbes' work is no doubt important in its own right, as part in parcel of recent intellectual movements towards the (re)contextualisation of the human sciences.59 But I would like to have it serve a more specific, though undoubtedly related, purpose. By highlighting the indissoluble relationship between physical and metaphysical reasoning I hope to elucidate also the mutual interpenetration of discussions about the physical and metaphysical structurings of space. Hobbes' arguments were never meant as part of some abstract philosophical debate, but were explicitly designed as a programmatic entry into the political turmoil of Civil War England. His anxiety about the ongoing strife of his time impelled if not the actual content, then certainly the timing and format of his publications.60 Hobbes clearly meant to have an impact on his society, and if it is true that he never thought in terms of political geography per se, it is nevertheless true that he was the architect of a new ideal spatial political order. Moreover this idealised political geography, to some degree mapped well into English economic and political actualities after 1688.61

In terms of the Newtonian paradigm which managed to secure a lasting intellectual hegemony after the late seventeenth century, their progressively more dogged denial of metaphysical problems as legitimate scientific concerns

58 Hobbes, Dialogus Physicus p.391
59 putting the 'humanity' back in the human sciences, so to speak.
60 His original trilogy Of Body, Of Man, Of Society, ended up being written almost completely backwards, with Of Society coming out first, because the latter work was felt by Hobbes to be of more immediate importance.
61 One has, I think, to be very careful about suggestions that Hobbes was the "first analyst of bourgeois power", since he himself very clearly sought not a bourgeois nation state but a recrudescent absolutist one. Still, the appellation does have much merit, as C.B. MacPherson has pointed out, from the point of view of Hobbes' moral theory. C.B. MacPherson 1962: The Political Theory of Possessive Individualism: Hobbes to Locke (Oxford: Clarendon Press).
marks the emergence of a double illusion. The first 'level' of illusion is embarks from the suggestion that metaphysics is, or ought be, irrelevant to science. Questions about values are explicitly ruled out of court in science, as are more phenomenological questions about selfhood and worldview. But this illusion feeds back on itself since the connection between physics and metaphysics is no less intractable for the atomists than it was for the plenists. The mere wave of a philosophical hand cannot logically be expected to purge scientific knowledge of the taint of human contingency. Consequently this denial of metaphysics transforms itself in fact into a metaphysical submergence of implicit political and social geographies. Some of these metaphysical 'hostages to fortune' will be discussed in this section, while a more fully geographical treatment of them is included in chapter 5.

In this way, experimental knowledge was construed to be both a social as well as an epistemological category. What is presented, from the positivist perspective, as a simple empiricism based upon the separation of fact from value and the drive to attain knowledge of, and control over, nature is, on closer examination, a socio-spatially located and structured system which exerted a powerful discipline over scientific discourse. A self perpetuating experimental structure, with significant linkages into political and social elite groupings, the Royal Society and its related institutions throughout Europe, rapidly attained hegemony over both the form and the content of post seventeenth century science. The irony of course, is that what was supposed to be in many respects a supremely democratic intellectual space was in fact fairly constrained and ultimately, as Hobbes pointed out, rather elitist. Experiments could not be conducted just anywhere, nor could they be about just anything, nor could they be conducted by just anyone. "Solutions to the problem of knowledge", as Schaffer and Shapin remind us (echoing Foucault), "are solutions to problems of social order".62

62 Schaffer and Shapin 1985 p.332
Chapter 5

"Theories of Absolute versus Relational Space: the interpenetration of physical and metaphysical spaces 3"

5.1 The Latent Spatiality of Scientific Discourse
5.2 The Logic of Relational Space
5.3 The Triumph of Absolute Space
5.4 Theories of Space and Seventeenth Century Geography
5.1 The Latent Spatiality of Scientific Discourse

In this chapter I would like to inflect the analytical trajectory of the foregoing discussion. Where previously I have undertaken the task of teasing spatial issues and problems out of discourses often putatively aspatial, a kind of 'geographical detective work', in this chapter I will introduce and evaluate the philosophical discourses of space themselves. During the latter seventeenth century there arose debates over the constitution of physical space, which were largely coincident with the two rival positions advocated by plenists and atomists. Statements, plenist or atomist, about how substance is ontologically constituted necessarily entail queries into where that substance is, or can be, constituted. Similarly, the intellectual step of setting this ontological framework into motion involves the problem of determining through what motion occurs. The problem of causality too raises spatial questions which, subsequent to the seventeenth century have been answered with either the idea of "action by contact" only (Hobbes and Descartes) or "action at a distance" (Newton).¹

Physical atomists, such as Boyle and Newton propounded a theory of space as an ontologically distinct and "absolute" container in which physical entities are constituted. Plenists, such as Hobbes and Descartes argued for a view of space as "relational" to the constitution of objects, denying that space has any ontological reality in and of itself.

This debate, between absolute and relational conceptions of space would be of little interest were it not for the fact that it was often conducted in terms of metaphysical as well as physical argumentation. In his Sixth Meditation, Descartes states:

> Although there are parts of space in which I find nothing that excites and affects my senses, I ought not therefore to conclude that they contain no objects.²

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¹ Robert D. Sack 1980: Conceptions of Space in Social Thought (Minneapolis: Univ of Minn Press). In this work Sack discusses different conceptions of space in terms of the problem of causality, though he rarely places his discussion in the context of the philosophical debates of the seventeenth century, making his a less useful source for my purposes than it otherwise might have been. His major organising theme is the development of a rather teleological framework of the development of space concepts, and consequently his explicit discussion of absolute and relative space tends to tacitly accept their commonplace objective and subjective imputations respectively. See esp Sack 1980 pp.55ff

² Descartes, Meditations, p.137
Descartes' plenism had been arrived at as a result of his scepticism about sense data, which is an epistemological claim, and is hence related to his concept of the knowing subject. This same form of argumentation can be applied to his relational theory of space where space is shown to be ontologically relative, in the final analysis, to the perspective of the knowing subject. The constitution of space was thought to be completely contingent upon acts of subjective perception, which would, ideally, be 'disciplined' through adherence to geometrical-rational habits of mind. And, as Descartes' points out in the Discourse on Method, these rational habits of mind ought form the basis for a 'scientific' morality. Consequently, the existence, or perhaps 'quasi-existence', of relative space would therefore be partially 'absolutised', that is to say rendered to be a general category, on the basis of Descartes' appeal to private morality.

Hobbes too argued along rather similar lines, a fact which has led Gary Herbert to refer to Hobbes as, interestingly enough, a "phenomenologist of space". Hobbes' spatial ideas were initially worked out in his early tract De Corpore where his preoccupations are physical and dynamical, and, much later, in Leviathan where they are political and theological. Even so, Hobbes' spatial ideas probably received their best expression in his polemics, including the Dialogus Physicus, against Boyle's air pump experiments in the early 1660s.

Spatial absolutists, such as Boyle and Newton, are rather more difficult to comprehend in these terms, since a good deal of their absolutism about questions of space is predicated precisely on the strategic effacement of metaphysical issues. As I argued in the last chapter, their natural philosophy depended upon rendering transparent to the public "Eye" the private activities of intellectual discovery, a fact which helps account for the apparent lack of interest in these intellectual quarters regarding questions of subjectivity, perception and the theory of mind. The absolutist project can however be shown to involve something of a reinterpretation of Cartesian dualism (as a rigid dichotomy, rather than as a dialectic) and a reformed, and rather Platonic, theology. This will involve a rather careful interrogation, effectively a deconstruction of their spatial absolutism, of certain scientific texts of Boyle and especially Newton.

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3 Demonstrating an interesting manner in which Descartes' rendered epistemological claims to be moral claims. Descartes, Discourse on Method, p.18-24.
Consequently, while the physical and metaphysical imbrications inherent in spatial absolutism were not as self consciously theorised as they were in the relativist writings of Hobbes and Descartes, it is nevertheless possible to trace them, albeit somewhat indirectly. Through elucidating some of the ways in which space is implicated philosophically in Newtonian science, it may be possible to perceive more subtle continuities and discontinuities between this absolute spatiality and that developed in a rather more sophisticated fashion by Kant and century later.

Such questions of multiply layered spatiality cannot be avoided indefinitely if one wishes to truly plumb the depths of the seventeenth century scientific revolution, and indeed its (spatial) implications for the 'project of modernity' itself. However my task is complicated by that fact that, until called upon to debate explicitly spatial questions, the thinkers under examination here rarely spared much thought at all for the systematic resolution of conceptual problems of space. Descartes' most rigorous treatment of spatial issues probably occurs in his Principles of Philosophy where he is concerned largely with the physical aspect of natural philosophy. And while comments about space are scattered throughout Leviathan and De Corpore as they pertain to other problems, Hobbes seems never to have felt a compunction to develop an independent and internally consistent conception of it outside of his many controversies. Even in the context of his debates with Boyle over the status of the air pump trials, his interest in space rarely rises above the incidental. Hobbes, after all, is quite preoccupied with the challenges posed by Boyle to his physical dynamics and political science. Similarly, Leibniz, in his written salvos against Newton's apologist Samuel Clarke (1715/16), does not present precedent in his own writings for the "relative space" he promulgates in opposition to Newtonian absolute space. Instead he draws on his analyses of physical

5 I have relied primarily on those excerpts included in Milic Capek (Ed) 1976: The Concepts of Space and Time: Their Structure and Development (Boston: D. Reidel Co). Interestingly, Margarita Bowen seems to have completely overlooked Descartes' interest in space though she does include citations from the Principles of Philosophy. Presumably this absence derives from the fact that her preoccupation is with Descartes' epistemology, coupled with the peculiar aspatiality of her a priori concept of geography. As I have argued, Descartes' system is not entirely perspicuous without attention to his ontological peregrinations, including those about space. See Bowen 1980.

6 Julian Barbour 1982: "Relational Concepts of Space and Time" British Inl for the Philosophy of Science 33, p.255
causality and motion. And Newton's conception of space is itself developed explicitly only as a "scholium", or propaedeutic, to the universal natural philosophy he presents in the Principia Mathematica.\(^7\) For the most part questions pertaining to space are marginalised or otherwise obscured by virtually all seventeenth century thinkers, presumably in their rush to develop theories of universal certain knowledge.

One may fairly wonder why there were so few theoretical treatments of space in early modern thought. Space, no doubt, had the same practical importance to the world of everyday affairs that it retains today. More to the point, more consideration was in fact given to questions of time, especially in its role as an an independent factor in experimentation. These silences about space are, in my view, 'eloquent silences', bespeaking not the marginalisation of spatial concerns, but in fact their very centrality to all that was at stake in seventeenth century scientific controversy. Heretofore I have taken a rather oblique approach to developing an understanding of seventeenth century ideas about space, teasing them out of general ontological and epistemological discussions. In this chapter it is precisely those often overlooked, though critically central, 'spatial modalities' which I would like to elucidate. I think that it is possible to identify, in the plenist ontologies of Hobbes, Descartes and Leibniz, a forceful, if not always perfectly coherent, 'theory' of space.\(^8\) When confronted with questions about space, place and spatiality, these thinkers attempted to articulate spatialities which followed most satisfactorily from their largely convergent plenist ontologies. This will involve tracing how the respective spatialities are implicated in theories of substance, motion, and also causality. Attention will then turn to the relationship of mathematics and geometry especially to spatial conceptions, since relationists and absolutists appropriated them differently in the debate about space. As previously intimated this is related to the process whereby a universalised subjectivity based on single

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\(^7\) This is not meant to deny Newton's recognition of the importance of space to his physics, but rather to emphasise the fact that he clearly thought it to be a matter largely preliminary to his more central physical science.

\(^8\) Indeed, given my claim that theories of space are really ancillary to the other preoccupations of these writers, it would be a matter of some suspicion if a unitary spatiality could be adduced from such diverse writings! Leibniz, for example disagreed with plenists about such basic points as the distinction between 'primary and secondary' qualities, though he still managed to underwrite a remarkably similar conception of relative space. See Paul Janet's introduction to Leibniz' Discourse on Metaphysics (La Salle, Ill: Open Court Press) p.xi
point perspective, including the priorisation of vision over all other forms of experience, came to be hegemonic in scientific discourse. Finally the two sections will close with an attempt to link these primarily physical systems with their metaphysical counterparts. Some of the implications of absolute and relational spatialities for conceptions of the subject, social and political order, and finally for 'right' theology will be presented. The reproblematisation of the physics/metaphysics partition will also ease the way for some comments upon the relationship between these ephemeral ideas and the material processes within which they were embedded. From this foundation it will be possible, in the final section of this chapter to begin to consider the impact these philosophies of space have had on the development and stature of the discipline of geography itself.

5.2 The Logic of Relative Space

I suggested in chapter 3 that Descartes' rejection of corporeal "simples" or "atoms" carries along with it an ontological dualism rather different from that popularly conceived. Viewed through positivistic spectacles Cartesian dualism appears as the familiar and straightforward dichotomy between 'mind-stuff' and 'body-stuff'. Furthermore, the categories of 'mind' and 'body' are taken to be both ontologically oppositional and mutually exclusive of one another. Yet Descartes' overriding commitment to a plenist ontology renders it impossible, or at least highly improbable, that such an interpretation can be readily maintained. The entire issue hinges, of course, on how the interface between the categories of mind and body are claimed to be related. My discussion of this problem above provides a useful starting point for an investigation of the notion of relative space. In much the same way that Descartes brought mind and body closer together, rendering them dialectical aspects of one another in fact, so too is the ontological reality of space postulated. For relativists to say that space is purely relative to the bodies located within it is equivalent to saying that space is predicated on the reality of the plenum. Spatial manifestation is a necessary and concomitant aspect of extension itself:

...the same extension in length, breadth and depth which constitutes body, constitutes spaces; and the difference between
them consists only in the fact that in body we consider extensions particular and conceive them to change as body changes...9

This *internal* constitutive manifestation Descartes, and Hobbes, refer to as "imaginary space" and especially "place". "Place" is that expression of spatiality which is intrinsic to the very constitution of substance in the perception of the knowing subject.10 For plenists, extension as well as space is predicated on constructive acts of subjective perception, even to the degree that objects contain their own locations, or, to be more precise, their quality of locatedness11 That predication, as Hobbes also realised, is itself "relative" to the constitution of the knowing subject. In turn this process is dialectically bound up with the material factors which influence the cognitive distancing of the viewer from the viewed, even to the point of objectifying intersubjective relations. From a relational perspective it is therefore meaningless to attempt to delineate some characterisation of space, substance, or the the world prior to its subjective apprehension. Space might well be treated as *analytically* detachable from that which is enmeshed within it, but one should not deduce from this that this analytic space merits ontological status.12 Consequently spatial relativists impugned the classical Greek notion, revived by the Newtonians, that space is an ontologically distinct "container" for corporeal substance.

But spatiality is not entirely expressed as a phenomenological artefact of the continual reconstitution of subjects and objects in the plenum, as might be inferred from the Cartesian theories of substance and motion. Nor is it merely phenomenological in the sense that it is ineluctably determined relative to the 'taken for granted world' of the knowing subject, as is implied in the last paragraph. There is also an *external* spatiality which is in some sense constitutive of the plenum itself. Descartes finishes the above quote with this thought:

9 Descartes cited in Milic Capek 1976 p.76
10 Note the similarity of this definition of "place" with that of Heidegger, cited in Chapter 1 of this thesis. Also in contrast with contemporary geographical notions of "place", this view seems not to include the contemporary attributes of "uniqueness" and especially "emergence" cited by Fred Lukermann 1965: "Geography: De facto or De Jure" Jnl Minnesota Academy of Science 32(3)
11 Hamsphire 1956 p.145
12 Hobbes referred to this error as one of mistaking terms of "honour" for terms of "fact". See Leviathan chapter 4
...in space, on the contrary, we attribute to extension a generic unity, so that after having removed from a certain space the body which occupied it, we do not suppose we have removed the extension of that space.

Space is thus "relative" in a second, but distinct, sense to that proposed above. Not only is space defined "internally" through the subjective constitution of corporeal substance, but it is also imputed from the relations between multiple substantial objects. In his "Fourth Letter to Clarke" Leibniz expresses this point:

As for my opinion, I have said more than once that I hold space to be something merely relative, as time is; that I hold it to be an order of coexistences as time is an order of successions. For space denotes...an order of things which exist at the same time, considered as existing together, without inquiring into their particular manner of existing.¹³

Obviously then space cannot logically be reducible to simple extension as is often implied in contemporary theoretical treatments of space.¹⁴ The concept of "extension" contains, in a sense, both internal and external characteristics of space. The (external) unity of the space concept derives from its expression through analytic geometry. Nonetheless this "generic" spatiality remains artifactual in the sense that it is wholly derivative of the convergence of collective perceptions of extended substance. In other words, some common language for the perception of bodies in space had to be discovered. And, of course, the discursive vehicle for uniting myriad subjective perceptions within a common collectivity had traditionally been held to be, for both relativists and absolutists alike, geometry. It is tempting to conclude that on the relational view, space is strictly an epistemological category, with no ontological standing at all. Special impetus for this view derives from the fact that the very ubiquity and relevance of spatial concerns renders a generic discursive description of space itself all that is really possible. While it would be stretching the evidence to suggest that plenists maintained a single and completely coherent theory of spatiality, we can nevertheless consider the basic elements of relationism to be expressed in Hobbes' distinction between the internal "places" which substances

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¹⁴ See Chapter 3
carry with them and the external "spaces" which are artifactual of their relative location.\textsuperscript{15}

The plenist' positive theory of relational spatiality implies an obvious criticism to be levelled against any postulation of absolute space. Taken at the most general level spatial absolutists contend that space is "a distinct, physical and eminently real or empirical entity in itself".\textsuperscript{16} Leibniz vociferously maintained that if space was held to be absolute then it must somehow have a real existence independent of subjective perception. Further, Newtonian absolute space would have to be either corporeal or incorporeal substance. But, if either of these possibilities is granted then determining the order of any natural array becomes impossible and science, in Leibniz' view, breaks down:

\begin{quote}
If space is a substantial property, prior to substance itself, then how can one determine the difference of one configuration [of extended substance] from another?\textsuperscript{17}
\end{quote}

Leibniz is quite cunning in this line of critique, constructing for Newton's hapless apologist Clarke a logical as well as scientific dilemma. He contends that the postulation of absolute space makes it "impossible [that] there should be any reason why God, preserving the same situations of bodies among themselves, should have placed them in space after one certain particular manner and not otherwise." Theological issues aside for a moment, it would be impossible to distinguish any spatial configuration of objects from any other in absolute space, without first developing an ontological understanding of space itself.\textsuperscript{18} Thus Leibniz infers that the postulation of an absolute ontological space cannot admit of any empirical verification. Now Leibniz himself was quite content to accept physical space as a manifestation of a transcendental God. But the dilemma for Newton is that, in terms of his own empiricism he must either come up with a completely physical explanation for absolute space or he must engage in metaphysical speculations which threatens the central distinction between

\textsuperscript{15} Herbert 1987 p. 710


\textsuperscript{17} Leibniz, 1956 p. 1145

\textsuperscript{18} Barbour 1982; Huygens also held to this view; see Max Jammer 1969: Concepts of Space, Second Edition (Cambridge:Harvard Univ. Press) p.126
physics and metaphysics which the Newtonians sought long and hard to build up in the first place!\textsuperscript{19}

But it is not just the ontological status of being in space which is relative for the plenists. The relative view of space becomes even more apparent when it is viewed in terms of plenist analyses of motion and causality. It will be remembered that, from the plenist perspective, all motion is necessarily "local motion". In other words, motion was thought to be a temporal sequence of reconstitutions of extended substance in successive contiguous "external spaces". While bodies necessarily take their \textit{places}, that is to say their "internal spaces", with them as they move they do not similarly take their (external) spaces with them. Hobbes is his usual perspicuous self on this point:

\begin{quote}
For no man calls it space for being already filled, but because it may be filled; nor does any man think that bodies may carry their [spaces] away with them, but that the same space contains sometimes one, sometimes another body; which could not be if space should always accompany the body which is once in it.\textsuperscript{20}
\end{quote}

The appearance of motion is in some measure therefore an artefact of the peculiarities of human perception. For example, in the standard high school physics demonstration of kinematic principles using a bouncing ball, what is perceived as continuous unbroken movement of the same ball, is in fact just the successive reconstitution of the ball in adjacent external spaces. It follows from this point that the appearance of rest, taken as lack of movement, is also the continual transformation \textit{in situ} of an object and therefore also constitutes "local motion", a point which Descartes repeatedly emphasised\textsuperscript{21} Motion and rest are in fact only conceivable because we possess a generic description of "external space" in terms of the diachronic relations between successive manifestations of corporeal substance.

It follows from this analysis of motion that all causes must be impressed directly and cannot be said to act through any putative medium of void space.

\textsuperscript{19} See next section
\textsuperscript{20} Herbert 1987 pp. 711, 713-4. Huygens also commented, in correspondence with Leibniz, "To those who ask what motion is, only this answer suggests itself: that bodies can be said to move when their place and their distances change, either with respect to each other, or with respect to another body." cited in Earman 1989 p.41
\textsuperscript{21} Grene 1985 p.101
After all "action at a distance" implies either void space, or space as an independent ontological entity endowed with its own causal force. The latter option is clearly nonsensical since it would then be necessary to develop scientific accounts for the agency of space acting independently of substance. The plenist view, it will be remembered, allows of two sorts of causes: "final" and "efficient". Because of the scepticism about the senses (which is part of an unavoidable metaphysics of subjectivity), it would seem to be impossible to know if any discernment of natural, or "final", cause has been accurately determined, or indeed how to go about such determinations. Moreover causality must be intrinsic somehow to substance itself, since plenism allows no other locus of causes. The "final" cause which Descartes and Hobbes eventually felt compelled to introduce was the highly problematic notion of the "conatus". This seems to be defined as the intrinsic volition of constituted substance to preserve its own inertia. In Leibniz' philosophy the corollary is of course the concept of the "monad". Once these ideas were on the philosophical table it was but a short step to relate them to an absolute final cause which emanates from the Judeo-Christian God. Both Hobbes and Descartes developed "deistic" conceptions of God which understood "Him" to be spatial in the sense that "He" pervades the plenum.

For Hobbes and Descartes, geometry is at once an epistemological framework, allowing philosophy to chart out the order of the universe, and also an affirmation of the moral landscape. Hobbes argued repeatedly that the value of geometry in natural and moral philosophy was that it was a discursive modality wholly within the human compass. Eschewing the renaissance notion of geometry as the "music of the spheres", Hobbes contended that the only way in which humanity could impose lasting order on its natural significations was through their transformation into a signifying "lexicon" which was rational, internally self contained and also self consistent. geometry understood this way is the imposition of a unified 'public' order on the activities of 'private' minds. Geometrical reasoning was therefore taken to be the discursive equivalent of the political sovereign as constitutive of the polity itself. By extension, space too was

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22 See Chapter 3
23 See Chapter 3
24 In ways this is similar to the Cambridge Platonist Henry More who argued that God was equated with space through the "immensity and omnipresence of [His] essence". J.E. Power 1970: "Henry More and Isaac Newton on Absolute Space" in Jnl of the History of Ideas 31 p.290
taken to be geometric in an epistemological sense; a view which forged yet another connection between the subject of geometry, the singular visually oriented perspective, and the plenum itself.

5.3 The Triumph of Absolute Space

Experimental philosophers inclined to an atomist ontology and the programme of the Royal Society, as might be expected, adhered to a very different conception of space. In the elucidation of this space concept there is probably no better source than Isaac Newton himself. While Newton was prepared to admit that, in practice, people tend to treat space as though it was relative only to those bodies located within it, he nevertheless upheld the view that space existed somehow in the physical world as an ontological entity in and of itself. His own most comprehensive discussion of the constitution of space appears in an introductory scholium to his epoch marking Principia Mathematica (1687):

> Absolute space, in its own nature, without relation to anything external, remains always similar and immovable. Relative space is some movable dimension or measure of the absolute spaces.25

At a stroke Newton proposed to settle the dispute between absolutists and relativists by subsuming relative space into a more general, universal and absolute space. Absolute space however was not merely conceived, as it was by other of Newton's contemporaries (such as Boyle), to be a universal immediately apprehensible "container space" of physical objects and events. Newton introduced a new aspect of the notion of absolute space which depended upon a different way of partitioning the "spatial" from the "material" and which, while novel, was also largely compatible with prevailing absolutist conceptions.

One of Newton's major achievements in the history of physics was to shift the discursive ground away from mechanistic simplicity and towards a new basis in the concepts of "force" and "mass". Newton proposed to subsume the kinematically based spatial relativism of Hobbes and Descartes within a new

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25 Newton's "Scholia on Space" cited in Capek 1976 p.97. Compare this definition with the one given by J.M. Blaut 1972, Note #16
dynamically oriented physics. In other words, relativistic arguments based upon the study of motion as it shows itself to the senses, Newton's "Five Powers", were to be recontextualised through an epistemological privileging of the study of force in nature.26 A key goal for all of Newton's dynamical demonstrations was not simply to show that there is some physical container space in any straightforward visual-geometric sense. Rather Newton endeavoured to prove via his experiments with moving globes, sailing ships and rotating water buckets, that there must be an absolutely constituted "inertial frame of reference", which is the natural Archimedean point for the scientific investigation of all natural phenomena.27 Newton thus shifted the philosophical debate from kinematics to dynamics; ground he believed more favourable to the demonstration of absolute space. Strategically it was also a good choice since plenists had been coming under increasing criticism, from both natural philosophers and theologians, in the late seventeenth century for introducing mystical concepts such as the "conatus" into their explanations of motion and causality.28

One of Descartes' demonstrations of the relativity of space, contained in his Principles of Philosophy, involved the consideration of a captain on a sailing ship.29 In this thought experiment Descartes reasoned that while the captain may be conceived to be at rest with respect to the ship, or some part of it, 'he' must always be in motion with respect to some other points of reference, such as the shore, the planet itself, and ultimately the universe. Descartes observed that one could never determine the captain's motion absolutely, since this would require taking into account all possible relative motions. Further, since one could never know if all relevant motions were accounted for then the very notion of absolute motion was not only indeterminate, but actually meaningless. It was an elegant proof, insofar as it forced his opponents to demonstrate that they could in fact account for all possible motions, while Descartes himself was

26 James Garrison 1987: "Newton and the Relation of Mathematics to Natural Philosophy" in Jnt for the History of Ideas 48(4) p.618
27 Max Jammer 1969 provides a good discussion of Newtonian dynamics in the context of theories of space, pp. 96-100ff
28 "Conatus" was generally conceived as an inclination to preserve being, and hence is not unlike the dynamic concept of "momentum", except that conatus was held to be intrinsic to matter. See Howard R. Bernstein 1980: "Conatus, Hobbes and the Young Leibniz" in Studies in the Hist. and Phil. of Science 11(1) pp.25-37
29 See the excerpts in Capek 1976 pp.76-84
left the much more congenial task of finding only a single counter example to any putative refutation!

Newton challenged this example head on, transforming Descartes' discussion of motion into a discussion of force. Remember that one of Newton's most significant propositions in the Principia was that natural philosophy could be fruitfully conceived as the investigation of interacting "mass points". That is to say he redefined the subject matter of natural science in terms of the mass produced in corporeal substance by the existence of forces acting on substance, rather than physical extension considered in and of itself. The ontological claim was that force, whether through gravity, elasticity, inertia or anything else, was also a "primary" quality. From this perspective the fact that the captain on the ship is in motion relative to the shore, or to anywhere else, becomes irrelevant. He is said to be at rest, inertially, in the absence of any changes in the forces acting upon him. The absolute space in which the captain on the ship is said to be at rest is dynamical space, not kinematic space, and his absolute location could, in principle anyway, always be determined as long as one accepts the postulation of an inertial centre of the universe. This appeal to dynamic, rather than kinematic, inertia obviated the need for for problematic notions of "conatus" and "simple circular motion", since kinematic motion was no longer taken to be the underlying basal element of the natural world.

Newton also proposed in his Scholium another, more famous, demonstration that space was structured absolutely. The "rotating water bucket" experiment has attracted a great deal of attention in the subsequent debate between relativists and absolutists. The eighteenth century geometrician Leonard Euler evaluated this experiment and upheld the conclusions that space is structured absolutely while Leibniz, George Berkeley and, much later, Ernst Mach rejected its conclusions, and even its premises, as erroneous. The experiment itself was quite simple. Newton suspended a bucket of water from a rope and gradually began to increase the angular force on the bucket by twisting the rope. The bucket of course began to spin, and the spin accelerated as long as the angular force was increased. At some point the water in the bucket, which is

30 Capek 1976 p. 96
31 Actually Newton talked about a "sphere" rather than a "captain", though this makes no difference to the argument
32 John Earman 1989
moving in a circular motion with respect to the rope, will begin to, as Newton put it, "climb the sides of the bucket". At some subsequent point the surface of the water will become concave indicating the recession of the water from the axis of rotation, while at the same time the angular motion of the water will be exactly equal to that of the spinning bucket itself. Newton then inquired about to what the recessive motion of the water was relative. The spatial relativist was supposed to be stymied, since the water clearly was not moving relative to the bucket apparatus itself. Instead it was moving "relative" to a non-physical point in space which coincided with the axis of angular momentum:

The effects which distinguish absolute from relative motion are the forces receding from the axis of circular motion. For there are no such forces in a circular motion purely relative, but in a true and absolute circular motion, they are greater or less according to the quantity of the motion.33

The ontological status of "absolute circular motion" had been debated for some years before Newton, though he was the first to accord it ontological significance as a dynamic phenomena. The result was to establish a view of absolute space as a real "container space", though not one which was kinematically apprehensible.

While plenists and atomists alike argued that the principles of Euclidean geometry and mathematics lent veracity to their respective positions, Newton deployed geometry in a new and more inclusive manner. Prior to Newton's Principia, the space which was taken to be representable geometrically, relativism and absolutism notwithstanding, was a tangible, visible space, one which was immediately apparent to the senses. Similarly the geometry that was conceived prior to the end of the seventeenth century was specifically suited to the measurement of that visual space. Succinctly put, Newton's achievement was to expand the compass of geometry to include also the indirectly apprehensible dynamics of phenomena. In the Principia he states:

Geometry itself is founded in mechanical practice and is nothing but that part of universal mechanics which accurately proposes and demonstrates the art of measuring.(my italics)34

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33 Newton quoted in Jammer 1969 p.105
Newton's concept of "mechanics" was concerned with the manipulation of nature to an end, rather than merely the passive mirroring of what was taken to be already present. Thus geometry was accorded an added level of verisimilitude, not present in Descartes, for it not only accurately describes the practical world of kinematic experience, but also represents the underlying substratum of dynamical phenomena. In Newtonian physics the forces acting on objects, as well as their motions, are resolved into linear geometric components.

After Newton's *Principia*, debate between absolute space theorists and spatial relativists proceeded essentially along two fronts. In the first place, the disputants continued to "talk past on another", absolutists proposing dynamical arguments about force, mass and inertia, while relativists continued to utilise a kinematic vocabulary. Newton's epoch-marking reformulation of the problematic of natural philosophy in terms of mass and force had the effect of removing the need for dubious plenist concepts of internal causality and motion. It did however create the not insignificant problem of making everything hinge on the maintenance of the postulation of a universal state of inertia. And since spatial relations were taken to be absolute insofar as they could objectively be determined solely by reference to that state of universal inertia, then any attack on Newtonian inertia was simultaneously an attack on the absolute conception of space. It was however at precisely this point that many philosophers, even in Newton's own lifetime, criticised the Newtonian edifice. The attack came from basically two directions. Theologians such as George Berkeley argued that by creating a universal physical entity as a pinion of his natural philosophy Newton had demeaned the power and glory of God. On the other hand, Huygens and also Leibniz, contended that the postulation of an inertial "centre" of the cosmos" was, in strictly empiricist terms, unverifiable.35 Newton's water bucket experiment, as his detractors repeatedly pointed out, did not establish the existence of a single "absolute distinguished inertial space", but only that water in a spinning bucket recedes from the axis of rotation.36 The horns of the dilemma sketched in the last section were thus posed: Newton had either to equate space with the efflorescence of God, and so give up his pure form of empiricism; or he must give up the idea of an inertial centre as empirically unprovable and with it the concept of absolute space. In various places Newton

35 Jammer 1969 p.101
36 Earman 1989 pp.62ff
attempted to deal with each horn of this dilemma, though in his later career he became increasingly prone to the theological arguments he had earlier eschewed.\footnote{In his later career he also attempted to assuage ecclesiastical concerns about the putative atheism of his theories, as is apparent in later editions of the \textit{Principia Mathematica}. Note also that the relationship between God and space was central to the debate between Clarke (Newton's mouthpiece since it has been proven that Newton wrote the responses to Leibniz's letters) and Leibniz. See the discussion of Newton's use of the notion of space as the "sensorium" of God in the first few salvos of the Leibniz-Clarke exchange.}

5.4 Theories of Space and Geography in the Seventeenth Century

The intellectual history of the seventeenth century can be charted in terms of the gradual separation of the constitution of certain knowledge about objects in the world from the constitution of subjects oriented towards the world. Neither Hermeticism nor Scholasticism, for the most part, had recognised this distinction; in those systems claims to knowledge about the 'natural world' were much more closely intertwined with moral and spiritual beliefs. By the end of the seventeenth century, however, natural and moral philosophy had been radically bifurcated at both epistemological and ontological levels. The experimental programme of Boyle, Newton and the Royal Society radically dichotomised the relations between subjects and objects, facts and values, and in fact most if not all of the conceptual repertoire which had previously integrated the realms of the physical and metaphysical. The key to the new regime was the notion that only completely objective knowledge claims about a dehumanised world of 'fact', could attain the highest level of epistemological certainty. By contrast, the plenisms of Descartes and Hobbes may appear as something of a transitional stage between Hermetic/Scholastic and experimental modalities which while problematising the modern dichotomies, still attempted to forge a radical reconciliation between them.

Concomitant with this transition in ideas about epistemological certainty was a shift in views about the constitution of space and also about its metrics. Throughout the century the concepts of "space", "matter" and "self" were progressively estranged from one another in a process which received its
culmination in Newton's view of "absolute space" as that immutable and unchanging "container" for all relative spatial experiences.\(^{38}\) As Smith has pointed out, a commitment to technical mastery over natural events was a necessary corollary to capitalist political economic development as was the reconceptualisation of space as denatured and 'objective'. Spatial relationism was coopted, in part, by reinterpreting its relational component as implying merely the subjectively interpreted relation between substantial entities in the world, themselves existing within an absolute spatial field. The constitution of the subject, which had so complicated Descartes' thought, was inexorably drawn into a new formative matrix through burgeoning commoditisation. And this new matrix itself is subsumed, together with the development of the subject as the locus of (self) discipline, within what Foucault has referred to as the "analytics of finitude".\(^{39}\) Correspondingly, mathematics, in Newton's hands, came to be explicitly and solely about empirical objects in empirical spaces, far removed from the "philosophia prima" of Descartes and Hobbes.\(^{40}\) The Newtonian conception of absolute space meant absolute relative to an absolute state of inertial 'rest'. Despite the fact that this cosmological state of rest was itself unverifiable by empirical means, and therefore abrogated Newton's own dictum of "hypothesis non fingo", it effectively submerged questions of space-substance-subjectivity relativity which were not to be revisited until Kant at the end of the eighteenth century.\(^{41}\)

For geography, as a discipline in the seventeenth and eighteenth centuries, the ascendance of absolute conceptions of space established both a clear paradigm and an undeniable problematic. Throughout this period geography was for the most part seen merely as the geometrical description of static physical spaces. For D'Alembert and Busching no less than Locke and Rousseau, geography was

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\(^{38}\) In his treatment of these themes, Neil Smith seems not to explicitly connect the progressive separation of space and matter during the seventeenth century with the progressive separation of the physical and the social during the same period. I tend to consider the radical separation of space, substance and self as a multidimensional whole, a schema which seems to me to allow for intellectual continuities as well as the discontinuities to be understood which are not necessarily bound to material practices. Neil Smith 1984: Uneven Development (London: Basil Blackwell)

\(^{39}\) Foucault 1970 p. 312

\(^{40}\) James Garrison 1987 p.612

\(^{41}\) Interestingly, Kant would uphold the Newtonian version of absolute space, though from the point of view of a transcendentally 're-natured' world. See Capek 1976.
taken to be only a *propaedeutic* to the more serious and thoroughgoing sciences. It was, as Bowen notes citing a late seventeenth century source, nothing more or less than "the eyes and feet of history".42 This is a striking metaphor, expressing the common seventeenth and eighteenth sense that geography is an ocularised description of static landscapes. Since the conceptual problem of space seemed to have been solved, then any putative discipline of geography appeared to strike intellectuals as at best ancillary to the disciplines of geology, physics, astronomy and other 'hard' sciences. In the human sciences geography suffered from an added indemnity, for not only was the space in which human action took place denatured, pushing human geography towards a sort of social cartography, but emerging disciplines such as sociology and anthropology seemed to render the notion of an autonomous human geography rather redundant. This is seen quite clearly in the spate of environmentally deterministic accounts which were popular throughout the period. In Shakelton's *A Blayzing Starre* (1580) no less that Hakewill's *Apologie* (1647), Ray's *The Wisdom of God Manifested in the Works of Creation* (1691) and Jean Bodin's *Six Booke of the Commonwealthe* the constitution of "geographical facts" was taken to be in large measure self evident. The realm of the geographical facts was generally considered to be an easily accessible independent variable by theorists with other substantive interests; Shakelton's interest in discerning the signs of senescence and Original Sin in the landscape, Hakewill's and Ray's refutations of the senescence doctrine, and Bodin's interest in discovering the causal relations between the environment and "national character".43

Besides the cosmographies of Bodin, Hakewill and others, regional geographies, collections of travellers' descriptions, continued to be collected and bound into volumes during the seventeenth century. These works tended to be quite popular, appealing to the general atmosphere of curiosity which must have attended a western European culture which must have seemed to be expanding almost daily with accounts of new people and places. Though he almost never travelled himself, the compilation of Samuel Purchas, entitled *Purchas, His Pilgrimage*, was one of the most popular English language works in this

42 Margarita Bowen 1980: *Empiricism and Geographic Thought* (Cambridge: Cambridge Univ. Press) p.155 The "history" this source had in mind, of course, was the Baconian notion of comprehensive "natural history", of which "chronology" was itself also a subsidiary component.
tradition. However, insofar as the development of the discipline of geography is at issue here, works such as Purchas's can only be considered as 'systematic' in the sense that he sought to compile "a [comprehensive] survey of the world from the point of view of the people and their religious practices". Other works which appeared about this time include William Pemble's *A Brief Introduction to Geography* (1630), which Taylor referred to as "that arid little compilation", and Peter Heylyn's *Microcosmus* (1621). Once again however these works are exclusively regional, descriptive 'geographies' which, for the most part, revived an essentially Straban modality. Insofar as one can talk about their 'theories of space', it seems fair to conclude that space existed in these works essentially as an absolute container space. However, missing from these 'geographies' is any conception of the discipline as centrally concerned with the critical interrogation of "the difference that space makes".

Besides these essentially descriptive 'geographies', geographical thinking did begin to be stretched in other directions during the seventeenth century. In keeping with philosophical trends towards practical utility and empiricism, several works of this period articulate linkages between political and economic interests and geographical knowledge. To be sure the potential utility of geographical knowledge for political and other purposes had been a commonplace of the discipline throughout its history. However, these new geographies were different. Instead of operationalising the straightforward claim that knowledge of other peoples and places can be useful, some during this period sought to elaborate geographies which were to some non-trivial degree constituted by these interests. Taylor has pointed to Lewis Roberts' *The Merchants Map of Commerce* (1660) as one of the first attempts at framing a decidedly *commercial* geography. In this work Roberts cites as his objective "a compendius survey of world trade, [and] of world rates of exchange". The frontispiece to this work (Figure 12) shows the providential aspect pertaining to a geographical understanding of world commerce, not just in terms of opportunities for exploitation revealed by the voyages of discovery (though this

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44 E.G.R Taylor 1934: *Late Tudor and Early Stuart Geography 1583-1650* (London: Metheun and Co.) p.54
45 Bowen 1980 p.68
46 Taylor 1934, pp.109
Figure 12: Frontispiece to Roberts' *The Merchant's Map of Commerce*
is not to be passed up) by, and more importantly, in terms of the notion of a "Mundi Commercium"; a world of geographically expressed commercial relations. Similar works which appeared during this period included Keymer's treatise on comparative tax regimes and Battie's work on geographical aspects of the wool trade in England. Though of course none of these works problematised the conception of space or spatial relations in abstract, their preoccupation with problems of commerce would seem to have predisposed them to the rigidification of the subject as a unit of labour and consumption. Consequently, all of those metaphysical and other issues which had underwritten the position of the spatial relativists, would have been eclipsed in importance and a view of space as an absolute container for the circulation of commodities and capital would have seemed most appropriate. All of this lends credence to Smith's claim that the development of the concept of absolute space and its emplacement as the central geographical problematic, should be related historically to the rise of capitalism if we are to develop a deeper understanding of the history of the discipline and its future prospects.

Whatever one might think about the argument adumbrated in the last paragraph, it should be fairly uncontroversial to state that the high water-mark of seventeenth century geography was achieved with the publication of Bernhardus Varenius' Geographia Generalis in 1650. In this work Varenius attempts a remarkable synthesis of many of the epistemological and spatial oppositions discussed in preceding chapters of this thesis. Perhaps first and foremost, Varenius sought to achieve for geographical knowledge the highest possible degree of epistemological certainty. In this he adopted an essentially Cartesian schema of the three levels of certainty possible:

For science is taken in three ways. Firstly, for any kind of knowledge, even if it derives only from what is probable. Secondly, for certain knowledge, whether this certitude depends upon demonstrations, or on the testimony of the senses. Thirdly, for knowledge solely by demonstration: which use is most strict and is appropriate to geometry, arithmetic, and other mathematical

47 reproduced from Taylor 1934, p.110. The citation "Mundi Commercium" appears just below the two pillars on the right side of the frontispiece.
48 Taylor 1934, pp.120,125
49 Smith 1984, p. 74
In this last clause Varenius establishes geography as a branch of "mixt mathematics" since its 'proofs' come from both mathematical argumentation and also "the experience and observation of men who have described individual regions". By establishing geography as a branch of mixt mathematics, it appears that Varenius sought a epistemological reconciliation of the theretofore separated and distinct realms of "general" and "specific" geography. Varenius vilified the tradition of special geography which "bored [its readers] with the bare enumeration and description of regions without an explanation of the customs of the people". He believed instead that scientific explanation of human spatial differences was not only possible, but was essential to the fullest development of both general and special modalities. In the Geographia Varenius argued that special geography was an integral element of general geographical explanations especially in its "comparative part" (which was treated in the last ten chapters of that work). Figure 13 shows how Varenius proposed to treat special geography in a future work which his untimely death almost immediately after the completion of the Geographia Generalis unfortunately precluded.

The Geographia Generalis is an interesting work for reasons other than those pertaining to Varenius' own genius in reformulating the discipline of geography. As Bowen and Warntz have both pointed out, the Geographia quickly became the standard for geographical research throughout the experimental and other sciences. Insofar as the English experience is concerned, the translation of the text by Isaac Newton for use at Cambridge is of signal importance. This is because Newton, and those other associates who revised his translations between 1672 and 1733, not only translated the Geographia from its original Latin, but also appropriated it to underwrite the dynamical cosmology laid out in Newton's Principia Mathematica and De Gravitatione. Though Newton made numerous corrections to Varenius'

50 Bowen 1980, p.83
51 Varenius in Bowen 1980, p.281
52 Varenius in Bowen 1980, p.279
53 While Bowen 1980, pp. 90,104 merely mentions the importance of Newton's translations of the Geographia, Warntz 1989 has produced a careful examination of the many and significant changes made by Newton and his associates to Varenius' work.
SPECIAL GEOGRAPHY

considers three kinds
of things in individual
regions

1. TERRESTRIAL
   (10)
   1. Limits and Boundary.
   2. Longitude of a place and situation.
   3. Shape.
   4. Magnitude.
   5. Mountains the name of them and situation, altitude, properties and contents.
   7. Forests and deserts.
   8. Waters see lakes, marshes, Rivers, their springs, origin, extent, width, abundance of water, speed, quality of water, cataracts, etc.
   9. Fertility or Barrenness, and Fruits.
   10. Animals.

2. CELESTIAL
   (8)
   1. Distance of a place from the Equator and the Pole.
   2. Obliquity of motion above the Horizon
   3. The length of days.
   4. The Climate and Zone.
   5. Heat, and also the seasons of the year, winds, rains, and other meteors.
   6. The rising and duration of Stars above the Horizon.
   7. Stars passing across the Zenith of the place.
   8. Quantity, or rather the speed of motion according to the Copemican hypothesis.

3. HUMAN
   (10)
   1. The stature of the Inhabitants, the life, food and drink, origin, etc.
   2. Profitably activities and arts, commerce, wages.
   3. Virtues and vices, ingenuity, learning etc.
   4. Customs concerning births, weddings, funerals.
   5. Common speech and language.
   7. Religion and the status of Ecclesiastical matters.
   8. Cities.
   10. Illustrious men or women, crafts, inventions.

Figure 13: Varenius' Plan for a Special Geography

calculations, of higher significance are undoubtedly the many illustrations he appended to Varenius' work, based on the Principia and De Gravitatione. While Newton himself did not delete Varenius' inclusion of Descartes' explanation of tides in terms of vortices in the cosmic plenum (an inclusion which smacks of spatial relativism), subsequent Newtonians, such as James Jurin, included "a very long discussion aimed at destroying the 'Cartesians' vain contrivance of vortices to explain the tides". In fact, whether of not Varenius was a spatial relativist is unclear from either Bowen's or Warntz's treatments, though this does not obviate the fact that his Newtonian translators blatantly sought the "hastening and reinforcement of [the Geographia's] transformation into a Newtonian statement". This objective would have entailed the removal of references to spatial relationalism wherever they cropped up, and their replacement with an absolutism more in conformity with Newtonian dynamics.

The debates between spatial absolutists and relativists had involved a mixture of both physical and metaphysical argumentation. Indeed, much of the discussion hinged upon how these categories were themselves constructed and adduced. Theories about perception, mind and subjectivity, as well about substance, motion and causality marked out the terrain of this debate. If geography is conceived as the particular problematisation of spatial relations, then the intellectual ascendence of absolutism as elaborated especially by Newton would have had great impact on the shape and constitution of the discipline. The version of geography implied in Newton's appropriation of Varenius set the object and methodology for geographical thinking and research (at least in English). These questions would not be revisited until Kant's monumental critique of rationality itself at the end of the eighteenth century.

55 Warnz 1989, p.186
56 An interesting project would be to try to assess how far the Newtonian "rehabilitation" of the Geographia undermined Varenius' own conception of space and geography.
Chapter 6

"The Historical Geography of Modernity and the Prospects for a Postmodern Human Geography"

6.1 On the Historical Geography of Early Modern Thought
6.2 On the Spatiality of Early Modern Thought
6.3 Modernity, Postmodernity and Critical Human Geography
6.1 On the Historical Geography of Early Modern Thought

Theories about human activities have always perforce existed under the constraint that the process of theorising which is intrinsic to all theorising unavoidably stifles some of the full richness and complexity - even confusion - of human possibility. To theorise is to highlight some aspects over others, and to organise them into an internally coherent narrative of change. Yet, if I may paraphrase Micheal Mann, "human societies are much messier than our theories of them". Social life will always, it seems, seep through the theoretical boundaries we so carefully delineate and defend. If this characterisation of the constraints of historiography is accurate, and I think few would challenge them, then it follows that theories about theories, which is the plane upon which this thesis operates, must operate under a double indemnity. Theories about how the shifts from certain sorts of theorising to others, each with their own permutations of ontological, epistemological, and other elements, can be made to make some historico-geographical "sense" are doubly complicated (at least) by the inherent limitations of abstraction. Even so, it is plainly evident that attempts at broad syntheses of diverse movements into intellectual trajectories, such as the "project of modernity", are valuable tools for developing a deeper understanding of the prospects and pitfalls our own contemporary situation.

In this thesis I have tried to root seventeenth century theoretical treatments of space in a critical historico-geography in a number of ways, and on a number of levels. First, I sought to show, in Chapter 2, how the development of new ideas about political, scientific, and moral order were related to material contexts within which their protagonists lived and worked. The people primarily discussed in this thesis, René Descartes, Thomas Hobbes, Robert Boyle and Isaac Newton, lived during a period of intense social, political, and economic turmoil and transformation. Indeed, I have suggested, in concord with Toulmin, Berman and others, that this turmoil was integrally related to the sense of intellectual anxiety all of these men felt and which, in part, impelled their novel and innovative theoretical formulations. Still, it is not just the matter of the material conditions of seventeenth-century England and western Europe, as they appear abstractly to a twentieth century observer, which is

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important here. Of equal or greater importance in developing a sensitive historico-geographical understanding of intellectual movements is to develop a more hermeneutic understanding of the contexts as the thinkers themselves comprehended them. What emerges from the treatment developed in this work is a complex, many-sided process which resulted in the ascendence, by century's end, of a new largely Newtonian view of scientific epistemology and the "right" apportionment of the intellectual disciplines. This 'Newtonian Accommodation', institutionalised in the Royal Society of London, was loosely though deeply connected with the rise of early capitalist political economy, especially after the English Revolution of 1688.

This 'Newtonian Accommodation' was neatly encapsulated under the rubric "Latitudinarianism". Latitudinarians, such as Boyle and Newton, occupied an epistemological position somewhere between the extremes of Rationalism and Empiricism. Though empirical research was, as I have argued, held to be constitutive of 'right' scientific method after 1662, the physical, social and spatial structure of a scientific "matter of fact" was carefully controlled \textit{a priori} to the process of scientific knowledge production (See Chapters 3 and 4). In other words, the programme of the Royal Society did not embrace unequivocally a straightforward Baconian inductivism in which all knowledge proceeds from the "things themselves". Newton Boyle and others rigidified many of the basic distinctions whose complex interrelations had given Descartes and Hobbes so much trouble. Distinctions such as those between subject/object, self/other and public/private received a strong and relatively lasting imprint as \textit{dichotomies} and \textit{oppositions}, rather than as complex dialectics, in the Newtonian tradition. Within the new modality the fluidity and complexity of world processes was displaced from the ontological constitution of the 'things themselves', to their epistemological and theoretical recombination in Newtonian dynamical theories. As such Latitudinarian science coopted much potential dissent from both endpoints of the Rationalism-Empiricism axis, creating for itself the basis for a strong intellectual movement.

But Latitudinarianism was more than simply a philosophical creed. First and foremost, the term itself had been coined in the context of the English Interregnum to describe a political position which espoused increased civil liberties and religious toleration within the framework of parliamentary
democracy or constitutional monarchy. The brotherhood of gentleman scientists (and I use these gender terms advisedly) described in such tracts as Bacon's New Atlantis, Platte's Macaria and Sprat's History of the Royal Society was also explicitly intended as an analogy for socio-political order. This being the case it is hardly surprising to find Royal Society members such as Newton and Boyle actively engaged in the administration of post Restoration, and especially post 1688 English government. Hobbes' Leviathan is emblematic of those alternative schemas which sought social-political-scientific stability through an essentially reactionary political absolutism. As Schaffer and Shapin have observed, echoing Foucault, "solutions to the problem of knowledge are also solutions to the problem of social order".2

6.2 On the Spatiality of Early Modern Thought

Of course these intellectual and political movements suggest spatial transformations at a number of levels. Of significance are the spatial constitution of ontological objects, of epistemological access to those objects as objects, and, ultimately, of space itself. The debate between spatial absolutists, who conceived of space as an ontologically absolute entity in and of itself, and spatial relativists, who thought space to exist solely through the relationships between bodies, was pursued on a wide assortment of physical, metaphysical, and even theological levels. From the perspective of the Newtonian Accommodation, the postulation of absolute ontological space eliminated the potentially pernicious metaphysical reasoning believed to pervade spatial relativism, while also permitting for the highlighting of dynamical, rather than kinematical, processes. Subsequently, change observed through time would assume a much greater theoretical significance than change over space. On the physical level at least the ascendance of absolute space, in ontology and epistemology, marked the scientific "annihilation of space by time" charted out by David Harvey with respect to primarily material processes.3

None of this is meant to imply that there could be no science of spatial relations within the Newtonian absolutist modality. On the contrary, the

2 Schaffer and Shapin 1985, p.332
3 Harvey 1989
seventeenth century saw the development of a number of new lines of geographical research. Varieties of environmental determinism were developed alongside more explicitly descriptive regional geographies and chorologies. As well, the steadily increasing impetus for new works oriented towards practical utility, resulted in commercial and political geographies designed to provide knowledge about "the difference that space makes" applicable in business and statecraft. Despite this effervescence of geographical thinking, few practitioners bothered themselves too much about the deep ontological or epistemological spatialities of their research. These of course were more explicitly treated in non-geographical works in physics, mathematics and metaphysics. One result was the initiation of a geographical paradigm which even as it focussed on the difference that space makes in the relations between objects, rarely turned its analytic gaze towards the spatiality of its own basic concepts. This silence about self critical questions of space is testimony to the very centrality of a highly specific spatiality which concretised during the seventeenth century and culminated in the ideas expressed Newton's "Scholium on Space". The subtle but far-reaching appropriation and transformation worked upon the highly sophisticated geographical ideas of Bernhardus Varenius is further testimony to the ascendance of a delimited spatiality to a position of unquestioned "naturalness". Such deeply self critical questions about space, spatiality and geography would not be raised again until Kant's critiques of reason at the end of the next century.

6.3 Modernity, Postmodernity and Critical Human Geography

A great deal has been said in these pages about the intersection between science, spatiality, geography and historico-geographical processes. I have attempted herein to develop a thoroughgoing examination of how certain ideas about space have developed in certain ties and places and what impact these have had on the prospects for a truly geographical discipline. In part my objectives have been 'methodological' as well as 'substantive' (if I may be allowed to tender such a positivistically oriented distinction for the moment). The examination of spatial ideas in seventeenth-century philosophy and geography has required the elaboration of new, more sophisticated historico-

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4 Of course, neither of these terms are to be taken in their contemporary senses.
geographical 'tools'. Underneath, and multiply imbricated with, extant theories of space, after all, are all sorts of other notions about the structuring, spatial and otherwise, of scientific method, social order, morality, aesthetics, and even subjectivity itself. An engaged "historico-geography of modernity", such as that called for by Gregory, can easily be made to speak reciprocally to the 'modernity of geography' as well.\(^5\)

In many ways it is precisely at the junctures of this complex dialectical relationship between the 'western philosophical tradition', Rorty's "Philosophy with a capital 'P'," and philosophy's former disciplinary 'colonies', such as geography, that the most interesting regions of debate and analysis regarding the "project of modernity" are located. When considered solely in abstract philosophical terms, questions about modernity, modernism and post-modernism tend to be at best stifling, and at worst completely irrelevant to the world of practical affairs. On the other hand, purely 'internal' disciplinary discourses about 'local' developments, such as the periodic revisitations of the "agency/structure" debate within sociology and human geography, have generally missed the broader implications of these inescapable problems. What seems to me to be exciting about the present intellectual milieu is the high degree of cross fertilisation which is occurring between disciplines. If the progressive partitioning of intellectual activities into increasingly refined (confined) departments is now thought to have been intrinsic to modernity, or at least modernism, then the re-establishment of lateral interdisciplinary connections must logically be part of any putative post-modernism. Within academic geography there can be no doubt that infusions of literary criticism and anthropology; of poetics as well as politics, have enriched geographical debate, irrespective of one's personal evaluation of the results. Ultimately such disciplinary cross fertilisation may open up the possibility for reclaiming a quasi-foundational basis to replace the discredited Philosophical one. In my view this would likely be a 'foundation', not in the old fixed Philosophical hierarchy of language games, the 'ancient regime' as it were, but in the lateral attempts to translate local disciplinary experiences into one another's lexicon; a kind of

\(^5\) Gregory 1989, pp.34-5
Lyotardian "free play of signs and signifiers" characterised by an abiding "incredulity towards metanarratives".6

With respect to geography, any attempts to move beyond the confines of modern geography must necessarily ground itself in the inquiry into these complexly interleaved spatial and geographical processes. In this thesis various ontological, epistemological, political and material processes have been shown to have come together in new ideas about spatiality and, therefore, also what is the rightful subject matter for geographical science. Any true "post" or "anti" modern geographies which do not take account of these orders of spatiality run the risk of reifying significant parts of the intellectual edifices they intend to transcend or reform. Yet geographers would seem also to be uniquely situated among the disciplines to make just such an interdisciplinary contribution.

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