

Robert Boyle reconsidered

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Introduction

MICHAEL HUNTER

The state of Boyle studies

By any standards, Robert Boyle (1627–91) is one of the commanding figures of seventeenth-century thought. His writings are remarkable for their range, their significance and their sheer quantity: during his life he published over forty books, which between them will occupy twelve substantial volumes in a forthcoming new edition, about which more will be said later in this Introduction. Boyle achieved wide fame in the early 1660s through a series of experimental treatises in which he investigated the characteristics of air, outlined what he called ‘corpuscularianism’ and sought to extend its applicability to a wide range of natural phenomena. His early publications also included more programmatic statements about the principles of experimentation and about the great potential of the new philosophy for understanding and controlling the natural world. For the rest of his life he published various longer or shorter treatises about a wide range of natural phenomena, many of them purely descriptive, others more speculative in character. Equally important were a number of books in which he sought to define the relationship between God and the natural realm and the role of human understanding in assessing this; he also wrote a series of theological works, including some of a devotional character. Indeed, in his blending of a commitment to scientific work with deep piety, Boyle presented almost an ideal type of ‘the Christian virtuoso’, to quote the title of one of his own books – a great intellectual innovator who was at the same time a paragon of godliness and probity.

This image of Boyle was confirmed by the earliest and most influential account of him to appear in print, the sermon preached by Bishop Gilbert Burnet at Boyle’s funeral at St Martin’s in the Fields on 7 January 1692. This set the tone for most subsequent evaluation of Boyle, proving as influential as it did largely due to its brilliance in evoking a picture of him which was at one both with his view of himself and with the taste of his contemporaries. It was intended that Burnet would complement his sketch by a definitive life of Boyle, which would have given a more detailed and contextualised account of Boyle’s achievement. When Burnet himself proved too busy to write this, the task was instead deputed to the scholar William Wotton: but he

never completed it either, and, instead, Burnet's rather generalised eulogy held the field. Apart from Boyle's own writings, this sermon formed the sole source of the first book-length life of Boyle, that published by the miscellaneous writer Richard Boulton in 1715. Even the life published by the antiquary and divine Thomas Birch in 1744, though notable for the detail that it added concerning Boyle's career, was much under the shadow of Burnet when it came to the general evaluation of Boyle.

Birch's own principal contribution to Boyle's posthumous reputation – a highly significant one – was to publish a lavish collected edition of his works, which first appeared in 1744 and was reprinted in 1772. Already, epitomes of Boyle's writings produced by Boulton and by Peter Shaw had borne witness to an appetite for his works, which Birch's text seems to have succeeded in satisfying. Indeed, Boyle's posthumous reputation was largely subsumed in his writings, as if Birch's capacious volumes had provided all that needed to be known about him. Partly as a result of this, there is virtually no Boyle scholarship to speak of from the mid-eighteenth to the early twentieth century: evidently, there seemed no need for the kind of biographical labours that the likes of Brewster and De Morgan carried out for Newton. With one or two exceptions, Boyle was placed on a pedestal and left there – not ignored, but taken for granted.¹

The rise of professional study of the history of science in the post-war years obviously changed this. Boyle claimed the attention of such luminaries of the history of science in this era as R. S. Westfall and T. S. Kuhn, but the scholar who devoted most effort to the elucidation of his ideas was Marie Boas, who later wrote under her married name, Marie Boas Hall. In two books and a series of articles, one of them itself of book length, Boas gave a detailed analysis of Boyle's aims and achievements, illustrating how he established the corpuscular philosophy on a foundation of brilliant experiment, and how he, more than anyone, sought to 'raise chemistry to a point where physicists recognised it as a real and important science, working in the same spirit as contemporary natural philosophy'.² Her writings form the starting point of a good deal of the investigation which is expounded in the following pages, even when the authors disagree with her conclusions.

But it might be felt that, for all this, Boyle did not receive as much attention in the post-war years as he might have done. To some extent this was because – despite his undeniable scientific significance – Boyle fitted badly into the view of the Scientific Revolution, which, as Roy Porter has perceptively pointed out, was typical of the prevailing historiography of this period.³ Under the influence particularly of Alexandre Koyré, this stressed the role of heroic individual thinkers in revolutionising knowledge by achieving great syntheses of mathematicised physics, a vision epitomised by Newton and his *Principia*. This was a setting into which Boyle did not fit well. One reason for this was his own distrust of the higher reaches of mathematics because of the idealised view of the world which he associated with them.⁴ Equally significant was the fact that his own opus comprised a variety of treatises, at best diffuse, at worst miscellaneous, bizarre and apparently trivial. How was a work like Boyle's *Experimenta & Observationes Physicae*, with its appendix of 'Strange Reports', supposed to fit into the

heroic view of the Scientific Revolution? Undoubtedly embarrassment with aspects of Boyle which were at odds with the prevailing image of the rise of the new science helps to explain his relative neglect; it also accounts for a tendency in those who *did* study him, including Marie Boas, to place as 'rational' and mechanistic an interpretation as possible upon his views, and to neglect aspects of his ideas which fitted badly into this, including some – such as his alchemy – which will receive coverage in the pages below.

Since the 1970s, we have seen the growth of a scholarly tradition which, in reaction to the internalism of much post-war historiography, has sought to contextualise science in terms of social, economic and cultural change in its period; Boyle studies have undoubtedly benefited from this alternative approach. Here, the trail had been blazed in the 1930s by Robert K. Merton in his well-known 'Science, technology and society in seventeenth-century England', in which Boyle played a significant role: indeed, up to a point, the post-war historiography was itself reacting against views of this kind.⁵ But Boyle has received particular attention in the context of the reformulation of a contextualist reading of early modern science over the past two decades.

One landmark was Charles Webster's *The Great Instauration* (1975), in which Boyle figures prominently – hardly surprisingly in view of his links during his formative years with the Hartlib Circle on which that book is focused. In addition, in various articles and a book published during the 1970s, J. R. Jacob made Boyle the subject of an attempt to forge a direct connection between the ethos of the new science and the ideological conflicts of the English Revolution. Jacob saw Boyle's personal values as redirected by his experience of the Civil War, and he claimed that, thereafter, Boyle's natural philosophy was formed at least in part to counter rival philosophies of nature. His views have had considerable influence over the past two decades.

On the other hand, though significant as a pioneering attempt at contextualisation, Jacob's views have not stood up to scrutiny in the light of subsequent research. Jacob's image of Boyle is in many ways rather partial and schematic, based on a selective reading of Boyle's writings, and often imputing ill-evidenced motives to him in his controversial works. In particular, the 'dialogue' that Jacob claimed to discern between Boyle as spokesman for an orthodox mechanistic worldview and a rival position which combined vitalism with politically subversive ideas is based on a mistaken presumption that natural philosophical positions were more clearly polarised than was actually the case; it also postulates a precise focus for the notions which Boyle attacked which is not warranted by the evidence.⁶ In so far as Boyle was reacting to contemporary events at all, his position was more complicated than Jacob implied. This is illustrated in relation to the politics of the Civil War period by Malcolm Oster's essay below, while the same complexity in Boyle's attitudes is in evidence in other episodes of which Jacob's account presumed that certain motives were predominant, when in fact this is hard to substantiate; the need for a total revision of the view of Boyle's relationship with his milieu given by Jacob is acute.⁷

More recently, Boyle has been the focus of a different attempt to redefine the agenda of the history of science, in this case that of Steven Shapin and Simon Schaffer in *Leviathan and the Air-Pump* (1985), and a series of ancillary studies. In their book,

Shapin and Schaffer concentrate on Boyle's debate with Thomas Hobbes not only to argue for the self-consciously ideological role of science in the Restoration period, but also to offer a contextualised reading of the claims that Boyle made for his experimental findings and their role. Especially important is their attempt to problematise a phenomenon which earlier studies had taken for granted, and this is the issue of how knowledge claims were put forward and assessed, and the role of experiments and instruments in this connection. Thus they have actually investigated how and where Boyle carried out his experiments, illustrating difficulties about the replication of trials using the air-pump. They have also emphasised the significance of the way in which Boyle wrote about his experiments and the strategies he deployed in trying to convince others by invoking as value-free the publicly verified 'matters of fact' obtained by such means.

Undoubtedly, this approach has opened up new ways of looking at Boyle and his seventeenth-century milieu, stimulating fresh consideration of many important issues. But it, too, has its drawbacks. To some extent there is a problem about how the new science's ideological role is presented, overlapping with the shortcomings of the Jacob thesis which have already been noted. Thus both the unanimity of the 'Royal Society' position that Boyle is seen to speak for, and its influence in contemporary society, are exaggerated; the result is that the relationship of the new science to its milieu is misunderstood.⁸ In addition, concentration on Boyle's exchange with Hobbes is unhelpful since it gives undue prominence to a position in natural philosophy which was in fact marginal: though 'Hobbism' may have been common in Restoration England, this seems to have represented a kind of eclectic cynicism rather than a systematic espousal of Hobbes' complete philosophical position, and protagonists of Hobbes' system of natural philosophy are almost impossible to find. Moreover concentration on this debate detracts attention from other significant threats with which Boyle had to deal, including the residual power of Aristotelian scholasticism. Shapin's and Schaffer's assertions about the context and significance of Boyle's methodological innovations, and particularly his preoccupation with 'matters of fact', have also been questioned, not least by Rose-Mary Sargent, who has shown that their arguments about the ideological implications of Boyle's claims concerning evidence and its proper interpretation are based on a somewhat distorted view of the precedents of such ideas in the legal tradition.⁹

There is a further, more fundamental, objection to the arguments of Shapin and Schaffer – which also applies to those of Jacob – and this is that they fail to do justice to Boyle because they offer too simplistically functionalist a reading of a man who in fact had a complex personality, which is easily distorted by an interpretation of this kind. As I have argued more fully elsewhere, we will never understand Boyle unless we take account of what might be termed the 'dysfunctional' as well as the 'functional' elements of his intellectual persona: the indefatigable experimenter was also the man who refused to become President of the Royal Society due to his 'great (and perhaps peculiar) tenderness in point of oaths', and arguably the two only make sense as complementary facets of the great 'scrupulosity' which Boyle showed in all areas of his

life.¹⁰ The need to link Boyle's personality with his scientific work has also been canvassed by J. J. MacIntosh, and Malcolm Oster has sought to throw light on the development of Boyle's personality by reexamining his upbringing and self-perception in his early years.¹¹ Sensitive study of this kind is likely to make sense of priorities and preoccupations on Boyle's part which cannot easily be accommodated in Shapin's and Schaffer's view of him.

Equally important is the risk that too much emphasis on Boyle's overall programme may detract from the *content* of his ideas and the extent to which the intellectual developments with which he was associated had an internal momentum of their own. Indeed, if it is possible to speak of a 'post-modernist' generation as far as approaches like those of Jacob, Shapin and Schaffer are concerned, it may be argued that the contributors to this book represent it. The scholars whose work appears here all take it for granted that ideas can only be properly understood through a full knowledge of their context, and they are quite receptive to certain aspects of the view of Boyle put forward by Shapin and Schaffer. Yet, at the same time, they are also sensitive to the power and complexity of intellectual traditions in their own right. Perhaps it is now possible to have the best of both worlds, with contextualism being combined with intellectual considerations which owe more to the post-war historiographical tradition, all in the setting of an understanding of Boyle's personality in its own right.

The present volume

Be that as it may, there is no doubt of the current vitality of Boyle studies: an unprecedented amount of work on him is currently being done, from a wide range of points of view. To some extent, as just noted, this marks a belated coming together of contrasting approaches to a figure of undeniable significance; it also reflects – and may in part be caused by – the fuller availability of resources for such study than ever before, the Boyle Papers having recently been catalogued for the first time and published in microfilm form. Whatever its explanation, it is this renaissance of Boyle scholarship which this book celebrates. Its immediate occasion was the symposium which, as explained in the preface, was held near Stalbridge in Dorset from 14 to 16 December 1991 to commemorate the tercentenary of Boyle's death. This provided an appropriate opportunity to bring together a group of mostly younger scholars working on Boyle, to offer a collective sample of their work, and to speculate a little on the direction in which studies of Boyle have developed in recent years and should develop in the future.¹²

The volume opens with Malcolm Oster's essay on Boyle's relationship to the turbulent events of the Civil War and its aftermath, in which, as already noted, he directly takes issue with J. R. Jacob's account of Boyle and the English Revolution. Oster indicates how Boyle's views during these decades were very much those which he had expounded in his earliest ethical writings, recently published for the first time by John Harwood, who has used them to condemn as schematic and misleading Jacob's account of the formative influences on the young Boyle.¹³ Oster continues this

analysis, providing a sensitive and helpful account of Boyle's position in the ideological and political cross-currents of the period; he also gives a fascinating view of the local conflicts by which Boyle was affected in Dorset and neighbouring counties. As he points out, Jacob's overall picture of Boyle depends on a serious distortion of the evidence, the essence of Boyle's position paradoxically being presented by Jacob as a concession to his claims as a whole. In fact, the young Boyle was prone to withdraw from political commitment, thus placing him in an intermediate position between royalists and parliamentarians. The same remained equally true in 1660: again, he was not particular about forms of government so long as they were effective. Throughout, he displayed a wish to be above politics, to transcend sectarianism. It was in this context that, from 1660 onwards, Boyle began to publish the writings which were in a sense to become programmatic of the new science.

John Harwood's essay is devoted to these books, looking in general terms at the published output which the remainder of the contributors to the volume analyse piecemeal. Drawing both on Boyle's works and on his correspondence, Harwood illustrates the extent to which Boyle consciously aspired to a public role through his activity as a writer, concerned as to the image of himself that his publications presented, and anxious about how his books were read and his ideas best communicated. Schooled in rhetoric from his early years, Boyle also sought to use rhetorical techniques to persuade his audience, attempting to develop an appropriate style for the presentation of findings about the natural world and of arguments about their philosophical and religious significance. Moreover – despite the hostility towards figurative language expressed by Thomas Sprat in his *History of the Royal Society* (1667), which Harwood sees as a polemical ploy in itself – Boyle and others in scientific circles were adept in their use of imagery. Appealing to experience, Boyle discovered how natural philosophy offered fresh opportunities for the interchange of the literal and the figural, which he sought to exploit. Though, as Harwood illustrates, Boyle often experienced difficulties in literary composition, this was balanced by a self-consciousness which has to be taken into account in order to understand him.

If Harwood's essay is indicative of a fresh dimension to our view of Boyle, with Rose-Mary Sargent's essay we come to the experimentalism for which he has long been celebrated. On the basis of a wide reading of his published and unpublished writings, she gives a helpful summary of Boyle's objections to Aristotelianism and a clearer account than hitherto of the relative importance of Baconian and Cartesian ideas in his thought. She also deals with his attitude to Galileo, Pascal and other experimental precursors, and surveys his indebtedness to the contemporary empirical traditions of chemistry, medicine and the practical arts. Above all, she emphasises the extent to which Boyle's views were formed by his actual experience of attempting to manipulate nature, and by his knowledge of the practices of artisans and tradesmen in direct contact with the natural world. Experimentation was a dynamic learning process, with a strong element of contingency which the more programmatic approach of Shapin and Schaffer obscures. Sargent also stresses that there was more to it than a simple empiricism: Boyle gave careful thought to the issue of how experiments should be

interpreted, using his practical experience in the laboratory to provide a subtle strategy for the replication and verification of such findings and the assessment of their significance.

In Antonio Clericuzio's essay we turn to one of the specific themes dealt with by Sargent, Boyle's attitude to the chemists. Clericuzio focuses for this purpose on Boyle's most famous – if problematic – book, *The Sceptical Chymist* (1661), considering its intentions and impact, and clarifying its relationship both to an earlier treatise which he had written on related topics and to the lengthy appendix that Boyle added to the book when it was republished in 1680, *The Producibleness of Chymical Principles*. He takes issue with the view of *The Sceptical Chymist* which Jan Golinski has recently adopted, namely that earlier writers had failed to give the narrative detail that Boyle saw as crucial. Rather, Clericuzio argues that the problem with chemists was that neither the manner in which they expounded their findings nor the way in which they interpreted them seemed to Boyle properly philosophical; it was for this reason that their work could not be considered an integral part of natural philosophy. Here, the dialogue form which Boyle first adopted in this work was itself crucial, giving philosophical sophistication to a subject traditionally more practical. Clericuzio continues by clarifying Boyle's views on chemical compounds, and revaluating his impact on late seventeenth-century chemistry; in the course of this, sense is made of the subject matter of Boyle's 1680 annexe to the book, in which he dealt not least with the notion of 'spirit' and with the nature of metallic 'mercuries'.

Clericuzio ends by alluding to Boyle's alchemical interests, and these form the subject of the two subsequent essays, in which new light is shed on his activity in a field his participation in which would at one time have been dismissed by historians of science as an aberration on Boyle's part. First, Lawrence Principe provides a useful overview of Boyle's alchemical studies, emphasising not only the immense amount of time that he evidently devoted to them, but also the extent to which he used alchemical terminology and deployed the alchemical techniques of secrecy and the 'dispersal' of a message through a work. It is now clear that Boyle made many transmutation experiments of a fully alchemical kind, which he refers to in passing in his works; he clearly also sought contact with other alchemists who had carried out similar experiments, as seen particularly in the famous article by him published in *Philosophical Transactions* in 1676. Principe also probes at Boyle's motivation in his alchemical activities, and attempts to chronicle their progress during his career. He further speculates how – quite apart from specific concepts which may have come from the alchemical tradition (on which the next essay throws fuller light) – Boyle may have seen a broader significance in alchemy as illustrating the reality of spiritual activity in the world, and thus providing a potential bridge between natural philosophy and theology.

William Newman documents a more specific link between Boyle's alchemy and his concerns as a natural philosopher, claiming that many aspects of Boyle's corpuscularianism can be traced back to the 'minima' tradition of medieval alchemy, seen best in the pseudo-Geber's *Summa perfectionis*, of which Newman has himself recently

produced a definitive modern text. This entailed a particulate theory of matter, in terms of which phenomena such as liquidity and volatility could be understood. Since 'Geber' is known to have influenced all the major alchemical authors of the sixteenth and seventeenth centuries, together with such mentors of Boyle's as Sir Kenelm Digby, George Starkey and Frederick Clodius, it is not difficult to postulate routes by which Geberian ideas might have reached Boyle. There are, of course, important aspects of Boyle's corpuscularianism which are not paralleled in this source, since for 'Geber' size was the only criterion, and no account was taken of either the movement of atoms or their shape. But many Boylean concepts make better sense in this context than in that of the revived atomism of the Epicurean school, such as his talk of the subtle and gross parts of matter, or his conception of 'dregs' or 'denseness'. Hence we may well here have an important source for Boyle's ideas, which has been obscured by an overstrong contrast between 'mystical' and 'rational' traditions in seventeenth-century natural philosophy, and by a mistaken presumption that Paracelsianism was more predominant in the alchemy of Boyle's day than was in fact the case.

The need to abandon simplistic preconceptions about the mechanical philosophy in its seventeenth-century context recurs in John Henry's essay, in which he concentrates on the 'systematical or cosmical' qualities of things to which Boyle devoted a tract in 1671 – qualities of bodies which did not depend on the shape, size and motions of their constituent corpuscles. Although such concepts would have been anathema to a strict mechanist, Henry shows that Boyle always insisted on the possibility of unknown corpuscles in nature which might have what he called 'peculiar faculties and ways of working'. Indeed, Boyle apparently believed that a whole range of factors of this kind must be at work in the world, even going so far as to hint that localised natural laws might exist, by which the normal activities of matter may be modified. Boyle was always somewhat defensive in his writings on such subjects, for reasons which will be considered more fully later in this Introduction: but he seems to have been certain that the principles of Cartesian mechanist were too limited, and that ultimately a true new philosophy would emerge which would do justice to considerations of this kind.

Moving to Boyle's writings on theological and philosophical issues, we begin with an essay by Jan Wojcik in which she convincingly anchors one of the most important, Boyle's *Discourse Concerning Things above Reason* (1681), in the theological controversies of its day. One of the problems stemming from the image of Boyle that has come down to us is that his writings often appear to be more timeless than they really are: Wojcik's full and careful investigation, on the other hand, brings to light a context for this work which has hitherto been entirely unsuspected. This stemmed from the fierce debate over Socinianism which raged in England from the 1650s onwards, including writings by nonconformists like Richard Baxter, John Owen and Robert Ferguson, and Anglicans like Joseph Glanvill; it overlapped with a debate on predestination stimulated by John Howe's *Reconcilableness of God's Prescience of the Sins of Men, with the Wisdom and Sincerity of . . . whatsoever Means He uses to prevent them* (1677), a work which Howe claimed that he had compiled at Boyle's request. Boyle's own book is to be seen as an answer to the latter: in it, he provided a broad rationale for 'privileged things',

stressing God's inscrutability, warning against dogmatism, and making an implicit statement of his own belief in conditional predestination. Wojcik also stresses the parallel between Boyle's views on the limits of reason in religion and in natural philosophy.

An equally seminal work by Boyle was his *Disquisition about the Final Causes of Natural Things* (1688), to which two chapters are here devoted. First, Edward B. Davis is able to deploy an extraordinary and hitherto unknown survival among the Boyle Papers to throw light both on this book and on Boyle's relations with the author of the document in question, who turns out to be none other than Robert Hooke. This paper – printed as an appendix to Davis's chapter – comprises a series of notes in Hooke's hand on what was evidently a draft of *Final Causes*, dealing particularly with Descartes' views on the subject. Davis points out that it had in fact been Hooke who had initially introduced Boyle to Descartes in a systematic way, and he indicates how such evidence reveals Hooke as much more of an equal of Boyle's than accounts of the relations between the two men such as that of Steven Shapin would imply. Equally important is what can be learnt from the newly discovered paper about Boyle's rhetorical strategy in dealing with those with whom he disagreed: in his notes, Hooke urged Boyle to exercise charity in attacking such rival viewpoints, advice which Boyle was indeed to follow in the final version of the book, attempting to minimise disagreements among Christians and hence achieve a united front against the over-riding infidel threat that so preoccupied him.

In his chapter, Timothy Shanahan looks at the *Disquisition* from a somewhat different perspective, arguing for the originality and importance of Boyle's treatment of final causes and the novelty of his conceptual apparatus for dealing with them. Elucidating Boyle's concern about the position both of the Epicureans and the Cartesians, Shanahan goes on to illustrate how he sought to eliminate ambiguity by clarifying both the terminology of types of ends and the modes of reasoning used to ascertain them. On this basis, Shanahan systematically reexamines Boyle's argument, showing how powerfully he vindicated final causes, and claiming a subtlety in Boyle's analysis which previous commentators have overlooked. Shanahan also delves more deeply than Davis into the grounds on which Boyle disagreed with Descartes, and the type of material that he felt it most appropriate to use to illustrate final causes. Moreover, in taking issue with the recent account of the subject by James Lennox, who saw Boyle as primarily concerned with final causes in science, Shanahan points out that in fact most of Boyle's examples are taken from natural history: his primary concern was a more general philosophical one, of strengthening the case for acknowledging the existence of a divine author of nature and stimulating devotion to him.

Implicit in Shanahan's paper is the more general case that Boyle is easily undervalued as a philosopher. It has often been presumed that, philosophically, Boyle had little that was original to say, or, in so far as he had, that Locke said it better. Just how wrong this is is illustrated by J. J. MacIntosh's chapter. On the basis not least of extensive use of material to be found among Boyle's unpublished manuscripts, MacIntosh explicitly compares Boyle's views on God's existence and on the argument from miracles with Locke's, and finds them superior. Thus he offers a rather critical

reading of Locke, whose arguments for God's existence are seen as 'almost startlingly weak'. Boyle, on the other hand, comes across as possessed of a subtle view on such matters, due not least to his awareness of the complexity of natural phenomena and hence the extent to which events were rarely as straightforward as might have been predicted. The views of the two men on miracles show a similar contrast. Locke's are seen as ambitious but not self-sustaining; Boyle, on the other hand, put forward a more limited but more subtle account of supernatural events as a whole, and the way in which decisions should be made as to what should be deemed miraculous. Again, a sophistication appears with which at one time Boyle might not have been credited.

The new Boyle

What is the image of Boyle which cumulatively emerges from these essays? The intention here is not to try to impose a synthesis on a thinker who was himself always reluctant to synthesise, who deliberately contrasted his manner of writing discrete expositions of specific themes to the systematising tendency which he saw as the bane of earlier philosophical traditions. But it is appropriate to end this Introduction by reflecting a little more broadly on Boyle's methods and preoccupations, and the way in which these affect the manner in which he should be interpreted. In doing so, I will draw partly on the findings of the essays that follow, and partly on my own recent work, published and unpublished, much of it related to the cataloguing of the Boyle Papers at the Royal Society and to the preparation of a new edition of Boyle which is to appear in the 'Pickering Masters' series, and which will finally supersede Thomas Birch's edition after two and a half centuries.¹⁴

One thing that is clear is that detailed study of the kind exemplified by the essays in this volume tends to enhance one's respect for Boyle's sophistication as a thinker – whether it be in his complex and novel typology of final causes, or his attempt to avoid some of the pitfalls of arguments about reason and its limitations. The same subtlety is in evidence in his attitude towards experiment and the means by which knowledge claims might be verified. Indeed, as both Rose-Mary Sargent and Antonio Clericuzio make clear, recent emphasis on 'matters of fact' as the basis of Boyle's scientific strategy has tended to obscure the true sophistication of Boyle's stance. 'Our way is neither short nor easy', as Boyle put it in the latter connection (see below, p. 73), and it may be argued that whatever Boyle applied himself to, he did so with an intensity which is significant in itself and which frequently took him beyond the position of his more superficial contemporaries.

This is as true of Boyle's life as of his thought. As I have argued elsewhere, there is a clear parallel between the indefatigability that Boyle displayed in the laboratory and the assiduity with which he sought to salve his conscience through casuistry.¹⁵ The same sedulity is also seen in the care with which he supervised the administration of his landed estates, as shown, for instance, by a paper of twenty numbered points outlining the 'Method' to be observed in managing his Irish estates in 1683.¹⁶ Nor is it fanciful to

recognise the same prudent ratiocination in his attitude to his health, as evidenced by Sir Hans Sloane's story that 'he had divers sorts of cloaks to put on when he went abroad, according to the temperature of the air; and in this he governed himself by his thermometer', or by the memorialist, Roger North's, account of his 'chemical cordials calculated to the nature of all vapours that the several winds bring; and [Boyle] used to observe his ceiling compass every morning that he might know how the wind was, and meet the malignity it brought by a proper antidotal cordial.'¹⁷

Linked to this general assiduity was an acute concern on Boyle's part about the fairness of the decisions he came to and the steps he took, and a wish to avoid divisive and morally reprehensible actions. In his personal life, Boyle was ceaselessly concerned about the rectitude of his role in financial and other transactions, and the dilemmas which this caused him are well illustrated by the surviving notes on his interviews with his confessors, Edward Stillingfleet and Gilbert Burnet, in the last months of his life.¹⁸ In politics, Boyle's objective was to avoid partisanship, aware as he was of the shortcomings of the more vigorous protagonists of either side: yet he could not entirely escape the political world, and hence, as Malcolm Oster indicates below, difficult decisions about allegiance were presented to him which he was reluctantly forced to confront.

In his intellectual life, Boyle's fastidiousness was juxtaposed with the need to balance various objectives in a milieu which was a veritable minefield. Here the problem was that, though Boyle might be convinced that his aims and priorities as a thinker and writer were interrelated, they sometimes pulled in different directions. The difficulties involved may be illustrated by briefly summarising his principal ends. First and foremost, there was his hope to achieve a reformed natural philosophy which would also form part of a properly defined relationship between God and man. To this end, one priority was to challenge the scholastic modes of thought which were still much in evidence in his day, including such unnecessary obfuscations as forms and qualities, together with the engrained and commonplace habits of mind which scholasticism inculcated in related spheres. Equally, there was the threat of 'atheism', generally associated with a thorough-going materialism, and personified for many of Boyle's contemporaries by the philosophical and political views of Thomas Hobbes: this was of particular concern to Boyle because of the extent to which the study of nature was traditionally, if in Boyle's view quite wrongly, suspected of encouraging atheistic attitudes.¹⁹ In addition, there were the dangers which Boyle perceived in the other alternatives to Aristotelianism which thrived in his period, whether they be Paracelsianism, the various vitalist and magical traditions of the day, or the ideas about a 'spirit of nature' espoused by such thinkers as the Cambridge Platonists.

Balancing these priorities was not easy, particularly for one as fastidious as Boyle, and the result is to explain some of the tensions and difficulties – as well as some of the profundities – which are revealed in the course of this book. Thus, as John Henry points out, while too austere a mechanism might seem to smack of materialism and hence make the idea of admitting non-mechanical attributes in matter attractive, this had the drawback of making it seem as if Boyle was faltering in his commitment to a