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Eighteenth-Century Science

Edited by G. S. Rousseau and Roy Porter

Excerpt

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INTRODUCTION

In my experience, almost all erroneous views of what went on in the 19th century are related to particular ideas as to what went on in the 18th century; and for the history of science and the history of ideas in the 18th century you can trust almost no one. The amount of 'hard' history of science for that period is so lacking that one simply leaps . . . from Newton in optics to Young in optics. Who else observed what, how well, and how thoroughly, and with what results? It is hard to tell. It is no reproach to my friends who are trying to do something with the 18th century to tell them that their labors have not yet reached the point at which a 19th century historian can confidently go ahead from the stable platform they have erected. And the same is emphatically true of the history of ideas related to the history of science.¹

With these trenchant words, Susan Cannon has recently placed a bomb under the whole state of scholarship of eighteenth-century science. What lies behind these devastating criticisms?

The last generation has wrought a revolution in the history of science. As it was written thirty years ago, history of science, with honourable exceptions, essentially celebrated the biography of humble genius and the triumphal progress of discoveries along the royal road of truth. The history of science was the spaniel of science itself. This approach had real merits, not least in spotlighting the tremendous power of science as an engine of investigation. But now the discipline – as many contributors to this volume insist – has changed utterly. Contextual scholarship in the history of ideas, methodological 'externalism', new approaches within Marxism and French structuralism, the techniques of historians of art, religion, philosophy and ideology, the seminal writings of anthropologists and psychologists,

¹ Susan F. Cannon, *Science in Culture* (Folkestone, 1978), 133–4.

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the anti-science temper of the counter-culture of the late 1960s, and the question-marks hanging over science in an age of demographic, ecological and technological crisis – all these have compelled profound rethinking. Certainties have given way to questions. The history of science is no longer a scientist's hymn to science: it has become part of history itself.

To rephrase this development sociologically: the last generation – as Roger points out in this volume – has seen the writing of the history of science tend to move out of the hands of scientists, and become the province of a separate, professional body of academic practitioners, whose primary allegiance is to history. The history, philosophy and sociology of science are now secure and prestigious academic disciplines. Nowadays it is possible for a work such as Thomas Kuhn's *Structure of Scientific Revolutions* (1962) not merely to exert a seminal influence in shaping research within its own field but also to offer a paradigm widely appropriated by other disciplines. Largely through Kuhn, the history of science has moved stage-centre in debates about the methods and truth-status of the humanities.

The development of science can no longer be served up as the sure tread towards truth. But exactly how it *should* be viewed is a question on which no consensus is in sight. What *is* clear is that – to pluck some choice examples – the Scientific Revolution will never look the same again since Frances Yates rediscovered Hermeticism; Newton has been historicized by McGuire and Rattansi, and Betty Jo Teeter Dobbs, and psychoanalysed by Frank Manuel; and Darwinianism has taken on new dimensions through the ideological approach of Young, quantum physics through that of Forman. Science today is being thoroughly recontextualized. The focus has switched away from the march of science to the sinuous mind of the scientist working within a society and milieu.

This revolution is, of course, very familiar. Its relevance here is that this profound change in the orientation of the history of science – one riddled with methodological anxieties – has as yet done little for the eighteenth century. Acton's advice to historians is classic: 'Study problems in preference to periods'. Yet the period of the eighteenth century *is* a problem. Historians of science have tended to regard it as a tiresome trough to be negotiated between the peaks of the seventeenth and those of the nineteenth century; or as a mystery, a twilight zone in which all is on the verge of yielding. This judgement may seem paradoxical. For even by the most conventional 'internal' standards of evaluation, the eighteenth century was one of noted achievement: it saw the establishment of fields such as electricity and heat, the 'chemical revolution', the new science of gases, the isolation

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of oxygen, the nebular hypothesis in cosmology, the foundations of rational mechanics, the birth-pangs of biology, geology and psychology. It was indeed an age when knowledge was in ferment.

Yet the century has suffered neglect. It is thus characteristic that the most recent English-language compilation devoted to eighteenth-century science, *Natural Philosophy through the Eighteenth Century and Allied Topics*, edited by Allan Ferguson, appeared as long ago as 1948, and for lack of competitors was thought worth reprinting in 1972. By many historians the century has been deplored for allegedly producing science that was boring, unoriginal, lacking in rigour, and over-speculative – at best, merely fall-out from Galileo, Harvey or Newton. ‘The first half of the eighteenth century was a singularly bleak period in the history of scientific thought’; ‘science somewhat languished’; the period was ‘comparatively undistinguished in its science’, which contained ‘an element of dullness’, due in part to its ‘too ambitious schemes’ and its ‘obstructive crust of elaboration and formality’.² This irritation, prominent in many historians’ responses to eighteenth-century science, perhaps betrays frustration at the century’s lack of towering heroes, of conflicts between titanic geniuses, or of martyrs – a century not of peaks but of trackless bog.

Indifference or antipathy to eighteenth-century science is nothing new. The ‘reading’ of science’s ineptitude in the age of the Enlightenment had taken firm root from early in the nineteenth century. Think, for instance, of Charles Lyell’s characterization of the eighteenth century in geology as a period of ‘retardation’ whose study was ‘singularly barren of instruction to him who searches for truths in physical science’.³ The myth is part, of course, of the Romantic and counter-French-Revolutionary reaction against all facets of the eighteenth-century world: its religion, its art and poetry, its history-writing. So potent does the myth remain that many fields of Enlightenment ideas and culture – perhaps especially gauging the pitch of its religion – suffer from scholarly neglect at least as seriously as its science.

The upshot is that the eighteenth century has been a period in which the currents of science in general, and the pattern of particular disciplines, have lacked strong interpretation. As Bos emphasizes in his essay here, the picture of the eighteenth century lacks structure

² These quotations are taken successively from S. F. Mason, *Main Currents in Scientific Thought* (1956), 223; J. D. Bernal, *Science in History* (1954), 358; A. E. E. Mackenzie, *The Major Achievements of Science* (Cambridge, 1960), 122; A. R. Hall, *The Scientific Revolution, 1500–1800* (1954), 339; H. T. Pledge, *Science since 1500* (1939), 101.

³ C. Lyell, *Principles of Geology* (3 vols., 1830–3), 1, 30.

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and focus, light and shade. Tellingly, the recent revolution in the history of science has not hitherto presented us with convincing reinterpretations of the age.

Even the best synthetic views have been fatally flawed. Thus Foucault's quasi-structuralist notion of an eighteenth-century 'Classical *episteme*' underpinning scientific discourses was applied illuminatingly to natural history, but then seems to have been abandoned by Foucault himself and now commands little support, even from the author. The hope of demonstrating the coherence of eighteenth-century science by relating all its elements back to some kind of fundamental 'natural philosophy' has been attacked – not least by Schaffer in this volume – for committing the unhistorical sin of 'lumping'. Attempts to show that eighteenth-century scientific achievements flowed out of the programme and consciousness of the *philosophes* have turned out to be premature. Not Buffon and Lamarck, but perhaps Linnaeus and Cuvier now appear to be the real forerunners of Darwin. Similarly, accounts of the growth of eighteenth-century science in terms of 'professionalization theory' break down. As Roger and Porter stress in their chapters, in some senses the eighteenth century rather witnesses the 'amateurization' of science; natural history is the creation *par excellence* of amateurs, and there is nothing incongruous about the conjunction of amateur with high-quality science. Thus all attempts till now to 'totalize' eighteenth-century science have been wrecked upon the reefs of diversity and complexity; and we do not yet have a modern Marxist reading of the century. Marxists interested in laying bare the constitutive role of science as a legitimating ideology for capitalism have concentrated almost wholly on nineteenth- and twentieth-century industrial societies.

None of this is offered to undervalue the substantial recent revival of research on eighteenth-century science. Nor does it deny that new perspectives and techniques over the last generation have enriched our views in certain directions. Thanks to these, we now take it as axiomatic – and correctly – that eighteenth-century science can be properly grasped only if its 'external' relations to other intellectual and cultural systems, such as theology and epistemology, are tackled head-on. We now no longer ignore the fact that the eighteenth century 'geography of knowledge', the relations between the sciences, was then markedly different from our own. It seems elementary to us (now!) that eighteenth-century scientific ideas cannot adequately be translated one-to-one into twentieth-century terminology. Indeed, one of the aims of this book is precisely to distil and evaluate this substantial body of empirical research that has been conducted in the last generation.

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Yet it seemed to us, especially in the planning stages of this volume, that no one had hitherto attempted – and certainly not within the covers of one book – to gather together these detailed and discrete publications, in order to survey, synthesize, appraise and criticize new trends and major controversies in eighteenth-century research. As the 1980s approached we wanted to pose directly such questions as:

What are the main scholarly readings of eighteenth-century science?

Which aspects of these are secure, which under fire, which undergoing fusion and fission?

What are the chief priorities for further empirical research and theoretical reconceptualization?

What can historians of eighteenth-century science most learn from scholars working in other fields?

With these questions in mind this book was conceived and written. The following essays aim to provide up-to-date accounts of research and interpretation across a wide range of the natural sciences, with each author offering his own vision of the ‘ferment’ of his field. The editors have not imposed any restrictions whatsoever on their contributors, not even a definition of the concept of ‘field’, but they have suggested that two considerations be borne in each author’s mind: (1) that the subject or field be set in a large cultural perspective and an approach be developed for generalists as well as for specialists; (2) that the *historiography*, not the history, of the field be the subject of the discourse. There are numerous ‘tunnel’ histories of the various sciences; there is unfortunately no historiography of many of these fields, certainly not any that covers all the sciences during the eighteenth century.

No apology is needed for the fact that these are essays in exploration, and that the views they present are personal and provisional. Historians of science have only recently awakened to the fact that history is not a ‘science’ in the popular sense of that word – objective, definite, positive, neutral – rather it is a dialogue of the present with the past. And in becoming thus aware they have also discovered that the science they study is not ‘science’ in that sense either, but a dialogue between individuals and societies, culture and nature. It would be absurd to squander this precious new sense of the relativity of historical interpretation by claiming that this book represents anything beyond a stab at ‘history for the 1980s’. This is not a textbook of eighteenth-century science; it is an exploration of its history seen through its historiography. As such it seeks to illuminate the issues of understanding science in the *siècle des lumières*.

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Some apology is perhaps required for the range of sciences covered. Certain specialties in natural science have been almost totally omitted (cosmology, instrumentation, crystallography, etc.). Also, there are no essays explicitly focused on some of the human sciences (e.g. anthropology, political economy), or on the sociology of scientists and their institutions. Furthermore, science throughout means Western science. We are well aware of these and other gaps; but to have included all we should have wished would have meant the writing of several books, not one.

The choice of scientific areas as the subjects of these essays may also seem inconsistent: in some, attempts have been made to capture fields of knowledge as construed by contemporaries (e.g. ‘Mathematical cosmography’, or ‘The terraqueous globe’, or ‘Psychology’), whereas others enshrine more modern classifications. There are no solutions to this problem, and it is as well not to pretend that there are. There is no natural grid of such a cultural artefact as the system of the sciences, and no single scheme of the division of scientific labour held sway throughout the eighteenth century. A book surveying the elective affinities of the sciences in the eighteenth century, especially in relation to the encyclopaedic ideal, would be very welcome.⁴

In choosing topics, however, we have attempted to give special weight to the most fruitful line of research over the last twenty years or so: the attempt to locate eighteenth-century natural science in its fullest philosophical, religious and linguistic context. Hence the opening chapters by Harré, reassessing major interfaces between Enlightenment epistemology and natural science; by Schaffer, undermining the modern historiography which has conjured up the imposing edifice of ‘natural philosophy’ without adequately relating it to the actual practice of scientific investigation; and by Shapin, decoding the social messages which are transmitted through the language of eighteenth-century natural philosophy. The other essays in the volume have been chosen in part to give greater prominence to the life sciences – to what Carl Pantin has called the ‘extensive sciences’ – than they are usually accorded.

The reader of these essays may also notice a common thread running through many of them, one in no way planned for: namely, the way in which so many of the authors seem to stray from their so-called assigned ‘science’. Thus, a scholar such as Jacques Roger, while surveying the biology of the period, expends a good deal of time and energy delving into its medicine and physiology; and G. S. Rousseau, while ostensibly charting aspects of Enlightenment psychology finds

⁴ One important contribution towards filling this gap is David Knight, *Ordering the World: a History of Classifying Man* (1980).

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himself discussing its philosophy and social metaphors. The like is true for many of the other contributors. While preparing these essays for publication the editors, rather independently, noticed how typical these amblings are of eighteenth-century science itself. This seeming deflection into other scientific areas than the author's elected one signals the development of the idea of organic form in the sciences of the eighteenth century, an idea whose life in that period has yet to be taken adequately into account in discussions of nineteenth-century science.⁵

Over the last generation, there has been much theorizing and polemicizing over how the history of science should be written. We offer this volume, to specialists and others, as an exploration of the continuing dialogue between research and debate within a particular field.

⁵ For a recent example of a volume of collected essays in which it is not duly considered, see G. S. Rousseau (ed.), *Organic Form: The Life of an Idea* (1972).

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PART I. PHILOSOPHY AND IDEAS

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Knowledge

ROM HARRÉ

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I. Historiography*Social conditions*

It is fashionable these days to link intellectual movements with social conditions, political issues and even economic developments. But while one acknowledges the importance of these matters it is extraordinarily difficult to establish what the links could be. Economic determinism is altogether too naive a point of view. More sophisticated theories based on conceptions such as that of 'ideology' remain vague as to the nature of the relations that obtain between the various interacting factors from which an author's thoughts and their acceptance or rejection by his contemporaries spring.¹ It is far from clear that the invention of doctrines on the one hand, and their reception on the other, are determined by the same influences. Yet it would be folly to ignore the fact that Locke was deeply involved in politics, or that Diderot and d'Alembert played an important part in the promulgation of middle-class values in pre-Revolutionary France. Nor should it be forgotten that Hume's history outraged both Catholics and Protestants; nor that Priestley's house was burnt by a Tory mob. But how all these matters flow together into the controversies about the limits of knowledge I am quite in despair to understand.

I began work on this chapter fully convinced that a strong case for an 'externalist' treatment was possible. But as the work proceeded I felt more and more inclined to submit to the judgement of Peter Gay,

¹ J. W. N. Watkins, 'Historical explanation in the social sciences', in J. O'Neill (ed.) *Modes of Individualism and Collectivism* (1973), 166–78.

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that one's vague sense of a relation between social conditions in England and France and the intellectual movements that accompanied them cannot be realized in detailed accounts of specific paths of influence from the one to the other. Specific pathways were personal and intellectual: the reading of books, the exchange of letters and conversation. The influences of one writer upon another are demonstrable. Kant read the works of Hume, which were sent to him directly from Scotland by a friend. Michell entertained Priestley in his country home. Diderot and d'Alembert shared an office, so to speak. In a sense the Enlightenment was nothing but an intellectual movement, whose development must be understood through an internalist account.

Yet the broad differences between the 'movement' in England, Scotland and France can be related to structural features of society. English discussions of the nature and limits of knowledge sheered away from the Baconian tradition which would have related scientific knowledge to the enhancement of useful crafts. It was dominated by the bearing on theology of philosophical arguments concerning the limits of science. This can hardly be detached from the career structure of Oxford and Cambridge dons. They left their fellowships early in life to take up matrimony and country livings. The calm, good-natured realism of the Scottish philosophers could be seen as a product of the club-like atmosphere they delighted to cultivate, in which both believers and sceptics in the Enlightenment mould liked to distinguish themselves from the sour Calvinists of the 'primitive' party.² And as I shall be suggesting in later sections, the more overtly radical atmosphere in which the *philosophes* engendered the French Enlightenment accounts to some extent for the pressures that led to the disintegration of the fragile *rapprochement* between a sensationalist groundwork for the theories of knowledge and traditional French Cartesian rationalism.

In much philosophical writing the works of the past figure as a resource rather than a topic. They are used as much to deploy the philosophical ideas of the historian as to display those of his subject. Writings on eighteenth-century epistemology are no exception. However, there have been some changes of importance in the historian's approach to certain crucial authors. Some historians of philosophy have turned to look more closely at the contemporary scene to understand the preoccupations of a period. I am fairly sure that the right way to approach the history of eighteenth-century philosophical controversies is by way of a study of the intellectual influences of one

² H. F. Henderson, *The Religious Controversies of Scotland* (Edinburgh, 1905).