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12. The Influence of the New Sciences on Daniel Defoe's Habit of Mind

Every epoch in the history of human thought emerges from a selection, re-alignment and development of previously existing ideas and beliefs. Yet the eighteenth century is frequently discussed as if it was almost a self-contained entity – as if the people who lived in it, influenced though they might be by classical antiquity, were relatively unaware of more recent developments. This paper argues for a continuation of thought. A chain of ideas is recognized that reaches from Bacon to Boyle and Locke into the eighteenth century, with Daniel Defoe representing a significant link in this development of ideas.

The importance of experimental science to the mental world of the late seventeenth century, its effect on man's understanding of physical reality and of himself, can hardly be over-estimated. Bacon had called for a re-apprehension of physical reality, and had advised that personal observation and personal experience should replace the received authority of learned men and books. Following Bacon's call, his disciples compiled histories not only of all aspects of nature but of 'nature improved by the hand of man,' that is, histories of arts and crafts, of trade and commerce. It should be emphasized that Bacon used the word 'history' in the sense that Aristotle employed it in his *Historia animalis*. If we turn to the *OED* we find under the fifth heading the definition that best illuminates the Baconian programme: a 'history' is a 'systematic account (without reference to time) of a set of natural phenomena.' By registering what was known, the Baconian natural historian hoped to discover what might be known. As a systematic enquiry into all the branches of human knowledge, Baconian history is then both a repository of knowledge and a stimulus to new research. The most significant aspect of experimental science lies in its presenting man with the hope that he could eventually come to know and understand the world he lived in and that, consequently, he could regain dominion over things and so control the future.

Defoe's Education

How did Defoe come to know the tenets of Bacon's experimental science? In c. 1674, when Defoe was about fourteen, he entered Charles Morton's Dissenting Academy in Newington Green, then a suburb of London. Morton had been at Wadham College, Oxford, for at least six years, from c. 1649 to 1655, that is, during the time when those associated with the foundation of the Royal Society met there regularly to discuss the advancement of experimental learning. The leaders of the new sciences with whom Defoe's future teacher could have been in daily contact were John Wilkins (the warden of Wadham and a motivating force behind the foundation of the Royal Society), Sir William Petty (anatomist and economist), Robert Hooke (later secretary to the Society), Seth Ward (mathematical astronomer), Sir Christopher Wren (scientist and architect), Thomas Willis (anatomist and physician), Thomas Sprat (future historian of the Society) and Robert Boyle (the great physicist and chemist).¹ At Wadham Morton's mind was awakened to experimental thinking; here he had also his first experience of practical science.² When in about 1674 he opened his own academy for the sons of dissenters (debarred by the Conformity Legislation of 1662 from entering the traditional universities), he applied what he had observed and learnt at Oxford.

Discussions of the Dissenters' Academies, and of Morton's in particular, have stressed the novelty of their curriculum. The main point that I would like to make is that in fact no aspect of Morton's educational reform was new. Morton's academy was founded upon principles that antedate the Conformity Legislation by twenty-five years or more. Bacon, or rather Bacon's programme of reform of knowledge, is the decisive element that characterizes Morton's Dissenting Academy.

We are extremely fortunate in that Morton's science lectures, published as the *Compendium Physicae*, survive to this day.³ Defoe considered these lectures so precious that he preserved them for more than twenty-five years.⁴ Even a short glance will indicate the *Compendium's* congruence with Bacon's experimental philosophy. The work in which Bacon outlined in greatest detail his idea of making 'histories' is the *Parasceve, or Preparative towards a Natural and Experimental History*, affixed to the *Novum Organum* (1620). This work concludes with 130 suggested 'histories' or areas of investigation, Bacon's 'Catalogue of Particular Histories by Titles.' So, for example, Bacon gives directions for histories 'of Showers, Ordinary, Stormy, and Prodigious..., of Hail, Snow, Frost, Hoar-Frost, Fog, Dew, and the like.' Morton's systems of rain, hail, frost and dew are to be found in his chapters 8, 9 and

15 entitled respectively: 'Of Air,' 'Of Water,' 'Of Watery Comets.' Bacon had directed that there be histories of earth and sea, of fiery meteors, of comets; Morton uses these suggestions and devotes his chapters 10, 12 and 13 to systems 'Of Earth,' 'Of the Species of Mixt Bodyes and Fiery Meteors' and 'Of Comets.' More examples could be given but these must suffice here to show the direct influence of Bacon upon Morton's science lectures – a point that seems to have gone unnoticed so far. While critics have recognized the Boylean influence upon Morton's *Compendium*, it is important to note that it is primarily the Baconian experimental philosophy which gives this work its structure and its methodology. Morton's *Compendium* used and taught the fundamental principles of experimental science. It taught a system of thought – one that significantly contributed to forming Defoe's mind.

Defoe and the New Sciences

Defoe had a life-long interest in science. He was not a 'practising' scientist but a commentator on the methods and aims of experimental philosophy. In *Caledonia*, a poem written in 1706 'In Honour of Scotland, and the Scots Nation,' he exclaimed:

*Hail Science, Nature's second Eye,
Begot on Reason by Philosophy,
Man's Telescope to all that's Deep and High;
What Infinites dost thou pursue!*

More than 20 years later in his posthumously published *Compleat English Gentleman* he described 'the study of science [as] the original of learning; the word imports it. 'Tis the search after knowledge.' Science, Defoe maintained, is 'the delightfull search into naturall history and the rarities discover'd daily in the vegetativ world' and is 'the most agreeable as well as profitable study in the world' (211, 228). In agreement with the tenets of Baconian science, Defoe believed that knowledge was a common property and that all had a right to it: 'Science being a publick blessing to mankind ought to be extended and made as difusiv as possible, and should, as the Scripture sayes of sacred knowledge, spread over the whole earth as the waters cover the sea' (CEG, 197-8).

Although by the beginning of the eighteenth century the battle against the Ancients had been won, Defoe still finds it necessary to re-engage in the debate and to stress the superiority of the Moderns. Our progenitors, Defoe observes in his *General History of Discoveries*

and *Improvements* (1725-27), failed to make progress, being unfamiliar with the direct methods of studying nature; but now it is 'as if all Nature was newly laid open to them.' 'Infinite Experiments' have been made 'by the *Boyls* and *Newtons*' of the present age and 'all modern knowledge seems to have builded upon their first Experiments and to stand upon their Shoulders' (266). Defoe asks: 'What was the World before? ... Where were the Sir *Walter Raleighs*, the *Verulams*, the *Boyls*, or *Newtons* of those Ages? Nature being not enquir'd into, discover'd none of her Secrets to them, they neither knew, [n]or sought to know, what now is the Fountain of all human Knowledge, and the great Mystery for the Wisest Men to search into, I mean *Nature*' (238-9, Defoe's italics). Before these great searchers into nature had applied their new methods, the world had

Philosophy without Experiment.

Mathematics without Instruments.

Geography without Scale.

Astronomy without Demonstration. (233-4)

One could argue that such questions as the relationship between the Ancients and the Moderns, established authority and intellectual independence, words and things, were and always will be part of the thinking world. Defoe's engagement in the debate, however, is not general and undefined; he lays hold of these dichotomies in order to defend his position as a Modern, and he does this by using the methods and terminology characteristic of the experimental scientists. Thus, echoing seventeenth-century attacks on the 'fruitless and obstreperous verbosity' of the past, Defoe compares the classical scholar to 'a kind of mechanics in the school, for they deal in words and syllables as haberdashers deal in small ware' (CEG, 201). In contrast, the 'real' scholar aims at solid judgment based on the evidence of nature; he will 'judge of true learning by the strength of nature; reason shall be his guide into the study of Nature as nature shall be in the pursuit of his reason, and he shall be a man of knowledge with ease and delight' (188). The only trustworthy guidelines are those validated by experience and experiment.⁵ The student of nature breaks the chain of words; he 'sets his private judgment up against an established opinion' and soon discovers which one 'cheats.' This passage from *The Political History of the Devil* (1726) continues: 'if I do not see anything in that received opinion capable of evidence, much less of demonstration, I must be allowed still to think as I do' (248).

A big cluster of references to contemporary scientific discoveries is to be found in Defoe's early prose satire, *The Consolidator, or Memoirs*

of *Sundry Transactions from the World in the Moon* (1705). Although an imaginative work, the *Consolidator* lacks coherence and focus: it is written in the long literary tradition of 'moon voyages' and it is also an allegory of the religious and political quarrels of the time. To us, it is significant for its remarkably detailed commentary on the activities of the members of the Royal Society. Here the narrator reports on the Chinese art of double-writing, their explanation of the theory of tides, the invention of the telescope and microscope – but the reader is not transported to the east; it is rather as if he was reading the index of the *Philosophical Transactions*. Defoe mentions experiments made with a 'speaking trumpet to convey sound.' One of the riches of Solomon's House in Bacon's *New Atlantis* were the 'soundhouses' which provided 'the means to convey sounds in trunks [i.e. tubes] and pipes, in strange lines and distances' (*Works*, III, 162-3). John Evelyn reported that at Wadham College he had seen Wilkins's 'hollow statue which ... utter'd words, by a long conceal'd pipe that went to its mouth, whilst one [spoke] through it at a good distance' (*Diary* July 13, 1654). Charles Morton, too, had explored the nature of sound with the help of a speaking trumpet. His history 'Of Hearing' (*Compendium*, 168) made extensive use of Samuel Mortonland's 'Account of the Speaking Trumpet' printed in the *Philosophical Transactions*. A funny little anecdote is attached to Morton's experiments with a speaking-trumpet. It is reported that Samuel Wesley (father of Charles Wesley and one generation after Defoe at the Newington Green Academy) was very shocked when 'his schoolmates tried out Master Morton's speaking-trumpet and bellowed insults to the local Anglican clergyman from a neighbouring hill.'⁶ More seriously, Defoe's apparent flights of the imagination can be shown to be based on the work of the new scientists. In the *Consolidator* we are told of a human philosopher, a 'great Master of Nature's Secrets' who has invented 'a curious contrivance to go to and from ... the moon' (280). The narrator, or rather Defoe, observes that 'all our mechanic motions of Bishop [John] Wilkins ... who could have taught God Almighty how to have mended the creation, are fools to this gentleman.' Wilkins – as Defoe obviously was aware – made a significant contribution to the tradition of moon-voyages; his *Discovery of a New World in the Moone* which appeared in 1638, had four editions by 1684. Very likely influenced by Wilkins's work, Morton speculated in his science lectures on the possibility that man 'may find out a Substitute for Wings so applied to an Engine, that they may row us in the Air, as a boat doth in water' (*Compendium*, 191). Once again, it is possible to trace a direct line of descent from Bacon to Wilkins, to Morton and to Defoe. The *Consolidator* failed as a political satire, but it has left us a record of Defoe's informed and imaginative use of the experimental scientists' interests and achievements.

The work in which Defoe most directly applied the tenets of Bacon's philosophy was the *Tour through the Whole Island of Great Britain* (1724-6). Although the *Tour* was 'particularly fitted for the Reading of such as desire to Travel,' its author is not primarily concerned with travel as such; his main interest consists in accurately studying a town, its people, their language, manners, trade, etc. Throughout, Defoe's stress is on verifiable truth. He acknowledges that his 'critical enquiries into what he could not [personally] see' were supplemented with reliable second-hand reports. Describing the original circumstances in which he had collected the particulars for the *Tour*, he notes

I took with me an *ancient Gentleman* of my Acquaintance, who I found was thorowly acquainted with almost every Part of *England*, and who was to me as a walking Library, or a moveable Map of the Countries and Towns through which we pass'd.⁷

Collective witnessing was one of the fundamental principles of the Royal Society. Sprat in his *History of the Royal Society* stated that the scientists' bank of knowledge consisted of both direct and second-hand accounts:

First they require some of their particular Fellows to examine all Treatises and Descriptions of the Natural and Artificial productions of those Countries ... At the same time, they employ others to discourse with the Seamen, Travellers, Tradesmen, and Merchants, who are likely to give them the best light. Out of this *united Intelligence of Men and Books, they compose a Body of Questions, concerning all the observable things of those places* (my italics).⁸

The Baconian ideal of 'mutual Intelligence' or 'inter-knowledge' expressed itself in the Fellows submitting histories of topography, cosmography, geology, voyages, trade, the weather, etc. Taken together, it was thought, these histories would effect the vast Baconian restoration of knowledge. It was within this conceptual framework, for example, that Petty's 'Method of Enquiring into the State of Any Country' or Boyle's 'General Heads for the Natural History of a Country, Great or Small' were compiled. Using the method of collective witnessing, these histories were not chronological accounts but investigations of countries, or indeed of the whole world. Defoe repeatedly employed the technique of collective witnessing. An early example is *The Storm*, published in 1704, one year before *The Consolidator*. Here a combination of eye-witness accounts and excerpts from the *Philosophical Transactions* contribute to giving an 'authentic account' of the tempest of 1703. In the *Compleat English Gentleman* Defoe advises, perhaps echoing Sprat,

that 'travellers, voiaagers, surveyors, soldiers' all contribute with their individual experience to 'the idea of the whole' (226). In the *Tour* he stitches together memories and contemporary facts, direct and second-hand experiences to give a comprehensive view of the whole. Here Defoe fuses the Baconian histories of nature, society, travel and trade and out of this 'united Intelligence from Men and Books' he composes (in his words) 'the present state of things.' For Bacon and his followers the meticulous study of a set of natural phenomena was only justifiable if it led to judgments and theories of how to order and control the future. Equally for Defoe: his careful investigation serves the larger purpose of presenting England with a vision of recovery of knowledge and power. Here the characteristic Baconian blend of the practical and the prophetic are applied to offer England an idea of how 'in time it may be.'

Bacon had explained his philosophy to himself and to the world by making reference to King Solomon. Solomon had been given depth of wisdom and insight into 'holy things,' yet he 'prided himself in none of these,' insisting instead that 'the glory of God is to conceal a thing but the glory of the King is to find it out' (Prov. 25:2). It is as if God were playing a game of hide-and-seek with man; God hides the secrets of nature in order that they can be discovered by those who persistently investigate. Bacon patterned his history of nature on Solomon's precision, diligence and modesty. We would expect Defoe to make reference to King Solomon: he does so on a number of occasions, as in the *Review*, *Serious Reflections during the Life and Surprising Adventures of Robinson Crusoe* and the *Tour*. His most detailed working out of the text is in the *Compleat English Gentleman* where Peter the Great is compared to King Solomon. Granted by God a sense of 'his own ignorance,' the Czar was fired with an 'earnest desire to know, to learn, and to be instructed. He sought wisdom thro' the whole world; he applied for knowledge in every branch of science.' Above all, Defoe admired the Czar's unrelenting application, which made him resolute in his desire to 'improve himself that he might improve his whole empire.' This, Defoe states, is what made him 'according to Solomon, *Search for knowledge as for silver and dig for it as for hid treasure*, Prov. 2:4' (36-7). Describing what constitutes a real scholar later in the work, Defoe once more returns to the biblical comparison: the 'compleat scholar' may 'according to Solomon be truly said to seek for knowledge as for silver and to search for her as for hid treasure' (212). Defoe frequently compares the merchant to the experimental explorer, the 'merchant-adventurer' who dives into the deep recesses of nature to fetch up her hidden resources. He writes:

The Treasures of Nature are conceal'd, as Rareties inaccessible but by Labour, reserv'd as a Reward to the Industries, and deny'd to the Slothful as a just Punishment of their Sloth, that *Solomon's* Words may touch our Experience.⁹

In offering her fruits, nature invites – indeed demands – industry and diligence. Defoe appears to be echoing Hooke, who had pointed out that 'it is the prerogative of Mankind above other Creatures, that we are not only able to *behold* the works of Nature ... but we have also the power of *considering, comparing, altering, assisting and improving* them to various uses' (*Micrographia* [1665], Preface). This is the message that permeates Defoe's *Historical Account of the Voyages and Adventures of Sir Walter Raleigh* (1720), the *General History of Trade* (1713), the *General History of Discoveries and Improvements* (1725-7) and *A Plan of the English Commerce* (1728). In one of his last works, *A Humble Proposal* (1729) he declares categorically:

the Voice of the World, is plain, like the Answer of an Oracle,

Dig and Find,
Plough and Reap,
Fish, and Take,
Spin and Live, in a word,
Trade and Thrive (5)

But it is in his masterpiece that the Baconian hope for 'man's empire over the universe' is most fully worked out. In Crusoe's desire to explore, to learn and apply his knowledge to every branch of science, we have Defoe's fictional rendering of his belief in man's prerogative to study, alter and improve nature to his various uses. We accompany Crusoe as he in time becomes a farmer, a potter, a baker, a tailor, a carpenter and a shipwright. Through unwearied application and invention, 'by stating and squaring every thing by Reason, and by making the most rational Judgements of things, [he becomes] in time Master of every mechanick Art.'¹⁰

Crusoe's account is concerned with the *skill* of making things. The book's real theme is man's progressive dominion over nature, and not economical prudence and profit. To see this work primarily as an exposition of economic individualism (as, for example, Ian Watt and others have done) is to distort the author's intention.¹¹ I would agree with those critics who have concluded that 'no one in his senses would choose the study of a man cast alone on an uninhabited island to illustrate a theory which only applies to the exchange of goods and services.'¹²

Let us take the familiar incident of Crusoe sowing and growing corn and baking bread. This episode begins with Crusoe's need for an empty bag. He finds one and carelessly empties its contents of dust and old husks on one side of his fortification. A month later, after the rains have come, he sees a few stalks of something green which he recognizes as 'perfect English Barley.' It is not until the fourth year, however, that he finally succeeds in harvesting a crop. (He loses most of his seeds because he did 'not observe the proper time; for I sow'd it just before the dry season so that it never came up at all'). Eventually, by observation and experimentation, words Crusoe uses repeatedly,¹³ by noting the rainy and dry seasons and searching out the fertile soil, he succeeds. He reports:

Finding my first Seed did not grow, which I easily imagin'd was by the Drought, I sought for a moister Piece of Ground to make another Trial in, and I dug up a Piece of Ground near my new Bower, and sow'd the rest of my Seed in *February*, a little before the *Vernal Equinox*; and this having the rainy Months of *March* and *April* to water it, sprung up very pleasantly, and yielded a very good Crop ...

But by this Experiment I was made Master of my Business, and knew exactly when the proper Season was to sow; and that I might expect two Seed times, and two Harvests every Year. (104-5)

Compare Crusoe's account with the following statement given in Birch's *History of the Royal Society* (1756) of Boyle's 'written account from his gardiner' of the growing and gathering of potatoes: they

are to be gathered in September, before the frost does take them. If you are minded to have a great store of small roots, which are fittest to set, you may cause them to lay down the branches in the month before-named ... Now the season for digging the ground is in April or May, but I hold it best the latter end of April; and when they dig the ground, let them pick out as many as they can find, small and great, and yet there will be enough for the crop. (I, 216-17)

The similarity between Crusoe's and Boyle's accounts is obvious; both are concerned with the careful study of nature. By gathering knowledge about plants, the seasons, the weather, etc., the experimental scientists hoped to increase the harvest. Boyle in his *Usefulness of Experimental Naturall Philosophy* declared that 'I shall not dare to think my self a true Naturalist, till my skill can make my Garden yield better Herbs and Flowers, or my Orchard better Fruits, or my Fields better Corn, or my Dairy better Cheese... Me thinks, it should be a

disparagement to a Philosopher, when he descends to consider Husbandry, not to be able, with all his Science, to improve the precepts of an Art.' As the title indicates, Boyle founded his defense of experimental philosophy upon its utility. This last quotation was taken from that section of the work which deals with the new science's 'Usefulness to the Empire of Man over inferior Creatures' (1671). Boyle put his case plainly when he stated:

I should not have neer so high a value as I now cherish for Physiology, if I thought it could onely teach a Man to discourse of Nature, but not at all to master Her.¹⁴

It is in this sense that Crusoe's success by experiment and his 'mastery over his business' are to be understood. With the new scientists he champions the belief that knowledge of things, gives man power over them: 'Whatever does increase [man's] knowledge, does proportionally increase his power.'¹⁵ Defoe in his history of science declares that the 'increase of knowledge has led to encreasing the Felicity of Man's life' (*GHDI*, 2).

In the course of the novel, Crusoe becomes 'absolute Master and King' of his complete but microcosmic world. And his progressive dominion over his physical surroundings is paralleled by his inward struggle and spiritual conquest over his fears, doubts and loneliness. It would be wrong to detach Crusoe's religious preoccupation from his empirical investigations. For clearly, the two go together, the search after the knowledge of things assisting and furthering the general knowledge of religious principles. Defoe explains his natural religion in part three of *Crusoe*. The protagonist is here made to observe that in the concurrence of dates and events man may discern the voice of God. Again, referring to Solomon, Defoe advises man to search for knowledge in order to discover 'the methods of Heaven,' as they 'are a happy guide to us to make a judgment in other.' But 'he that is deaf to these things, shuts his ears to instruction, [is] like Solomon's fool, [who] hates knowledge' (187). Defoe reveals himself as that kind of experimental scientist who believed that the careful study of God's works would yield insight into God's Word. With Bacon, Boyle, Wilkins, Morton, Defoe saw no difficulty in reconciling scientific and religious pursuits. Crusoe's island experience serves as an emblem of man's search and discovery of natural as well as spiritual knowledge.

In what lies the enduring attraction of *Crusoe*? Certainly not in the hero's acquisition of various mechanical skills; the truth is, he far from succeeds in everything he does. Nor does the novel's greatness derive from the way it painstakingly records every minute particularity of the

island. It succeeds because the theme of the book and Crusoe's character are in complete harmony. Crusoe's study of nature, his learning of all the crafts (in the seventeenth century often described as 'Nature at second-hand'), like his penchant for making lists, his diligent journal and spiritual book-keeping, and his plain, colourless manner of recording what he has done and experienced, are all part of the same theme of gaining knowledge of and power over things.¹⁶ In *Crusoe* words and works, words and things, correspond, creating an absolutely creditable account of human experience. Here the new scientists' belief in direct observation of nature through the senses is rendered in fictional terms. In this Defoe looks back to the Baconian new philosophy; he also looks forward to the nineteenth and twentieth centuries when the desire for individual apprehension of reality had evolved into the primary convention of the novel. *Crusoe* is the first English novel, as it is the first instance in the history of English literature where a man is put absolutely convincingly into the 'reality' of a fictional world. Our theme at this conference is 'Broadening Horizons,' the progress of learning and the impact of science on the mind of man. I would like to compare *Crusoe* to the first stone thrown into a silent lake – its significance lies in its inspiring a new and ever-broadening literary art form. Had Defoe not written anything else, he would have earned himself a place of honour in this tradition.

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Notes

- 1 Although Boyle came to live in Oxford only in about 1654, he had at Wilkins's invitation been a frequent visitor to Wadham in the early 1650s.
- 2 Such statements as that Morton had no 'experience of any university in which similar work was being done' and that his 'activities must therefore be regarded as an original contribution' must be read with utmost care (J.W. Ashley Smith, *The Birth of Modern Education* [1954], p. 247).
- 3 See *Compendium Physicae*, ed. S. E. Morison (Boston: Colonial Society of Massachusetts, 1940); all references are to this re-print. Morton's indebtedness to Baconian experimental philosophy is argued in greater detail in my forthcoming article 'Defoe's *General History of Trade* and the Baconian Histories of Trades,' *Literature and History* 13 (1987), 200-218.

- 4 Defoe wrote in 1704: 'The Author of these Sheets happens to be one that had what little Education he can pretend to ... by, viz. Mr. *Charles Morton of Newington Green*, and I have now by me the Manuscripts of Science, the Exercises and Actions of his School, and, among the rest those of Politicks in particular' (*More Short-Ways with the Dissenters* [1704], pp. 5-6).
- 5 Knowledge to be effective has to be applicable to the necessities of life. Defoe abhors the 'meer paedagogue' who is 'form'd in a school to dye in a school,' whose knowledge is of no use to either himself or the world. Such a scholar although he may be able to 'read half the Polyglot Bible, ... knows nothing of the World, – has neither read Men nor Things; ... Why then that SCHOLAR is a LEARNED FOOL,' *Applebee's Weekly Journal*, Nov. 6, 1725 in Lee, *Life and Writings of Daniel Defoe*, III, p. 439.
- 6 *Compendium*, p. 168.
- 7 *The Great Law of Subordination Consider'd* (1724).
- 8 Ed. Jackson I. Cope and Harold Whitmore Jones (London, 1959), pp. 155-56.
- 9 *Review*, July 23, 1709.
- 10 *Robinson Crusoe*, ed. J. Donald Crowley (Oxford: OUP, 1981), p. 68. All subsequent references to this edition are given in the text.
- 11 *The Rise of the Novel* (London, 1957).
- 12 Diana Spearman, *The Novel and Society* (London, 1966), pp. 154-72.
- 13 The words 'observation,' 'experience' and 'experiment' occur frequently throughout the book: see, for example, pp. 54, 97, 99, 104, 105, 106, 121, 123.
- 14 Birch, *The Works of Robert Boyle* (1744), I, p. 463.
- 15 *Ibid.*, III, p. 155.
- 16 Henry Power wrote in the Conclusion to his *Experimental Philosophy* (London, 1664), p. 194: 'For Art, being the Imitation of Nature (or Nature at Second-Hand) it is but a sensible expression of Effects, dependent on the same ...; and therefore the works of the one, must prove the most reasonable discoveries of the other.'