

OTHER VOLUMES IN THIS SERIES OF CAMBRIDGE
COMPANIONS:

AQUINAS *Edited by* NORMAN KRETZMANN *and*
ELEANORE STUMP *(published)*
ARISTOTLE *Edited by* JONATHAN BARNES *(published)*
BERKELEY *Edited by* KENNETH WINKLER
DESCARTES *Edited by* JOHN COTTINGHAM
(published)
EARLY GREEK PHILOSOPHY *Edited by* A. A.
LONG
FICHTE *Edited by* GUENTER ZOELLER
FOUCAULT *Edited by* GARY GUTTING *(published)*
FREGE *Edited by* TOM RICKETTS
FREUD *Edited by* JEROME NEU *(published)*
HABERMAS *Edited by* STEPHEN K. WHITE *(published)*
HEGEL *Edited by* FREDERICK BEISER *(published)*
HEIDEGGER *Edited by* CHARLES GUIGNON
(published)
HOBBS *Edited by* TOM SORELL *(published)*
HUME *Edited by* DAVID FATE NORTON *(published)*
HUSSLER *Edited by* BARRY SMITH *and* DAVID
WOODRUFF SMITH *(published)*
WILLIAM JAMES *Edited by* RUTH ANNE PUTNAM
KANT *Edited by* PAUL GUYER *(published)*
KIERKEGAARD *Edited by* ALASTAIR HANNAY *and*
GORDON MARINO
LEIBNIZ *Edited by* NICHOLAS JOLLEY *(published)*
LOCKE *Edited by* VERE CHAPPELL *(published)*
MARX *Edited by* TERRELL CARVER *(published)*
MILL *Edited by* JOHN SKORUPSKI
NIETZSCHE *Edited by* BERND MAGNUS *and*
KATHLEEN HIGGINS *(published)*
OCKHAM *Edited by* PAUL VINCENT SPADE
PEIRCE *Edited by* CHRISTOPHER HOOKWAY
PLATO *Edited by* RICHARD KRAUT *(published)*
PLOTINUS *Edited by* LLOYD P. GERSON
SARTRE *Edited by* CHRISTINA HOWELLS *(published)*
SPINOZA *Edited by* DON GARRETT *(published)*
WITTGENSTEIN *Edited by* HANS SLUGA *and* DAVID
STERN

The Cambridge Companion to **BACON**

Edited by Markku Peltonen
Academy of Finland



CAMBRIDGE
UNIVERSITY PRESS

divine ideas and archetypes. Bacon's rejection of any natural philosophy founded on allegorical interpretations of Scriptures meant a withdrawal from exemplarism and symbolism, both common features of mediaeval philosophy and still flourishing in the seventeenth century. As all works – says Bacon – show the power and ability of their maker, but not his image, so God's work "do shew the omnipotency and wisdom of the maker, but not his image" (III, 350). The distinction between the will and power of God, so fully and subtly present in Baconian texts, is very important. "The heavens declare the glory of God, and the firmament showeth his hand-works": this verse from the Psalms (18,2) is quoted by Bacon several times. The image of the world, immediately after the Word, is a sign of the divine wisdom and power, and yet the Scriptures do not call the world "the image of God," but regard it only as "the work of his hands," neither do they speak of any image of God other than man. Theology is concerned with knowing the book of the word of God; natural philosophy studies the book of God's works. The book of Scripture reveals the will of God, the book of nature, his power. The study of nature has nothing to say about God's essence or his will (IV, 340–3).

Bacon proposed to the European culture an alternative view of science. For him science had a public, democratic, and collaborative character, individual efforts contributing to its general success. In science, as Bacon conceives it, truly effective results (not the illusory achievements of magicians and alchemists) can be attained only through collaboration among researchers, circulation of results, and clarity of language. Scientific understanding is not an individual undertaking. The extension of man's power over nature is never the work of a single investigator who keeps his results secret, but is the fruit of an organized community financed by the state or by public bodies. Every reform of learning is always a reform also of cultural institutions and universities.

Not only a new image of science, but also a new portrait of the "natural philosopher" took shape in Bacon's writings. This portrait differed both from that of the ancient philosopher or sage and from the image of the saint, the monk, the university professor, the courtier, the perfect prince, the magus. The values and the ends theorized for the composite groups of intellectuals and artisans who contributed in the early seventeenth century to the development of science were

different from the goals of individual sanctity or literary immortality and from the aims of an exceptional and "demonic" personality.

A chaste patience, a natural modesty, grave and composed manners, a smiling pity are the characteristics of the man of science in Bacon's portrait of him. In the *Redargutio philosophiarum* Bacon wrote:

Then he told me that in Paris a friend had taken him along and introduced him to a gathering, 'the sight of which', he said, 'would rejoice your eyes. It was the happiest experience of my life'. There were some fifty men there, all of mature years, not a young man among them, all bearing the stamp of dignity and probity. . . . At his entry they were chatting easily among themselves but sitting in rows as if expecting somebody. Not long after there entered to them a man of peaceful and serene air, save that his face had become habituated to the expression of pity . . . he took his seat, not on a platform or pulpit, but on level with the rest and delivered the following address . . . (III, 559)⁹

Bacon's portrait doubtless resembles Galileo or Einstein more than it does the turbulent Paracelsus or the unquiet and skittish Cornelius Agrippa. The titanic bearing of the Renaissance magus is now supplanted by a classical composure similar to that of the "conversations" of the earliest Humanists. Also in Galileo's *Dialogo* and in Descartes's *Recherche de la vérité* we find the same familiar tone and style of conversation in which (Descartes wrote) "several friends, frankly and without ceremony, disclose the best of their thoughts to each other."¹⁰ But there is besides, in Bacon, the quiet confidence that comes from knowing the new powers made available to man by technology and collaboration.

The new kind of learning, for which Bacon is searching, must get away from touches of genius, arbitrary conclusions, chance, hasty summaries. The emphasis laid by Bacon on the social factor in scientific research and in determining its ends, places his philosophy on a radically different plane from that of the followers of Hermetic tradition. Bacon's insistence on the organizational and institutional aspects of science stemmed from his own definition of learning, which is often hindered by "the nature of the society and the policies of the state":

That there is no composition of estate or society, nor order or quality of persons, which have not some points of contrariety towards true knowledge.

new
type
of
intellectual

science as collaboration

That monarchies incline wits to profit and pleasure, and commonwealths to glory and vanity. That the universities incline wits to sophistry and affectations, cloisters to fables and unprofitable subtilty, study at large to variety; and that it is hard to say, whether mixture of contemplations with an active life, or retiring wholly to contemplations, do disable and hinder the mind more (III, 252).

In the only piece of autobiography and self-analysis in which Bacon indulged (*De interpretatione naturae proemium*, III, 518–20), he says that the discovery of new arts for the bettering of human life is a better ambition than politics, but he allowed himself to be deflected into politics for family and patriotic reasons and because he hoped that “if I rose to any place of honour in the state, I should have a larger command of industry and ability to help me in my work” (III, 519).¹¹ Like no other philosophers of his time, Bacon vividly sees that scientific enterprise is a collective effort that concerns all society and requires institutions specific to it. The relation between science and politics, in spite of his personal psychological doubts and incertitudes, has for him a structural character. The solution he offers in the *New Atlantis* was a clear, firm separation. The men of science, in the *New Atlantis*, lived in solitude. Their place reminds us of a university campus cut off from the daily concerns of common mortals. But there is something else: the scientists of the *New Atlantis* held meetings to decide which of the discoveries that had been made should be communicated to the public at large and which should not. Some of the discoveries that they decided to keep secret were revealed to the state; others were kept hidden from political power. On the uses that might be made of scientific and technological discoveries he was no optimist. The wise men who decided to keep some of their dangerous discoveries to themselves did not live in the society of Elizabethan England nor in our corrupt world, but within the imaginary civilization of the *New Atlantis*, an extremely peaceful and tolerant society.

Bacon's major claim for his science was that it would be a *scientia operativa* (IV, 22, 32) that is, productive of works. What Bacon vigorously refused and what made traditional philosophy appear to him like an infertile desert was the fact that from Socrates to Bernardino Telesio a disjunction had been introduced between knowledge and operation, theories and experiments, theory and practice, truth and

utility. One of the “topical” aspects of Bacon's philosophy is the attempt he made to show how these oppositions came about and were reinforced in the history of Western civilization.

In the *Partis instaurationis secundae delineatio* (III, 549), in the *Cogitata et visa* (III, 612), and later in the *Novum organum* (IV, 110), Bacon replies to a very foreseeable objection which could easily be raised from the viewpoint of traditional philosophy:

It will be thought, no doubt, that the goal and mark of knowledge which I myself set up (the very point which I object to in others) is not the true or the best; for that the contemplation of truth is a thing worthier and loftier than all the utility and magnitude of works; and that this long and anxious dwelling with experience and matter and the fluctuations of individual things, drags down the mind to earth, or rather sinks it to a very Tartarus of turmoil and confusion; removing and withdrawing it from the serene tranquillity of abstract wisdom, a condition far more heavenly. (IV, 110)

Those who have talked about “Baconian utilitarianism” have often based their arguments precisely on the questions to which Bacon earnestly endeavored to give a reply. The answers given by Bacon preclude even the possibility that his position could be mistaken as “utilitarian.” In the *Cogitata et visa* he wrote:

It may be that there are some on whose ear my frequent and honourable mention of practical activities makes a harsh and displeasing sound because they are wholly given over in love and reverence to contemplation. Let them bethink themselves that they are the enemies of their own desires. For in nature practical results are not only the means to improve well-being but the guarantee of truth. The rule of religion, that a man should show his faith by his works, holds good in natural philosophy too. Science also must be known by works. It is by the witness of works, rather than by logic or even observation [ex argumentatione aut etiam e sensu], that truth is revealed and established. Whence it follows that the improvement of man's mind and the improvement of his lot are one and the same thing. (III, 612)¹²

So Bacon accepts as entirely legitimate the question about the relation between contemplation and utility. But the question does not constitute an objection because the value of theories is wholly realized into the reform of knowledge.

The aphorism 124 of the first book of the *Novum organum* is very important, and must be extensively quoted:

Spec of technology

utility

pragmatism

Now to this I readily assent; and indeed this which they point at as so much to be preferred [the contemplation of truth] is the very thing of all others which I am about. For I am building in the human understanding a true model of the world, such as it is in fact, not such as a man's own reason would have it to be; a thing which cannot be done without a very diligent dissection and anatomy of the world. But I say that those foolish and apish images of worlds which the fancies of men have created in philosophical systems, must be utterly scattered to the winds. Be it known then how vast a difference there is (as I said above) between the Idols of the human mind and the Ideas of the divine. The former are nothing more than arbitrary abstractions [*abstractiones ad placitum*]; the latter are the creator's own stamp upon creation [*vera signacula Creatoris super creaturas*], impressed and defined in matter by true and exquisite lines. Truth therefore and utility are here the very same things: and works themselves are of greater value as pledges of truth than as contributing to the comforts of life [*atque ipsissimae res sunt, in hoc genere, veritas et utilitas: atque opera ipsa pluris facienda sunt, quatenus sunt veritatis pignora, quam propter vitae commoda*]. (IV, 110)

Bacon knew Latin well enough to use *idem* correctly in place of *ipse*. The term *ipsissimus*, much used in Scholastic terminology, recurs in other passages of the *Novum organum* with a precise technical meaning. The translation "truth and utility are the very same things," broadly diffused among English and American scholars,¹³ is undoubtedly wrong, as I demonstrated in 1962.¹⁴ The "Ideas of the divine," as we can read in the *Novum organum*, are "the true signatures and marks set upon the works of creation as they are found in nature" (IV, 51). The expression *ipsissimae res* and the term *ipsissimus* were used by Bacon in reference to the "objective reality of the things" or to "things in their reality," or simply to "essence" (in the particular meaning that Bacon gives to this term). In the aphorism 20 of the second book of the *Novum organum* heat is considered not in relation to the man (*ex analogia hominis*) but in relation to the universe (*ex analogia universi*). According to Bacon's view, heat is a species of genus "motion." It is not to be thought that heat generates motion or is generated by it; rather, the very essence of heat, or the substantial self of heat, is motion and nothing else (*ipsissimus calor sive quid ipsum caloris motus et nihil aliud est*).

The meaning of that Baconian statement can be summed up as follows: things as they really are, considered not from the viewpoint

of appearance but from that of existence, not in relation to man but in relation to the universe, offer conjointly truth and utility. A literal, correct translation is: "the very things themselves are, in this kind, both truth and utility."

From this point of view, the question as to whether scientific truth depends on the procedures employed to affirm them, or on their fruitfulness in practice, is a meaningless dilemma: a scientific truth is always fruitful and this fruitfulness depends precisely and exclusively on its characteristic of full truth: "The chain of causes cannot by any force be loosed or broken, nor can nature be commanded except by being obeyed. And so those twin objects, human Knowledge and human Power, do really meet in one; and it is from ignorance of causes that operation fails" (IV, 32).

IV HOW SCIENCE GROWS

All of Bacon's work calls for a revolutionary reform which was supported by a conviction of radical changes occurring in European history and by the belief that a new epoch was about to be born. These changes *do not depend on philosophy* and do not derive from the philosophical schools or sects. They are connected with a series of material factors which have modified man's way of life. The course of history, according to Bacon, was completely changed by mechanical inventions, oceanic voyages, geographic discoveries. A new world requires a new kind of philosophy: "It would be disgraceful if, while the regions of the material globe, – that is, of the earth, of the sea, and of the stars, – have been in our times laid widely open and revealed, the intellectual globe should remain shut up within the narrow limits of old discoveries" (IV, 82). Since the conditions of time are ripe, Bacon presents his own work as a masculine child of the time (*Temporis partus masculus*) rather than of the mind of a genius.

Three great inventions, the compass, the printing press, and gunpowder, have changed the world of human space, the world of communication, the world of politics. No empire, no philosophical sect, no star has exerted greater power in human affairs. For two thousand years philosophy and the intellectual sciences "stand like statues, worshipped and celebrated, but not moved or advanced"

so the epistemological reflections of a Boyle, a Hooke, or a Newton had to elaborate methodological doctrines which, though avowedly but vaguely Baconian, went far beyond the Lord Chancellor's proposals in order to respect nationalistic polarizations in the philosophical debate of the second part of the seventeenth century.

The founding of the Royal Society represents both Bacon's deification as a philosopher and the final victory of the Baconian project of collaboration, utility, and progress in natural inquiries. In the words of its first secretary, Henry Oldenburg, the Society "aims at the improvement of all useful sciences and arts, not by mere speculations but by exact and faithful observations and experiments."¹⁷ Thomas Sprat, the official historian of the Society, claims that its Fellows

have shown to the world this great secret, that Philosophy ought not only to be attended by a select company of refined spirits. As they desire that its productions should be vulgar, so they also declared that they may be promoted by vulgar hands. They exact no extraordinary preparation of learning: to have sound senses and truth is with them a sufficient qualification. Here is enough business for minds of all sizes.¹⁸

This is but Sprat's characteristic rephrasing of Bacon's celebrated contention that his method "places all wits and understandings nearly on a level" (IV, 63). Further yet, the democratization of science of which Cohen spoke proceeds not only vertically, that is, up and down the social scale and the hierarchy of intelligences, but also horizontally. That is to say, perhaps for the first time in Christian history, science (or something approaching our notion of it) is saluted as a human endeavor to be kept rigorously apart from the pursuit of metaphysical or theological truths. No doubt there is a considerable amount of rhetoric in this claim, since Sprat's account is chiefly latitudinarian, but again the Baconian strict separation of the domains of scientific and religious knowledge as expressed in the *Novum organum* becomes crystallized in an institutional shape. In Hooke's own words, the business of the Royal Society was: "To improve the knowledge of natural things and all useful arts, manufactures, mechanic practices, engines and inventions by experiments – not meddling with divinity, metaphysics, morals, politics, grammar, rhetoric or logic."¹⁹

The exact character of the method propounded in Royal Society

circles is more difficult to elucidate. Sprat couples a vague reference to experimentation (for which he fails to mention precise rules of the type laid down by Bacon in the second book of the *Novum organum*) with the general appeal to observation, patient fact-gathering and cautious (or nonexistent) theorizing. This is Sprat's for a time canonical summary of Bacon's method:

True philosophy must first of all be begun by a scrupulous and severe examination of particulars; from them, there may be some general rules, with great caution, drawn: but it must not rest there; nor is that the most difficult part of the course: it must advance those principles, to the finding of new effects through all the varieties of matter, and so both the courses must proceed orderly together; from experimenting to demonstrating, and from demonstrating to experimenting again.²⁰

Robert Hooke's design to develop a "philosophical algebra," on the other hand, was presented from the start as a conscious attempt at elaborating Bacon's methodological insights. His formulations are scattered in various works. Defined by Bacon's nineteenth-century editor R. L. Ellis as "the best commentary on Bacon" (I, 25), the relevant passages in the *Micrographia* (1665) and the *Discourse of Earthquakes* (1668) are the most significant to this respect. Hooke asserts that all hope of human regeneration in matters of knowledge is to "proceed from the real, the mechanical, [and] the experimental philosophy," by virtue of which we may perhaps be enabled to discern all the secret workings of Nature "almost in the same manner as we do those that are the productions of art, and are managed by wheels, and engines and springs that were devised by human wit."²¹ For Hooke the right method for investigating Nature is the upshot of "solid histories, experiments and works"; his thirty-year-long geological observation and classification is a clear paradigm of what his contemporaries regarded as Baconian inductive practice: laborious compilation of data and cautious and provisional theorizing. The lack of any guiding metaphysical presupposition – except the ubiquitous belief that Nature does everything by way of motion, bulk and figure, that is, the basic premise of mechanicism – is indeed the mark of a new style of scientific thinking, which can aptly illustrate Kuhn's conception about the emergence of the so-called Baconian sciences in the seventeenth century.²²

Bacon's influence on Robert Boyle is somewhat more complex to

democratic spirit of Baconian science!

