



Bacon's great idea

### **Description**

The story of Francis Bacon (1561-1626) is that of a life devoted to a great idea. The idea gripped him as a boy, grew with the varied experience of his life, and occupied him on his deathbed. The idea is a commonplace today, partly realised, partly tarnished, still often misunderstood; but in his day it was a novelty. It is simply that knowledge ought to bear fruit in works, that science ought to be applicable to industry, that men ought to organise themselves as a sacred duty to improve and transform the conditions of life.

This idea, great in itself, received such development at his hands that it came in the end to throw light on the course of human history. From the standpoint of his new idea Bacon passed the whole of human culture under review to see why it had borne so little fruit in works and how it could be improved. The books in which he set forth his proposals are among the great things in world literature.

Nor was Bacon's new philosophy of works merely an intellectual notion. It was with him a humanitarian ideal. The advocacy of it brought into play all his qualities both of mind and heart. It coloured all his thoughts and found expression not only in his writings but in his private meditations and in his prayers. Our main task will be to trace the development of this idea in his writings. But we shall find a place also for his other interests and the external events of his life.

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In the history of science Francis Bacon takes a leading place. He is among the very great. But his contribution was not strictly scientific. He was not the pioneer in any field of research, the revealer of any fresh law of nature, the author of any great new hypothesis. He prided himself on a revolutionary advance in method but posterity will not allow his claim. His achievement lies elsewhere. His special concern was with the place of science in human life. It is as a philosopher of science that he is great. He was also a pioneer of the history of science, understanding it in a special way. He did not see science only, or even primarily, as a record of opinions; he saw it rather as the record of what those opinions had enabled man to do.

His ambition was to systematise and organise the development and application of natural knowledge on a scale never imagined before. With him this idea carried the sanction of religion. In the first chapter of Genesis he read that when God made man, he gave him dominion over all creatures. This, in Bacon's opinion, was what knowledge was for. He despised all knowledge that did not help to restore mankind to this dominion.

The seriousness with which his whole personality was engaged in his endeavour is one of his greatest qualities. That he often proved himself but a clumsy investigator in the various fields he tried to cultivate does not affect his title to renown. It is true that he was not even abreast of the science of his own day in some of its developments. But his vision of what science could do for mankind was incomparably more comprehensive, more penetrating and more just than that of any contemporary. Nor was this only an intellectual superiority. In challenging men with such earnestness to win power over nature in order to improve the conditions of human life he kindled a new conscience in mankind.

This was not the mood of the ancient or of the medieval world. Neither ancient Greek philosopher nor medieval Schoolman had in mind the possibility of a drastic improvement in the conditions of human life. Philosophy before Francis Bacon was too often a school of resignation. He stirred a fresh hope and made himself the advocate of a new conception of man's place in nature. Bacon's ambition was to reconstitute man's knowledge of nature in order to apply it to the relief of man's estate. It is in his pursuit of this aim that his claim to remembrance lies. In common with others of his time he was struck by the effects produced on the fortunes of mankind by a few practical inventions. But nobody else in his day and not many in the three hundred years since have thought so deeply and so truly about this question of the influence of inventions on human life. So important did it seem to him that it became the major concern of his life to open men's eyes to its significance.

Others besides Bacon were interested in the progress of invention in this age. The reason is not far to seek. In the later Middle Ages technical inventions had been remarkably frequent and their cumulative effect was now such as to raise visions of the possibility of a radical transformation of the conditions of human life. It is this possibility that holds the first place in Bacon's thoughts.

'It is well to observe,' he writes, 'the force and effect and consequences of discoveries. These are to be seen nowhere more conspicuously than in

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those three which were unknown to the ancients and of which the origin, though recent, is obscure; namely, printing, gunpowder and the magnet. For these three have changed the whole face and state of things throughout the world; the first in literature, the second in warfare, the third in navigation; whence have followed innumerable changes; insomuch that no empire, no sect, no star seems to have exerted greater power and influence in human affairs than these mechanical inventions.' (*Novum Organum* 129)

There is here a historical judgement of tremendous significance. Men have been wont to attach supreme importance in history to such political events as the conquests of Alexander the Great or the establishing of the Roman Empire; or to the emergence of new religions and new philosophies; or to possible influences of the planets. But here by his mention of empire, sect and star Bacon challenges politics, conquest, religion, philosophy to show results comparable to those wrought by a few mechanical discoveries of nameless men.

Convinced of the soundness of this historical judgement, Bacon goes on to speculate on its moral implications for mankind. 'It will not be amiss to distinguish the three kinds and as it were grades of ambition in mankind. The first is of those who desire to extend their own power in their native country, which kind is vulgar and degenerate. The second is of those who labour to extend the power of their country and its dominion among men. This certainly has more dignity, though not less covetousness. But if a man endeavour to establish and extend the power and dominion of the human race itself over the universe, his ambition (if ambition it can be called) is without doubt both a more wholesome thing and a more noble than the other two. Now the empire of man over things depends wholly on the arts and sciences. For we cannot command nature except by obeying her.' (*Novum Organum* 129) The third ambition was that to which Bacon dedicated his life.

Such an empire over things could be won, Bacon thought, only by means of a revolution in man's conception of knowledge. He pleaded for the restoration of what he called 'the commerce of the mind with things' (*commercium mentis et rei*). He was convinced that men must consult nature rather than books if they were to make progress in truth. He pointed out that most of the fundamental inventions had been made in very early times when men had but little learning and added: 'If the truth must be spoken, it was when the rational and dogmatical sciences began that the discovery of useful works came to an end.' In earlier and less sophisticated times men had more direct contact with nature. Accordingly, Bacon pleaded for the restoration of the commerce of the mind with things and he did not hesitate to describe this as 'the most precious of all earthly things.' Bacon has not always been well understood by learned and bookish editors. They fail to realise how simply and sincerely he meant his praise of inventions and how convinced he was that men must learn science from nature, not from books. To understand him better let us consider the three inventions he singled out for praise.

First, then, when Bacon stressed the revolutionary consequences of the invention of the printing press, he was not thinking, as historians of scholarship do, only of the transference from manuscript to printing of the writings of classical antiquity. He did, of course, attach importance to this. Without access to the older literatures such a historical perspective as he had achieved would have been impossible. But his mind was turned to

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the future rather than the past. More significant for him than the old books were those embodying new knowledge of the kind that he desired. We shall discuss a few of them in a moment.

When he stressed the importance of gunpowder, we must suppose him to have in mind, as he habitually had, the political circumstances of his own day. Though Bacon felt in the highest degree the noble ambition to serve all mankind he could not be indifferent to the destiny of his own country. It should be remembered, then, that it was in the reign of Henry VIII (1509-47) that English naval architects began to mount heavy cannon in the body of their fighting ships. It was the novel possibility of discharging a *broadside* through a row of portholes that not only protected Protestant England from the might of Catholic Spain but was, in the lifetime of Francis Bacon, transferring from Spain to England the control of the seas. Similar developments in the use of artillery on land were being made in the Low Countries about the same time by Simon Stevin (1548-1620) in furtherance of a similar historical purpose, the defence of the Netherlands against Spain.

The importance of the third discovery he mentions, the magnet or compass, was that it stood as the symbol of those great voyages of discovery by which the Portuguese, the Spaniards and the English had opened up for the first time to Europe the knowledge of half the world.

To the sixteenth century these three discoveries - printing, gunpowder and the compass - were the symbols of what mechanical inventions could effect. But the history of technology was then in its infancy and though the sixteenth century did not make a bad choice, scholars in the twentieth century would expand and alter the list of epoch-making inventions. The compass by itself would not have been of much use without a change in the whole character of the ship. This change, involving the invention of a true rudder and giving precedence to sails over oars, made possible the voyages of discovery. Transport by land, too, had been revolutionised in the tenth century by the discovery for the first time of an efficient method of harnessing the horse. Gunpowder alone would not have introduced modern artillery had not the application of water power to metallurgy created a new type of forge, which made possible the casting of guns.

The detailed history of these technical developments remained for the future to write. Bacon, however, understood enough about them for his purpose. His originality consists in his sense of the importance of inventions in human history. His immense learning was applied to the historical illumination of this theme. The full force of his philosophy of inventions was very imperfectly grasped by his contemporaries. The appreciation of it requires an informed and enlightened imagination and its lessons are even now being forced upon humanity by the pressure of events. But its practical bearing was immediately apparent. Among his ardent disciples was the mining engineer Thomas Bushell (1594-1674). When Bushell in 1662 received a parliamentary concession to reopen the Mendip mines, a contemporary writer observes: 'The Lord Chancellor Bacon's philosophical theory in mineral discoveries did light the first candle to these and all other mines of like nature.' (( *Collected Edition of Bacons Works*, London, 1730, vol. I, p. 150. ))

Among the books which best indicate the technical revolution that was

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taking place at this time, the most significant are perhaps those of the Italian Vanoccio Biringuccio and the German Georgius Agricola (1494-1555). These men, both highly skilled in the arts of mining and metallurgy, were pioneers of industrial capitalism. Biringuccio's book, which is called *Pirotechnia*, was published in 1540. It belonged to a very original class of writing, as will immediately be understood when it is mentioned that, although in the hundred years printing had been in existence thirty thousand books had come from the presses, this was the first on metallurgy. Its author was aware of his originality. He boasted of his uniqueness in publishing a book that was not based on other books but was drawn from direct experience of nature.

Biringuccio wrote in his native Italian. Agricola, a German (his name was originally Georg Bauer), was more learned and used Latin. His *De Re Metallica*, which appeared in 1556, is a still more comprehensive treatise on mining and metallurgy. (( The first English translation was made by Herbert Hoover and his wife, Lou Henry Hoover and published privately for them by The Mining Magazine, London, 1912. )) It is remarkable, among other things, for its hundreds of illustrations of the tools and machines used in the various processes it describes. It was promptly recognised as one of the important books of the age. The French historian Jean Bodin, writing in 1566, claims that in its own sphere it made Aristotle and Pliny look ignorant.

Nor was the book only technical. It developed a vein of philosophy not alien to Bacon's way of thought. It contains an eloquent statement of the significance of the metal industry for human history, which concludes: 'If metals were removed from the service of men, gone would be all the means of protecting and maintaining health and supporting a civilised mode of life. Without metals men would live a brutish and wretched life on the level of wild beasts. Back they would go to their acorns and berries in the woods.' Bacon would have found such truths not unworthy of a place in his philosophy.

We might, indeed, be more direct and say that he did find such truths worthy of his consideration. For he was acquainted with the *De Re Metallica*. He refers to it in the Third Book of his *De Augmentis Scientiarum*, recognising its practical importance and paying a compliment to its merits. Whether he also knew Biringuccio's book is not certain but it is very likely that he did. It too was one of the books of the day. It was brought at once to England by Sir Thomas Smyth, a prominent figure at the court of Elizabeth and large portions of it were translated and incorporated into two English books just before Bacon was born, as indeed they had been also appropriated by Agricola.

Late in life the mining engineer Bushell repeatedly claimed to have derived his theory of mining from Bacon. J.W. Gough in his carefully documented biography of Bushell (*The Superlative Prodigal*) has doubts about the value of this claim because it was obviously of advantage to Bushell to exploit the name of Francis Bacon. But Bacon did encourage mining and Bushell was his confidential servant and secretary from about his fifteenth year till he was over thirty (1609-1626). The techniques which Bushell claimed that Bacon imparted to him are in no way original. They are those of Biringuccio and Agricola. But there is no reason at all to doubt Bushell's claim that it was from Bacon that he learned the theory of mining contained in their

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books.

It was inevitable that England should need these books, for England was now embarking on her first industrial revolution, which took place in the hundred years following on the dissolution of the monasteries. In the reign of Henry VIII, which ended in 1547, England was industrially backward. By the reign of Charles I, which ended in 1642, England was leading Europe in mining and heavy industry. The change is said to have been most rapid between 1575 and 1620 - that is, between Francis Bacon's fifteenth and sixtieth birthdays. As the prophet of the application of science to industry, Bacon was swimming on the crest of the wave.

But there is also a sense in which he was a voice crying in the wilderness. What he wanted done with system and foresight was happening at haphazard and blindly. What he vaguely hoped might be an act of planned philanthropy under government direction and royal patronage was being carried out by individuals actuated by selfishness and in fulfilment of no plan.

A similar economic transformation, reflected in both its technological and its philosophical literature, occurred in France at this time. Since this was the one foreign country Bacon visited, we shall conclude this chapter with a brief mention of it. It is said that, while industrial progress in England at this time consisted chiefly in the multiplication of material conveniences, in France it mainly took the form of improvement in the arts and crafts. Typical of this progress was the career of the potter Bernard Palissy (1510-89). Apprenticed first as a glassmaker he next turned his attention to pottery and the fervour of his quest for the secret of the famous white enamel which eventually won him royal patronage has become a popular legend. It is said that he had come so near ruin that he was burning his household goods in order to keep his kilns going.

But Palissy was something more than a craftsman. In fact, he made striking advances in a variety of different sciences: chemistry, geology, forestry, agriculture. When Francis Bacon, as a youth, was resident at the French court, Palissy, now a famous man, was giving public lectures before distinguished audiences and it is very likely that Bacon attended some of them. They were novel enough in themselves but still more novel was the museum of natural objects by which they were illustrated. Of this Palissy says in his *Discours Admirables*: 'I can assure you, dear reader, that in a few hours, in the very first day, you will learn more natural philosophy from the objects displayed in this museum than you could in fifty years devoted to the study of the theories of the ancient philosophers.' Here is a startling assertion of Bacon's first principle, which he called the most important of all earthly things, the commerce of the mind with things. It has even led to the inference, which is certainly untrue, that Bacon derived the inspiration for his life's work from the French potter and was too proud to acknowledge it.

It is untrue, because he was already possessed by this inspiration when he went to France. But all the same it can be proved, I think, that he knew Palissy. In a famous passage in the *Novum Organum* (Aphorism 81) he writes: 'The true and lawful goal of the sciences is simply this, that human life be enriched by new discoveries and powers. The great majority have no feeling for this. Their thoughts never rise above money making and the routine of their calling. But every now and then it does happen that an

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exceptionally intelligent and ambitious craftsman applies himself to a new invention and, as a rule, ruins himself in the process.'

This is a generalisation but it must be based on something. When we remember that Bacon was for a couple of years about the court where Palissy was employed, the very Palissy who has become the most famous example in history of an intelligent and ambitious craftsman who applied himself to a new invention and nearly ruined himself in the process, it is difficult to doubt that the reference is to him. If it be so, it must also be taken as a very high compliment, for Bacon singles out this high-souled workman from the ruck of routine money makers in a passage which, in its social implications, is unique in his writings. Whomever he had in mind - whether Palissy or some other he felt himself united with him by a community of feeling which cut across all social barriers. We shall find Bacon fighting for the idea that the philosopher, if he is to create a science fruitful in works, must overcome his contempt for the craftsman. Perhaps Palissy rid him of this prejudice.

We have said that French philosophical literature also reflects the economic situation at this time. René Descartes (1596-1650) is as conscious as Bacon of the need to supplant speculative philosophy by another kind of philosophy capable of application to industrial production. 'I believed,' he remarks with regard to his discoveries in natural philosophy, 'that I could not keep them concealed without greatly sinning against the law which obliges us to procure, as much as lieth in us, the general good of all men. For they have shown me that it is possible to arrive at knowledge which is very useful in life and that instead of the speculative philosophy which is taught in the schools, a practical philosophy may be found. By means of this, knowing the power and the action of fire, water, air, stars, heavens and all the other bodies which environ us, as distinctly as we know the various trades and crafts of our artisans, we might in the same way be able to put them to all the uses to which they are proper and thus make ourselves, as it were, masters and possessors of nature.'

In its philosophic outlook and its philanthropic purpose this is quite Baconian. We may imagine it to have been arrived at independently or, as is more likely, to have been derived by Descartes from the study of Bacon's works. In either case it shows how ripe was the situation for the idea which Bacon was trying to promote - the marriage between natural philosophy and industrial production.

In his advocacy of this idea of a marriage between science and industry, Bacon makes it clear that his design was so extensive that he did not think it could succeed unless it should have the good fortune first to be taken up by the King and then to enlist the support of the learned and influential throughout Europe. He was disappointed in this hope, which, indeed, he hardly dared to entertain.

He seems to have regarded it as depending on a degree of enlightenment and goodwill which his experience showed him, he was not likely to find. But he did not wholly fail. Though he did not live to see it, a good deal was done to carry out his plans. Within a few years of his death men were grouping themselves together in pursuit of some of his aims. In the appendix we print the description of Solomon's House from the New Atlantis. It is Bacon's fullest and clearest expression of his ideal of organised

scientific research. It caught the imagination of his contemporaries. It was in the express hope of making the vision of Solomon's House a reality that Hartlib, friend of Milton and pioneer of agricultural reform, invited the great Bohemian educationalist Comenius (1592-1670) to visit England. And Bacon's project received recognition by the Crown in 1662 when Charles II took a step that Bacon would have liked to see Elizabeth or James take. The Royal Society of London for Promoting Natural Knowledge was formally incorporated by Charter. Bacon's great idea, if only in a partial and imperfect form, had found institutional embodiment.

The aim of the Royal Society, namely to promote *natural* knowledge, was a consciously revolutionary step. It was a deliberate effort to substitute observation and experiment for speculation and logical deduction. The novelty of the aim and its connection with Bacon, who had led the attack on the old philosophies, were celebrated by Abraham Cowley, the immensely popular poet of the day, in his *Ode to the Royal Society*:

From these and all long errors of the way,  
 In which our wandering predecessors went,  
 And like th'old Hebrews many years did stray  
       In deserts but of small extent,  
 Bacon, like Moses, led us forth at last.  
       The barren wilderness he past,  
       Did on the very border stand  
       Of the blest promised land,  
 And from the mountain top of his exalted wit,  
       Saw it himself, and shew'd us it.

The same acknowledgement was made in the first history of the Royal Society (1667) by the Bishop of Rochester, Thomas Sprat. "I shall only mention one great man, who had the true imagination of the whole extent of this enterprise, as it is now set on foot; and that is the Lord Bacon; in whose books there are everywhere scattered the best arguments that can be produced for the defence of the experimental philosophy, and the best directions that are needful to promote it: all of which he has already adorned with so much art, that if my desires could have prevailed with some excellent friends of mine, who engaged me to this work, there should have been no other Preface to the History of the Royal Society but some of his writings.' The Royal Society may justly be said to constitute the greatest memorial to Francis Bacon.

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