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# Francis Bacon as Educator

## He inspired the creation of the Royal Society and foresaw the rise of modern science.

Loren C. Eiseley

There are two colossal intellectual figures which loom across the century of Queen Elizabeth. Of one, William Shakespeare, we know almost nothing except that by some terrible insight into men, he understood almost as much about the human psyche as we have since learned painfully by scientific means. Of the other man, Francis Bacon, we think we know almost too much. We frown from the safe distance of four centuries at the intrigues of a mean court and moralize upon his fall, yet we are sufficiently overawed by the meteoric genius of both men that we sometimes seek to combine their talents in the body of one individual. The talents we are trying to combine represent, oddly enough, the two great academic worlds of today—the scientific and the humanistic. They were less divorced in the time of which we speak; in fact, one world, the scientific, was at best incipient, and the other, at least in the case of the drama, had the stain of lower-class vulgarity upon it.

Now Francis Bacon represents an odd phenomenon in science. He is frequently denounced, but we cannot lay his ghost. Within the last few months I have heard him castigated by legal scholars as a scoundrel whose personal life made anything he might have to say on ethical matters suspect. Similarly, on occasion I have heard Bacon criticized by scientists as a man who discovered nothing and who presented the world with an inductive method which, furthermore, would make it impossible, if consistently followed, to discover anything. In addition, Bacon has been excoriated as the propounder of a false idea that there is no aristocracy of scientific great men and that scientific research can be performed by common men pursuing certain principles. This, it has been contended, was the crowning folly of Bacon's particular world view. Why then, we may ask, in the light of these multiple charges, does this man, whose generation, in his own words, wore out days few and evil, who made no single great act of discovery, whose personal life is unsavory to our age (*1*), stand out with Shakespeare as one of the two greatest minds of a generation marked by great deeds and powerful personalities?

Last and most curious of all, why does Francis Bacon, whose four hundredth anniversary we are celebrating, continue to be tried and retried before the court of his intellectual descendants in every century since his death. Why cannot we let this poor ghost rest? Why cannot we render a final verdict? Is it because he left his name ambiguously to the "next ages" and because each age since his death feels it is the one to pronounce a verdict? Or is it that we, in trying this man, are unconsciously seeking to pass judgment upon our century and upon ourselves? Is it we who are both judged and the givers of judgment? Are we projecting outward upon a vacant chair and a phantom defendant, in this age perhaps more than any other, our fears, our hatreds, our almost willful misunderstanding of the world for which he spoke?

It is my contention that this psychological projection is a fact, and I shall assume the case for the defendant. Let it be understood at the outset, however, that each of us is both the judger and the judged—that each man among us sits in the dock, as well as at the prosecutor's table. Only so can the necessary charity of which Bacon once spoke be compounded with knowledge. "Make," he said, "the time to come the disciple of the time past and not the servant." The words ring with such axiomatic brevity that without reflection the sharp ax-blade of his thought glances aside from our dull heads. Yet in that single phrase is contained the essence of Bacon, the educator, who, though trained in the profession of law, admonished posterity, "Trust not to your laws for correcting the times, but give all strength to good education." No man in the long history of thought strove harder to lay his hands upon the future for the sake of unborn generations. "I confess," he wrote, "that I have as vast contemplative ends as I have moderate civil ends."

### His Life

Like the lonely African witch doctor recently described by Victor Turner (*2*), Bacon's whole life was spent in a barbaric society exposed to the dangers that attended those who surrounded the royal person. The headsman's ax was a familiar sight to him. He lived in its shadow. Gibbets were the seamarks for coasting mariners. Bacon had seen the heart torn from a living man leap after it was flung upon the fire. "It was an age," says one historian, "when it was

The author is provost of the University of Pennsylvania, Philadelphia. This article is based upon an address given at the Commemoration of the 400th Anniversary of the Birth of Francis Bacon, on 23 January 1961, under the joint sponsorship of the University of Pennsylvania and the American Philosophical Society. An expanded version delivered as "Francis Bacon and the modern dilemma" in the Montgomery lecture series at the University of Nebraska, 20–22 March, will be published by the University of Nebraska Press.



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present drowning not to swim with the stream." With no means but that derived from royal favor, Bacon survived Elizabeth only to fall victim to James, the First. After achieving the office of Lord Chancellor, he ended his days in disgrace under charges concocted to make him a scapegoat for the crimes of his masters. If some of the mud of that harsh era in which he struggled to survive sticks to his doublet, let us remember with Blake the price of experience:

> Do men buy it for a song?
> No, it is bought with the price
> of all that a man hath, his house, his wife, his children,
> Wisdom is sold in the desolate market where none come to buy.

"There is nothing more lamentable in the annals of mankind," wrote Basil Montagu, one of Bacon's biographers, "than that false position, which placed one of the greatest minds England ever possessed at the mercy of a mean king and a base court favorite." It is ironic that those who took his possessions and destroyed his name are remembered only as shabby villains posturing eternally upon a stage from which their victim has long since departed.

James I—even Elizabeth—could not comprehend the world of which their courtier spoke, yet what he sought was no more nor less than an education which would give men power over their own destiny. "For the world," Bacon said, "is not to be narrowed till it will go into the understanding (which has been done hitherto), but the understanding to be expanded and opened till it can take in the image of the world. . . . Then, and only then," admonished Bacon, "shall we no longer be kept dancing within little rings, like persons bewitched, but our range and circuit will be as wide as the compass of the world."

It is customary to assume that the education of our day supplies all that Bacon envisaged, but a careful reading of his work will raise some doubt about the validity of this judgment. It may well be that we are still dancing in our own particular ring—a dance engendered, it may be, by some of his writings, but lacking the balance of his final judgment.

Like most classics, Bacon is more written about than read. Moreover, many who come to him for a phrase or a literary passage forget that he wrote both in a time of royal censorship and in a time when it was necessary to persuade men to follow new paths. For this reason his meanings are sometimes veiled and his appeals are made on a frankly material basis more frequently than might have been necessary at a later epoch. One has to read him all, and to know, at the same time, something of the despotism, "the little ring," that kept him chained. If it had been possible for him to gain the intelligent interest of the rulers he served, the march toward the modern world might have begun a century earlier—and perhaps (who knows?) under more balanced circumstances.

But it was not to be. All his eloquence gained him, in his generation, no more than the lonely and intelligent witch doctor of a small tribe might garner by spells in a dark forest. He died alone, in winter, coughing out his life, a stranger in the huge cold bed of a nobleman in whose house he had sought shelter. It is doubtful if in his dying hours this seemed to him in any way unusual. It was no more than sym-




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bolic of the life he had led for all of his 65 years. The age had always been cold, and he had walked, reserved and wary, by rack and ax and gibbet to this final ending, out of favor and forgotten; no record remains of his funeral. "I leave my name . . .," he wrote with the sure instinct of one who knew that books would carry him like a wind-wafted ship safe out of the age in which he was imprisoned. "I leave my name [my knowledge, he might have added] in books exempted from the wrongs of time and capable of perpetual renovation."

## New Continents

Total originality in anything so sweeping as a new philosophy is difficult, if not impossible, to demonstrate. Many scholars seem to believe that if they can show that Bacon did not originate induction, or that, if he talked much about inventions (*3*) but failed to make any, they will have succeeded in dismissing him as a leading figure of the scientific revolution. Actually, though Bacon talked about the experimental method, he was primarily an educator—one of the first in the new field of science.

He knew this very well and was humble about his own contributions. One thing he knew, however, with intense certainty: the world was changing. There was a wind blowing, not alone from the new continents discovered by the voyagers, but also from some new continent of the mind—some isle awaiting its birth in time. Bacon, with an almost supernatural prescience, had sensed the first faint breath of wind out of the future: "Let it be believed, and appeal made thereof to Time . . . that the New Found world of land was not greater addition to the ancient continent than there remaineth at this day a world of inventions and sciences unknown."

If men, in the past, have been impressed by some one discovery or invention, he reasoned, how much higher a thing "to discover that by means of which all things else shall be discovered." Pausing on the threshold of modern science he recognized that the scientific method itself is the invention of inventions. "The very beholding of the light," he tells us, "is a fairer thing than all the uses of it."

"But," counters the cynic, "his own scheme of induction is not original, nor does it work. Scientific discoveries are not made in this fashion, not by schemes, not by inductive ladders of ascent, but by the intuitions and insights of men of genius."

It is perhaps well at this point to examine just how seriously Bacon took his inductive system—a system which, it must also be remembered, he never completed. The originality, first of all, does not lie in the system. It lies, as Benjamin Farrington has very ably pointed out, in its application (*4*).

Bacon was one of the first time-conscious moderns. Unlike the ancients, he was not interested in a logical system intended merely to enable men to argue consistently, or to contemplate the universe. Instead, Bacon was concerned with process and with time. He was intent upon bringing his figurative "new continent" out of the limbo of the future. The traditional logic, concerned largely with eternal ideas and definitions, had to be reoriented in an empirical direction, in, as he puts it, "the discovery of particulars." Moreover, the contemplation of the natural world was not enough. An artificial world could, through knowledge, be imposed upon the purely natural world. "By the agency of man," contends Bacon, in what was then a bold and novel interposition of the human into the natural universe, "a new aspect of things, a new universe comes into view."

Bacon makes a sharp distinction between nature at rest and nature tormented by the experimenter: "For like as man's disposition is never well-known till he be crossed, nor Proteus ever changed shapes until he was straightened and held fast, so the passages and variations of nature cannot appear so fully in the liberty of nature as in the trials and vexations of art."

## The "Art of Discovery"

It is frequently reiterated that Bacon felt that his inductive method had done away with the necessity for genius, and that he was laboring under the fixed idea that the collection of facts would almost automatically lead to discoveries. Two things have obscured his real intentions. First, much of his work, because of the vicissitudes of his career and the enormity of the task he attempted, remains fragmentary and of variable and uncertain date. Second, his own reservations are lost sight of in the cult which has surrounded his name. The following remarks, for example, are as dispassionate and as far from fanatical intemperance as could possibly be imagined:

> I think my rules are true and useful. But I do not say that they are either perfect or absolutely indispensable. I do not mean to suggest that nothing can be done without them. On the contrary I think that if men had available a good Encyclopaedia of Nature and of Art and would work hard at it, remembering just two of my rules—first, to drop all preconceived notions and make a fresh start, and second to refrain for a while from trying to rise to the most general conclusions or even near to them—they would succeed without any other rules of induction by the light of their own intelligence in falling into my method of interpretation . . . . I must admit the possibility that the art of discovery itself will advance as discoveries advance.

He knew, moreover, that, in the search for truth there was a double ladder, "ascendant and descendant."

Archibald MacLeish, in a fine poem, that may well be familiar to numerous readers of *Science*, "Epistle To Be Left in the Earth," narrates the thoughts of a last, desperate survivor on a dying earth. "I pray you," the unknown survivor writes ("if any open this writing"),

> Make in your mouths the words that were our names.

Laboring under the heavy burden of his own mortality, he cries anxiously,

> I will tell you all we have learned
> I will tell you everything.

The poem then runs off into the disjointed efforts of a man scrawling, haphazard, a last few facts about this planet:

> It is colder now
> there are many stars
> we are drifting
> North by the Great Bear
> the leaves are falling
> the water is stone in the scooped rocks.

There is a poignant similarity between this verse and the real life creation of Bacon's *Sylva Sylvarum*. The book was written in haste in his declining years after all his hopes for new universities, co-workers in science, and aid from enlightened rulers had been disappointed. But the man, like the individual in MacLeish's poem, still struggled to collect the facts out of which the new continent should be built. He is aging, hope is gone, the task looms gigantic. He has no adequate conception of the size of the universe he has attempted to engage. No one



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will come to his aid. The book becomes an almost incoherent babble of facts drawn both from personal observation and diverse sources. Moss grows on the north side of trees. Strange fungi spring up in the forests. Fruit put into bottles and lowered into wells will keep long. He writes of the moon and vinegar, of cuttle ink, and of the glowworm. These are such facts as each one of us, divested of four centuries of learning, might try to record for posterity if we were the last of a dying race.

In a sense Francis Bacon was such a man. He was dying seemingly without scientific issue; the great continuity of learning for which he pleaded had been received indifferently by the world. Yet hidden in the *Sylva Sylvarum*, regarded as of no importance today, is a quite remarkable statement.

The passage is striking because it sets the stage for as pure a demonstration of the value of the induction for which Bacon argued as he could possibly have hoped for. Yet because 250 years were to elapse in the reasoning process, men have forgotten the connection. After some observations upon changes in plants, he remarks: "The transmutation of species is, in the vulgar philosophy, pronounced impossible, and certainly it is a thing of difficulty, and requireth deep search into nature; but seeing there appear some manifest instances of it, the opinion of impossibility is to be rejected, and the means thereof to be found out." This tolerant and studious observation, with its evolutionary overtones, was made before the nature of fossils was properly understood and before the length of geological time had been appreciated.

"The path of science," Bacon had proclaimed, "is not such that only one man can tread it at a time. Especially in the collecting of data the work can first be distributed and then combined. Men will begin to understand their own strength only when instead of many of them doing the same things, one shall take charge of one thing and one of another."

For the next 200 years men allied in international societies originally foreseen by Bacon would make innumerable observations upon the strata of the earth, upon fossils, and upon animal and plant distributions. Heaps upon heaps of facts collected and combined by numerous workers would eventually lead to Darwin's great generalization. In the end Darwin himself was to write: "I worked upon the true principles of Baconian induction" (*5*). The individual empirical observations which led to the theory of evolution and the recognition of human antiquity had been wrenched piecemeal from the earth.

Bacon, moreover, was keenly cognizant of the value of the history of science. He deplored its neglect and urged that all such history of "oppositions, decays, depressions [and] removes . . . and other events concerning learning will make men wise. . . . For," continues Bacon, "the unlearned man knows not what it is to descend into himself, or to call himself to account . . . whereas with the learned man it fares otherwise, that he doth ever intermix the correction and amendment of his mind with . . . the employment thereof."

Bacon also anticipated the folly of great thinkers in their tendency to extrapolate too broadly from the base of a single discovery. Thus, though he admired Gilbert's discovery of the magnet, Bacon wrote: "he has himself become a magnet; that is he ascribed too many things to that force." One might observe that this well-known tendency is apparent in Louis Agassiz's final exaggeration of the extent of the Ice Age. Other equally pertinent examples could be cited. Even the great thinker, warns Bacon, sometimes shows a tendency to create anew a ring within which he dances.

## Building with Common Clay

One other view which Bacon advocated was severely criticized by Macaulay in the early 19th century, and still evokes comment today—namely, his so-called neglect of genius. "The course I propose for the discovery of sciences," Bacon argues, "is such as leaves but little to the acuteness and strength of wits, but places all wits and understandings nearly on a level."

At first glance such a remark is apt to offend the superior intellect. In actuality, however, just as Clemenceau is reputed to have remarked that war was too important to be left to generals, so Bacon is not content to leave the development of the sciences to the sporadic appearances of genius. Nor, practically speaking, I think, would any educator today.

A careful reading of Bacon reveals that what he is anxious to achieve is the triumph of the experimental method. This triumph demands the thorough institutionalization of science at many levels of activity (*6*). In one passage he encompasses in a brief fashion all those levels on which science operates today. "I take it," he writes prophetically, "that all those things are to be held possible and performable, which may be done by some persons, though not by everyone; and which may be done by many together, though not by one alone; and which may be done in the succession of ages, though not in one man's life; and lastly, which may be done by public designation and expense, though not by private means and endeavor." Only in this manner can the continuity of the scientific tradition be maintained and the small bricks which go into the building of great edifices be successfully gathered. "Even fourth rate men," Darwin was later to observe, "I hold to be of very high importance at least in the case of science."

If Bacon meant anything at all he meant that working with the clay that sticks to common shoes was the only way to ensure the emergence of order and beauty from the misery of common life as his age knew it. He eliminated, in effect, reliance upon the rare elusive genius as a safe road into the future. It partook of too much risk and chance to rely upon such men alone. One must, instead, place one's hopes for Utopia in the education of plain Tom Jones and Dick Thickhead.

Ironically, this was the message of a very great genius, an aristocrat who had lived all his life in the pomp of circumstance, but who, in the end, was willing to leave his name to later ages and his work to their just judgment. "I say without any imposture, that I . . . frail in health, involved in civil studies, coming to the obscurest of all subjects without guide or light, have done enough, if I have constructed the machine itself and the fabric, though I may not have employed or moved it."

Bacon had an enormous trust in the capacities of the human mind, even though no one had defined better than he its idols and distortions. "There be nothing in the globe of matter," he wrote, "that has not its parallel in the globe of crystal or the understanding." John Locke, almost a century later, is far more timid than this. Perhaps Bacon reposed too much hope in the common man. Or perhaps it is we who lack hope, the age for which Bacon waited being still far off, or a dream. But is it not a very great wonder that a man who spent all his life in the arrogant class-



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conscious court of a brutal age strove for personal power as a means of transmitting to the future an art which would, in a sense, make him, a very great genius, and men like him, almost unneeded for human advancement?

I know of no similar event in all history. As an educator in a country which has placed its faith in the common man, I can only say that the serenity of Bacon's faith takes our breath away and gives him, at the same time, our hearts. For he, the Lord Chancellor, was willing to build his empire of hope from common clay—from men such as you and I. "It is not," he protests, "the pleasure of curiosity . . . nor the raising of the spirit, nor victory of wit, nor lucre of profession, nor ambition of honor or fame, nor inablement for business, that are the true ends of knowledge." Rather it is "a restitution and reinvesting of man to the sovereignty and power which he had in the first state of creation."

Have we, Bacon's intellectual descendants, forgotten this vision? Are we swollen with that venomous sting of which he warned us, as contained in knowledge without charity? Are we already about the business of man's second fall?

## The Light of Reason

I shall here reiterate that I have taken the case for Bacon's defense, not to confuse the jury, or to conceal crimes, or to claim innocence, but because I am part, as all men are part, of this venture and because each of us sits in the dock with him and knows that after 400 years judgment is not yet passed, nor can it yet be passed, upon him and the work he did. For is it not written in a certain Book that a thousand years are but as a day?

Those who dismiss Bacon as a scientist because he made no inventions have forgotten his own uncanny and preternatural answer, for he remarked that in the beginning there was only light. The grinding of machines and the sounds above us in the air we have taken for the scientific fruits he spoke of. After 400 years the light, however, is only along the horizon—that beautiful, dry light of reason, which Bacon admired above all things, and which he spoke of as containing charity. Has the prisoner before the bar seen further still? Is he talking, still, to an age farther away and more remote from us than Elizabeth's court will ever be?

The defense rests. It does not ask that the prisoner be discharged, but that he be reprieved. I who sit in the dock and yet argue this case before you plead for another thousand years.

Ours is not the light he saw. Ours is still the vague and murky morning of humanity. He left his name, the name of all of us, to the charity of foreigners and the next ages. We presume if we think we are those addressed in his will. We are, instead, only a weary renewed version of the court he knew and the days he wore out in blackness. The gyrocompass in the warhead has no new motive behind it; the Elizabethan intrigues that flung up men of power and destroyed them have a too-familiar look; the religious massacres that shook Bacon's century have only a different name in ours.

There is something particularly touching about Bacon's growing concern "to make the mind of man, by help of art, a match for the nature of things." He knew, in this connection, that man the predator is also part of that nature man had to conquer in order to survive. Bacon had sat long in high places; he knew well men's lusts and rapacities. He knew them in the full violence of a barbaric age.

Although he has been accused of giving "good advice for Satan's kingdom," he understood from the beginning, and stated in no uncertain terms, that the technological arts "have an ambiguous or double use, and serve as well to promote as to prevent mischief and destruction, so that their virtue almost destroys or unwinds itself. . . . All natural bodies," he contended, with some dim, evolutionary foreboding, "have really two faces, a superior and inferior." Man has in him "something of the brute."

In one of those strange yet powerful sentences which project like reefs out of the sum total of his work, he gives us a Delphic prophecy: "Whatever vast and unusual swells may be raised in nature," he says, "as in the sea, the clouds, the earth or the like," so that in this age our mind flies immediately to man, "yet nature," he continues, "catches, entangles and holds all such outrages and insurrections in her inextricable net, wove as it were of adamant."

John Locke, some decades later, struck by the immensity of the great American forest, cried out, "In the beginning the whole world was like America." Had Bacon, spokesman for science, a hundred years earlier, seen the possibility of the return of that forest even before it had departed? Or did he look beyond this age to a time when, by greater art than now we practice, we may have made our peace with the nature of things?

"It must ever be kept in mind," Bacon urged, "that experiments of Light are more to be sought after than experiments of Fruit." The man was obsessed by light—that pure light of the first morning of Creation before the making of things had commenced, before there was a garden and a serpent and a Fall, before there was strontium and the shadow of the mushroom cloud. He who will not attend to things like these can, in Bacon's own words, "neither win the kingdom of nature nor govern it."

Because Bacon saw and understood this light, it is well, I think, that he be not judged by us. Those who charge him, like a necromancer, with having called up from the deeps of time the direst features of the modern age, should ponder well his views upon the soul—"the world being in proportion," as he says, "inferior."

"By reason whereof," our worldly philosopher adds, "there is agreeable to the spirit of man, a more ample greatness, a more exact goodness, and a more absolute variety, than can be found in the nature of things." Because he could not renounce this vision, in the name of man, in the name of all of us, the defense of Francis Bacon rests—for another thousand years.

### References and Notes


1. In simple justice it should be said that much of this widespread impression springs from the biased and unfair but widely circulated essay of Lord Macaulay. The student would do well to study the defense of Bacon contained in the lifelong researches of James Spedding, H. Dixon, Basil Montagu, Bryan Bevan, J. G. Crowther, and others who have exhaustively reviewed the evidence and exploded many of the false assumptions upon which estimates of Bacon's character have been based.
2. V. Turner, in *In the Company of Man*, J. B. Casagrande, Ed. (Harper, New York, 1960).
3. It must be remembered that in Elizabethan times the word *invention* applied to ideas and the arts of literature as well as to mechanical devices.
4. B. Farrington, *Francis Bacon: Philosopher of Industrial Science* (Schuman, New York, 1949).
5. Darwin's sincerity in making this statement has been questioned, but for our purpose the facts are sufficient. Whether consciously or not, Darwin and his forerunners had assimilated the observations of previous observers in a long process of induction.
6. John Storck has commented that "at this point, if no other, Bacon contributed an idea of the first importance to the development of modern science" [*J. Philosophy* **28**, 183 (1931)].




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