# Scientific Revolution: Francis Bacon and René Descartes

**Francis Bacon’s *New Organon***

*Francis Bacon (1561-1626), an English lawyer and statesman, envisioned a community of scientists sharing knowledge and using it to increase human power. This text, published in 1620, tried to create a system of natural inquiry, in part by identifying the flaws in the human intellect. Bacon’s goal was to build science on the right foundation.[[1]](#footnote-1)*

[We must ensure that], after the lapse of so many ages, philosophy and the sciences may no longer float in air, but rest on the solid foundation of experience of every kind… I admit nothing but on the faith of eyes, or at least of careful and severe examination, so that nothing is exaggerated for wonder’s sake; what I state is sound and without mixture of fables or vanity.

*…*Since there is so great a number and army of particulars [i.e., particular facts], so scattered and dispersed…, little is to be hoped for from the skirmishing and slight attacks… of the intellect, unless all the particulars which pertain to the subject of inquiry shall, by means of Tables of Discovery, apt [and] well arranged… Questions (not as to *causes* but as to *facts*) should be added in order to provoke and stimulate further inquiry… In any new and more subtle experiment, the manner in which the experiment was conducted should be added, so that men may be free to judge for themselves whether the information obtained from that experiment be trustworthy… If in any statement there be anything doubtful or questionable, [it should be plainly stated…]

There are and can exist but two ways of investigating and discovering truth. One hurries on rapidly from the senses and particulars to the most general axioms; from them as principles and their supposed indisputable truth, it derives and discovers the intermediate axioms. This is the way now in use. The other constructs its axioms from the senses and particulars, by ascending continually and gradually, till it finally arrives at the most general axioms. This is the true but untried way.

Each of these two ways begins from the senses and particulars, and ends in the greatest generalities. But they are immeasurably different; for the one merely touches cursorily the limits of experiment, and particulars, whilst the other runs duly and regularly through them; the one from the very outset lays down some abstract and useless generalities, the other gradually rises to those principles which are really the most common in nature.

There is no small difference[[2]](#footnote-2) between *the idols of the human mind*, and *the ideas of the divine mind*; that is to say, between certain idle dogmas, and the real stamp and impression of created objects, as they are found in nature. The idols and false notions which have already preoccupied human understanding, and are deeply rooted in it… will thwart the establishment of the sciences, unless mankind, when forewarned, guard themselves with all possible care against them. Four species of idols beset the human mind: to which (for distinction’s sake) we have assigned names: calling the first idols of the tribe; the second idols of the den; the third idols of the market; the fourth idols of the theatre. The formation of notions and axioms on the foundation of true induction is the only fitting remedy by which we can ward off and expel these idols…

The idols of the tribe are inherent in human nature, and the very tribe or race of man. For man’s sense is falsely asserted to be the standard of things. On the contrary, all the perceptions, both of the senses and the mind, bear reference to man, and not to the universe, and the human mind resembles those uneven mirrors, which impart their own properties to different objects, from which rays are emitted, and distort and disfigure them.

The idols of the den are those of each individual. For everybody has his own individual den or cavern, which intercepts and corrupts the light of nature; either from his own disposition, or from his education, or from his reading, and the authority acquired by those whom he reverences and admires, or from the different impressions produced on the mind…

There are also idols formed by the reciprocal conversation and society of man with man, which we call idols of the market, from the commerce and association of men with each other. For men converse by means of language; but words are formed at the will of the generality, and they lead to astounding confusion.

Lastly, there are idols which have crept into men’s minds from the various dogmas of peculiar systems of philosophy, and also from the perverted rules of demonstration, and these we denominate idols of the theatre. For we regard all the systems of philosophy hitherto received or imagined, as so many plays brought out and performed, creating fictitious and theatrical worlds…

The human understanding, when any proposition has been once laid down, forces everything else to add fresh support and confirmation; it rejects instances that may exist to the contrary, rather than sacrifice the authority of its first conclusions…

The human understanding resembles not a *dry light*, but admits a tincture of the will and passions, which generate their own system accordingly: for man always believes more readily that which he prefers. He, therefore, rejects difficulties for want of patience in investigation; sobriety, because it limits his hope; the depths of nature, from superstition; the light of experiment, from arrogance and pride, lest his mind should appear to be occupied with common and varying objects; paradoxes, from a fear of the opinion of the vulgar; in short, his feelings imbue and corrupt his understanding in innumerable and sometimes imperceptible ways.

By far the greatest impediment and aberration of the human understanding proceeds from the dullness, incompetence, and errors of the senses. All the better interpretations of nature are worked out by fit and apt experiments, where the senses only judge of the experiment, the experiment judges of nature and the thing itself.

Some men become attached to particular fancies... They corrupt philosophy and science by their preconceived fancies, of which Aristotle affords us a signal instance, who made his natural philosophy completely subservient to his logic, and thus rendered it little more than useless and disputatious… Some men are more vigorous and active in observing differences of things, others in observing resemblances. Each of them readily falls into excess… Some dispositions evince an unbounded admiration of antiquity, others eagerly embrace novelty. Few can preserve the just medium, so as neither to tear up what the ancients have correctly laid down, nor to despise the just innovations of the moderns…

Let such, therefore, be our precautions in contemplation, that we may ward off and expel the idols of the den: which mostly owe their birth either to some predominant pursuit; or, secondly, to an excess in synthesis and analysis; or, thirdly, to a party zeal in favor of certain ages; or, fourthly, to the extent or narrowness of the subject. In general, he who contemplates nature should suspect whatever particularly takes and fixes his understanding, and should use so much the more caution to preserve it equable and unprejudiced.

The idols of the market are the most troublesome of all, those, namely, which have entwined themselves round the understanding from the associations of words and names… Hence the great and solemn disputes of learned men often terminate in controversies about words and names… Take some word for instance, as *fluid*. It will be found that the word *fluid* is nothing but a confused sign of different actions, admitting of no settled and defined uniformity. For it means that which easily diffuses itself over another body; that which is indeterminable and cannot be brought to a consistency; that which yields easily in every direction; that which is easily divided and dispersed; that which is easily united and collected… In one sense flame is fluid, in another air is not fluid, and in another fine powder is fluid…

The idols of the theatre are not innate, nor do they introduce themselves secretly into the understanding; rather, they are manifestly instilled and cherished by the fictions of theories and depraved rules of demonstration… Aristotle … corrupted natural philosophy by logic… and imposed innumerable arbitrary distinctions upon the nature of things; being everywhere more anxious as to definitions in teaching, and the accuracy of the wording of his propositions, than the internal truth of things… Nor is much stress to be laid on his frequent recourse to experiment in his books on animals, his problems, and other treatises; for he had already decided, without having properly consulted experience as the basis of his decisions and axioms, and after having so decided, he drags experiment along, as a captive constrained to accommodate herself to his decisions; so that he is even more to be blamed than his modern followers (of the scholastic school), who have deserted her altogether.

**Descartes****’s *Discourse on the Method…***

*René Descartes (1596-1650), the French philosopher and mathematician, was disillusioned by his university education. After travelling and serving as a soldier, he settled down to a life of contemplation and writing. Descartes had high hopes: the full title of this text, published in 1637, was Discourse on the Method of Proceeding Rightly in the Sciences.[[3]](#footnote-3)*

…Since I wanted to devote myself solely to the search for truth, I thought that I should act in the opposite manner, and reject as absolutely false anything about which I could imagine the slightest doubt, so that I could see if there would not remain after all that something in my belief which could be called absolutely certain. So, because our senses sometimes trick us, I tried to imagine that there was nothing which is the way that we imagine it; and since there are people who are mistaken about the simplest matters of geometry, making mistakes in logic, and supposing that I was as likely to make mistakes as anyone else, I rejected as false all the reasonings that I had considered as valid demonstrations.

…Considering that all our thoughts which we have when we are awake can also come to us when we are sleeping without a single one of them being true, I resolved to pretend that everything I had ever thought was no more true than the illusions in my dreams. But I immediately realized that, though I wanted to think that everything was false, it was necessary that the “me” who was doing the thinking was something. Noticing that this truth—*I think, therefore I am*—was so certain and sure that all the wildest suppositions of skeptics could not shake it, I judged that I could unhesitatingly accept it as the first principle of the philosophy for which I was seeking.

Then, examining closely what I was, and seeing that I could imagine that I had no body and that there was no world or place where I was, I nevertheless could not imagine that I did not exist at all. On the contrary, precisely because I doubted the existence of other things it followed quite obviously and certainly that I did exist. If, on the other hand, I had only ceased to think while everything else that I had imagined remained true, I would have had no reason to believe that I existed. Therefore I realized that I was a substance whose essence, or nature, is nothing but thought, and which, in order to exist, needs no place to exist nor any other material thing. So this self, that is to say the soul, through which I am what I am, is entirely separate from the body, and is even more easily known than the latter, so that even if I did not have a body, my soul would continue to be all that it is.

**Descartes’s *Rules for the Direction of the Mind****, published posthumously in 1684.[[4]](#footnote-4)*

RULE I. The aim of our studies must be the direction of our mind so that it may form solid and true judgments on whatever matters arise.

RULE II. We must occupy ourselves only with those objects that [human] intellectual powers appear competent to know certainly and indubitably.

RULE III. As regards any subject we propose to investigate, we must inquire not what other people have thought, or what we ourselves conjecture, but what we can clearly and manifestly perceive by intuition or deduce with certainty. There is no other way of acquiring knowledge.

Rule III lists all the intellectual activities by means of which we can attain to knowledge of things without any fear of deception; it allows of only two such: intuition and deduction. By *intuition* I mean, not the wavering assurance of the senses, or the deceitful judgment of the imagination, but a conception formed by unclouded mental attention—a conception so easy and distinct as to leave no room for doubt in regard to the thing we are understanding…

Thus, anybody can see by mental intuition that he himself exists, that he thinks, that a triangle is bounded by just three lines, and a globe by a single surface, and so on; there are far more of such truths than most people observe, because they disdain to turn their mind to such easy topics… The self-evidence and certainty of intuition is, moreover, necessary [for deductive reasoning].

…By *deduction*… I mean any necessary conclusion from other things known with certainty. …Many things are known although not self-evident, so long as they are deduced from principles known to be true by a continuous and uninterrupted movement of thought, with clear intuition of each point. [Similarly,] we know the last link of a long chain is connected with the first, even though we do not view in a single glance all the intermediate links on which the connection depends; we need only to have gone through the links in succession and to remember that from the first to the last each is joined to the next.

Thus we distinguish… between *intuition* and certain *deduction*: the latter, unlike the former, is conceived as involving a movement or succession; it is unlike intuition in not requiring something evident at the moment, but rather, so to say, borrowing its certainty from memory. From this we may gather that when propositions are direct conclusions from first principles, we may say that they are known by intuition or by deduction, according to different ways of looking at them; but first principles themselves can be known only by intuition, and remote conclusions, on the other hand, only by deduction.

These are the two most certain ways to knowledge; and on the side of the mind no more must be admitted; all others must be rejected as suspect and liable to mislead. This, however, does not prevent our believing that divine revelation is more certain than any knowledge; for our faith in it, so far as it concerns obscure matters, is an act not of the mind but of the will; and any intellectual foundations that it may have can and must be sought chiefly by one or other of the two ways I have mentioned…

1. Francis Bacon, *The New Organon,* originally published in 1620. <http://www.bartleby.com/242/> [↑](#footnote-ref-1)
2. *There is no small difference*: i.e., there is a great difference. [↑](#footnote-ref-2)
3. <http://public.wsu.edu/~brians/world_civ/worldcivreader/world_civ_reader_2/descartes.html> [↑](#footnote-ref-3)
4. <https://en.wikisource.org/wiki/Rules_for_the_Direction_of_the_Mind> [↑](#footnote-ref-4)